Department for Transport

Call for evidence on shore power

Implementing maritime commitments in the Transport Decarbonisation Plan

February 2022

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33 Horseferry Road
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This publication is also available on our website at www.gov.uk/government/organisations/department-for-transport

Any enquiries regarding this publication should be sent to us at www.gov.uk/government/organisations/department-for-transport

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Ministerial foreword

The Transport Decarbonisation Plan (TDP) charts a pioneering course towards net zero, setting out the government's ambitions for decarbonising the entire transport system in the UK. In the TDP, my department committed to consulting with industry on shore power to build expertise in carbon-busting technology that can secure the green foundations of our maritime sector.

Shore power is a mature technology enabling vessels to switch off the engine and plug into the grid whilst berthed. It reduces carbon emissions and creates charge point infrastructure for ships and port operations alike. Rolling-out shore power will bring private investment, encourage new careers, create thousands of jobs, boost economic growth, and revitalise coastal communities. The transport revolution is happening. Plans for shore power are aligned with continued R&D funding for maritime decarbonisation in support of securing greener fuel from cleaner sources, electrifying domestic shipping, ramping up net zero infrastructure and anchoring the UK's position as a global maritime leader.

An industry-led task and finish group on shore power launched in October 2021, and in partnership with the Clean Maritime Council, they have scrutinised initial proposals. However, this process has made clear the limits of available evidence. More information is needed to understand the scale of vessel emissions at berth, the potential for shore power to reduce emissions, the barriers to the commercial uptake, and the impact of solutions proposed by industry to roll-out this technology. We must also consider the consensus across government and devolved assemblies on the need to explore the synergies and consequences of shore power upon other policies.

This call for evidence aims to address the gaps in our understanding by gathering information on shore power's benefits and costs. It will be followed by further consultation on specific policy proposals to support its uptake. Once all consultations are concluded, we will announce a set of interventions to support the uptake of shore power in the UK as part of the refresh of the Clean Maritime Plan in 2023.

The emission-cutting benefits of shore power and the ambitious maritime initiatives in the TDP will come together alongside the work of the UK Shipping Office for Reducing Emissions (UK-SHORE), a unit within the Department for Transport focused on decarbonising the maritime sector. UK-SHORE will build on the Clean Maritime Demonstration Competition, boosting maritime decarbonisation through research and development funding. It will take inspiration from other transport modes and programmes such as the Office for Zero Emission Vehicles.

Shore power will be one part of the refreshed Clean Maritime Plan, sparking the transition to net zero shipping technologies as we place the UK at the forefront of the industries of

the future. This is the time to gather the evidence as we decarbonise maritime infrastructure – your expertise will help us in that effort to shape the exciting future that lies before everyone in maritime.

How to respond

The consultation period began on 7 February 2022 and will run until 25 April 2022. Please ensure that your response reaches us before the closing date. If you would like further copies of this consultation document, it can be found at https://www.gov.uk/dft#consultations.

You can respond to this call for evidence in four ways:

- By downloading the response form and emailing us the return to MaritimeTDPConsultation@dft.gov.uk;
- By email, to: MaritimeTDPConsultation@dft.gov.uk;
- Posting your response to:

  Call for evidence on shore power
  Maritime Environment, Technology and International Division, Maritime Directorate,
  Department for Transport, Zone 1-5, Floor 4,
  Great Minster House,
  33 Horseferry Road,
  London, SW1P 4DR

When responding, please state whether you are responding as an individual or representing the views of an organisation. If responding on behalf of a larger organisation, please make it clear who the organisation represents and, where applicable, how the views of members were assembled.

Please note that we do **not** expect you to submit evidence or views in response to every question listed if not applicable.

If you have any suggestions of others who may wish to be involved in this process, please contact us.

Freedom of Information

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the Freedom of Information Act 2000 (FOIA) or the Environmental Information Regulations 2004.

If you want information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information, we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the department.

The department will process your personal data in accordance with the Data Protection Act (DPA) and in the majority of circumstances this will mean that your personal data will not be disclosed to third parties.

Data Protection

The Department for Transport is carrying out this consultation to gather evidence on shore power in the UK. This call for evidence and the processing of personal data that it entails is necessary for the exercise of our functions as a government department. If your answers contain any information that allows you to be identified, the department will, under data protection law, be the Controller for this information.

As part of this consultation process we're asking for your name and email address. This is in case we need to ask you follow-up questions about any of your responses. You do not have to give us this personal information. If you do provide it, we will use it only for the purpose of asking follow-up questions.

The department's privacy policy has more information about your rights in relation to your personal data, how to complain and how to contact the Data Protection Officer. You can view it at https://www.gov.uk/government/organisations/department-for-transport/about/personal-information-charter.

Your information will be kept securely on a secure IT system within the department and destroyed within 12 months after the consultation process has been completed.

1. Introduction

The policy context

The UK is a climate leader and was the first major economy to set legally binding carbon budgets and to legislate to end its contribution to climate change. Tackling climate change and improving air quality by decarbonising transport is one of the Department for Transport's priority outcomes and the government has made considerable progress over recent years.

This has included significant developments, related both specifically to the maritime sector and to transport decarbonisation directly.

In January 2019, the government published a Clean Air Strategy and a Maritime 2050 Strategy. The Clean Air Strategy sets out our plans for dealing with all sources of air pollution, including from maritime, making our air healthier to breathe, protecting nature and boosting the economy. The Maritime 2050 Strategy sets out our vision for clean shipping in the UK.

The Clean Air Strategy and the Maritime 2050 Strategy both announced the commitment to publish a Clean Maritime Plan in July 2019, making the UK one of the first countries to issue a strategy on domestic action to reduce shipping emissions, following the agreement of the Initial International Maritime Organization (IMO) Strategy for greenhouse gas (GHG) emissions in 2018. The IMO Strategy committed to cut GHG emissions by at least 50% by 2050, compared with 2008 levels, and to phase them out completely as soon as possible this century.

The Clean Maritime Plan identifies ways to tackle air pollutants and GHG emissions while securing clean growth opportunities for the UK. It reflects the government decision in June 2019 to legislate for a net zero domestic greenhouse gas emission target by 2050[1,2]. The Clean Maritime Plan represents one of the government's most ambitious strategies to facilitate the transition to zero emission transport

Alongside the Clean Maritime Plan, the government published Port Air Quality Guidelines. These guidelines provide a framework for ports to produce their own Port Air Quality Strategy (PAQS). The guidelines include advice on the territorial scope ('who' is asked to produce a PAQS), place the strategies in the wider context of UK Air Quality (the 'why')

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[1] https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law

[2] As set out in April 2021, the sixth Carbon Budget will incorporate the UK's share of international aviation and shipping emissions – an important part of the government's decarbonisation efforts that will allow for these emissions to be accounted for consistently.

and provide advice on content and structure including a checklist that can serve as a ready reckoner for planners (the 'how').

The UK has consistently supported international efforts to limit pollutant emissions from shipping, as air pollution is regulated by the IMO through the International Convention for the Prevention of Pollution from Ships (MARPOL). For instance, the UK backed the establishment of the North Sea Emissions Control Area (ECA) which covers SO_X emissions and, from 1 January 2021, NO_X emissions. ECAs have also been established in coastal waters in Europe and North America. Furthermore, the UK championed the agreement at the IMO for a 0.5% Sulphur limit for global shipping outside the ECA and played a significant role in both the development of the regime and the supporting guidance for industry before it came into effect on 1 January 2020[3].

The Clean Maritime Demonstration Competition (CMDC), announced as part of the Prime Minister's Ten Point Plan for a Green Industrial Revolution on 1 November 2020, represents a key next step to decarbonise the maritime sector. Launched in March 2021, the CMDC seeks to accelerate the demonstration and deployment of low and zero emissions technology in the maritime sector. Up to £23m of grant funding has been allocated to 55 projects supported by 208 UK organisations, to deliver feasibility studies and technology trials in zero emission solutions, including in shore power technology.

In July 2021, the government published a Transport Decarbonisation Plan, which sets out the commitments and actions needed to decarbonise the UK transport system, including maritime. The plan identifies a pathway to net zero transport in the UK, the wider benefits net zero transport can deliver, and the principles that underpin the government approach to delivering net zero transport.

In October 2021, the government published the Net Zero Strategy: Build Back Greener, setting out policies and proposals for decarbonising all sectors of the UK economy, including maritime, to meet the UK's Net Zero target by 2050. The Net Zero Strategy includes a commitment to extend the Clean Maritime Demonstration to a multi-year programme. This is part of our commitment to a UK Shipping Office for Reducing Emissions.

[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

Purpose of this call for evidence

The Transport Decarbonisation Plan includes a commitment to consult on how government can support the wider deployment of shore power, including consideration of regulatory interventions, for both vessels and ports, that could drive deployment as we transition to a net zero world, and bring forward appropriate measures.

This consultation process began in October 2021 with the launch of an industry-led task and finish group in partnership with the Clean Maritime Council, to provide initial advice to the Department for Transport on their proposals to support the uptake of shore power, ahead of wider public consultation. The Clean Maritime Council is a strategic advisory body bringing together leading figures from the maritime industry, academia, and government[4].

This initial engagement with industry identified limitations in the evidence base available to government, so **this call for evidence does not identify a preferred approach on proposals to support shore power.**

More information is needed, for example, on the scale of vessel emissions at berth, the actual potential of shore power alongside other technologies in reducing emissions, the barriers to the commercial take-up of shore power and the impact of potential solutions to enable the roll out of this technology.

Shore power policy options will be developed in cooperation with Devolved Administrations. Further evidence and engagement are needed to review the impact of options on devolved competencies. It should be noted that policy areas of relevance to ports as well as environment policies are devolved in Scotland, Wales, and Northern Ireland[5][6]. This has led to environment regimes in each of the four nations that are in some respects distinct[7]. Whilst the main legislation which provides for UK shipping including pollution is reserved, some competences concerning maritime transport are devolved e.g. in Scotland[8].

This call for evidence builds on the work of the industry-led task and finish group and considers a range of policy options, explored in increasing levels of ambition, to gather further evidence on their impact and implications.

Responses to this call for evidence will help to inform further policy development work, as part of the 2023 refresh of the Clean Maritime Plan. Any specific policy options will be subject to further consultation accompanied by impact assessment, informed by the findings of this call for evidence.

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[4] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

[5] https://researchbriefings.files.parliament.uk/documents/CBP-8823/CBP-8823.pdf

[6] https://www.gov.uk/guidance/guidance-on-devolution#devolved-responsibilities

[7] https://publications.parliament.uk/pa/ld201617/ldselect/ldeucom/109/10912.htm

[8] https://researchbriefings.files.parliament.uk/documents/SN03156/SN03156.pdf

Structure of this call for evidence

Chapter Two provides an overview of shore power, its benefits and costs and the barriers to its commercial take-up in the UK and includes a series of questions to inform the extent and impact of such barriers.

Chapter Three reviews a range of policy options which emerged from the work of the industry-led task and finish group and includes questions to gather evidence to inform further policy development.

The options proposed by the task and finish group are:

- **Exploring the potential of government's coordinating function.** For example, commissioning research, producing guidance for port operators concerning planning and energy network requirements, and facilitating collaboration across the sector as well as information sharing. This could also include exploring other potential measures to unlock private investment.

- **Exploring the potential of government mandates through regulation.** This could include requiring vessels and ports to report on the usage of shore power, requiring vessels to use shore power when in port, and requiring ports to install shore power infrastructure.

- **Exploring the potential of market-based measures.** This could include economic instruments based on the "polluter pays principle[9]", to incentivise the adoption of shore power by vessel and port operators.

[9] The polluter pays principle is the principle that those who cause pollution or damage to the environment should be responsible for mitigation or compensation. See also: https://deframedia.blog.gov.uk/2021/03/11/consultation-launched-on-environmental-principles/

2. The rationale for intervention

Benefits of using shore power

Shore power is one of the available technologies to reduce vessels emissions at berth. Also known as cold ironing, shore power is the provision of shoreside electrical power to a vessel at berth while its main and auxiliary engines are shut down. When a vessel docks, it no longer needs energy for propulsion but may still be a large consumer of energy. Onboard generators are still running when in port to supply the domestic loads of the vessel (e.g. lighting, galleys, air-conditioning, etc.), resulting in air pollutant as well as greenhouse gas (GHG) emissions. Rather than letting on-board generators produce the necessary electricity, this can be provided through a standardised onshore interface while the vessel is at berth[10].

The National Policy Statement for Ports incorporates guidance on the provision for shoreside power in section 5.7 (air quality and emissions). For example, paragraph 5.7.13 states that "*All proposals should either include reasonable advance provisions (such as ducting and spaces for sub-stations) to allow the possibility of future provision of cold-ironing infrastructure, or give reasons as to why it would not be economically and environmentally worthwhile to make such provision"*.

Shore power has the potential, alongside other measures, to contribute to a reduction in GHG emissions from the maritime sector. This potential will further increase as the national electricity grid decarbonises. Government-commissioned research estimates that without any further policy intervention, the total annual electricity demand at UK ports could rise from 20 GWh in 2016 to around 250 GWh by around 2050, largely driven by the demand for shore power from container vessels[11]. In contrast, under a scenario in which there are very ambitious assumptions about maritime electrification, this research estimates that annual electrical demand at UK ports could rise to over 4000 GWh by around 2050, predominantly driven by demand for electric propulsion, but with demand for shore-side power also expected to increase significantly.

Further research commissioned by the government concludes that "the total share of a ship's energy demand that can be met through shore power is small"[12], therefore other solutions are likely to have a greater overall contribution to reducing GHG emissions. This research adds that "there are significant potential benefits from shore power for controlling air pollution emissions when ships are in port and close to centres of population where impacts of those emissions may be greatest" [13]. In addition, related research identifies that

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[10] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:02014L0094-20200524&rid=8

[11] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816017/potential_demands_on_UK_energy_system_from_port_shipping_notification.pdf

[12] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816018/scenario-analysis-take-up-of-emissions-reduction-options-impacts-on-emissions-costs.pdf

[13] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816018/scenario-analysis-take-up-of-emissions-reduction-options-impacts-on-emissions-costs.pdf

the use of shore power as opposed to auxiliary engines will reduce, emissions, noise and vibrations from vessels at berth, improving working conditions in ports[14].

By helping to address the sector's environmental impacts, the increased use of shore power would help to future proof jobs in the UK maritime sector. In 2017, it is estimated that maritime directly supported around 220,000 jobs in the UK[15]. In addition, the increased use of shore power has the potential to directly support UK jobs in the markets for relevant technologies. Research commissioned by the Government concluded that the UK has "some basis for competitive advantage" in the market for low carbon shore power technologies, including "several manufacturers of relevant electrical equipment", and a "strong basis for competitive advantage" in the related markets for onboard batteries and electric propulsion[16].

Whilst the available evidence suggests that shore power can lead to significant reductions in air pollutant emissions from ships whilst they are at berth[17], it would not address all sources of emissions. For example, there would continue to be emissions from the use of boilers[18], which are "used on board larger vessels for heating and hot water production"[19]. In addition, ships would still produce emissions when manoeuvring within ports. For these reasons, **shore power is only one of the measures that the government is supporting to reduce maritime emissions.** Other interventions include incentivising the supply of alternative marine fuels through the Renewable Transport Fuel Obligation, exploring the role of economic instruments, funding for feasibility studies and technology trials allocated via the Clean Maritime Demonstration Competition, and other maritime commitments in the Transport Decarbonisation Plan.

Crucially, the scale of the total impact on UK GHG and air pollutant emissions from the use of shore power at UK ports is currently subject to uncertainty and is expected to be influenced by a range of factors. These include the type of marine fuel that would be used, the energy efficiency of the vessels calling at UK ports, and how the electricity that is used is generated. Consequently, it is expected that the impact on emissions will change over time as both the maritime sector and the electricity sector decarbonise. For example, research commissioned by the government suggests that "alternative low emission fuels will be essential to achieve the ambitions for zero emission shipping, particularly beyond 2030"[20]. In addition, the available evidence suggests that the benefits from reducing air pollution will also be influenced by the location of ports[21]. More analytical work is therefore required to assess the benefits of a significant take-up of shore power in the UK and how these could vary under different scenarios.

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[14] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816017/potential_demands_on_UK_energy_system_from_port_shipping_notification.pdf

[15] https://www.maritimeuk.org/media-centre/publications/state-maritime-nation-report-2019/

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

[17] For example, see https://www.epa.gov/ports-initiative/shore-power-technology-assessment-us-ports

[18] https://www.epa.gov/ports-initiative/shore-power-technology-assessment-us-ports

[19] https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1712140936_ED61406_NAEI_shipping_report_12Dec2017.pdf

[20] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816018/scenario-analysis-take-up-of-emissions-reduction-options-impacts-on-emissions-costs.pdf

[21] For example, see https://theicct.org/sites/default/files/publications/ICCT-WCtr_ShorePower_201512a.pdf.

Although the provision of shore power has been a proven process for twenty years, its deployment in the UK remains very limited. Apart from the presence of shore power infrastructure at the Royal Navy base at Portsmouth, only two UK ports are equipped with shore power facilities, Orkney and Southampton[22]. Industry analysis illustrates that the international picture is different, as local circumstances contribute to the conditions for greater adoption of this technology[23].

Costs of using shore power

There are several different costs associated with the use of shore power, including the costs to vessels of fitting the necessary equipment to make use of shore power, and the investment required within ports to enable this. Further costs will also be incurred when upgrading existing port electricity network connections.

For vessels, investments may include “a cable reel, connection boxes, switchgear, transformer and control panel” according to research commissioned by the government[24]. The available evidence suggests that investment costs vary between different types and sizes of vessel[25], and that retrofitting existing ships with the required equipment can be significantly more expensive than incorporating it into new builds[26].

The use of shore power will also impact on the operational costs of vessels. Whether the use of shore power will increase or decrease operational costs will depend on the relative prices of electricity and the maritime fuel that would otherwise be used by the vessel. Fuel prices fluctuate over time due to market conditions. Relative prices of electricity and marine fuels will also be influenced by the wider policy landscape, and the potential for any future changes in pricing or regulatory policy. In addition, relative prices will be impacted by changes in the type of maritime fuel that would otherwise be used. For example, in situations where expensive low carbon fuels would otherwise need to be used by vessels in the future, the use of shore power has the potential to decrease operating costs when vessels are at berth.

Research commissioned by the government suggests that investments required on land may include “substations, switchgear and power connections”, as well as “power network reinforcement or local generation if the port is in a poorly connected location” [27]. The available evidence suggests that the total cost of investments required within ports can vary significantly[28]. In addition, research commissioned by the government suggests that the costs of any enhancements required to the power network “are likely to be very context

[22] https://www.britishports.org.uk/content/uploads/2021/02/Shore-power-Tyndall-FINAL-DEC-2020.pdf.

[23] https://www.britishports.org.uk/content/uploads/2021/10/BPA_Shore_Power_Paper_May_2020.pdf

[24] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815667/economic-opportunities-low-zero-emission-shipping-technical-annexes.pdf

[25] For example, see https://glomeep.imo.org/technology/shore-power/.

[26] For example, see https://theicct.org/sites/default/files/publications/ICCT-WCtr_ShorePower_201512a.pdf.

[27] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815667/economic-opportunities-low-zero-emission-shipping-technical-annexes.pdf

[28] For example, see https://www.britishports.org.uk/content/uploads/2021/02/Shore-power-Tyndall-FINAL-DEC-2020.pdf.

specific"[29]. For example, costs would be much higher "if a new substation were needed or if large-scale reinforcements were needed"[30].

The available evidence suggests that the costs of a significant rollout of shore power in the UK are currently subject to significant uncertainty such as the circumstances of different ports and different scenarios for how the fuels used by ships in UK ports could evolve in the future. More analytical work is required to fully assess the costs of a significant rollout of shore power in the UK and how these costs could vary under different circumstances.

Barriers and market failures

Research undertaken by both industry and government has highlighted significant existing barriers to the uptake of shore power. These include the cost of infrastructure (both in ports and for electricity network connections) and a lack of evidence about long term levels of demand from vessels[31]. These barriers include, but are not limited to:

- **Negative externalities**. At present, maritime fuel prices do not reflect the costs of their greenhouse gas and air pollutant emissions. This means that there is currently a suboptimal incentive for investment in emission reduction options, including shore power[32].

- **High capital costs, especially upfront costs for ports.** Upfront costs for ports can be split between **(1)** capital costs for installing infrastructure inside the port and **(2)** costs for connecting to the electricity network, including upgrading the existing port network connection such as building new substations. Government-commissioned research suggests that the cost of upgrading electricity connections is subject to uncertainty as this is "very context specific"[33]. In some locations where the capital costs associated with electricity network connections are particularly high, solutions such as renewable generation and storage might help to reduce costs [34,35]. It should also be noted that the contribution currently required by connecting customers to network connection upgrades varies between the electricity transmission and distribution networks. For distribution networks the independent energy regulator, Ofgem, has proposed that the costs of network reinforcement required to accommodate demand connections be socialised[36]. Currently, a proportion of these costs is

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29 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816017/potential_demands_on_UK_energy_system_from_port_shipping_notification.pdf

30 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816017/potential_demands_on_UK_energy_system_from_port_shipping_notification.pdf

31 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009448/decarbonising-transport-a-better-greener-britain.pdf

32 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815671/identification-market-failures-other-barriers-of-commercial-deployment-of-emission-reduction-options.pdf

33 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816017/potential_demands_on_UK_energy_system_from_port_shipping_notification.pdf

34 https://www.e4tech.com/resources/247-e4tech-identifies-potential-uk-clusters-of-clean-maritime-activity.php

35 https://www.mseinternational.org/res/files/decarbonisation/British_Ports_Association_Shore_Power_Paper_May_2020.pdf

36 These costs would be recovered from all users of the network in the local distribution network area.

recovered from the connecting customer. Any changes would take effect from April 2023. In addition, the GB electricity network is separate from the Northern Ireland electricity network and connection costs may be recovered differently in Northern Ireland, for example Ofgem's proposed changes would only apply in GB.

- **The cost of electricity.** Aside from the cost of upgrading connections to the electricity network, the price of electricity compared to conventional marine fuels is often raised by industry as another key barrier to the commercial take-up of shore power. Of the 25 IEA countries reporting industrial electricity prices in 2020, the UK had the third highest after Japan and Germany. For comparison, during the same period Norway had the lowest price[37,38].

- **Split incentives to invest and co-ordination failures between ports and the shipping industry**. Ports are unlikely to invest in shore power infrastructure until the demand can be credibly demonstrated. At the same time, shipping operators are unlikely to invest in shore power solutions (e.g. retrofit) as well as other zero emission solutions if the necessary infrastructure is not readily available across ports. Split incentives to invest between ship owners and charters may also be a further impediment.

- **Imperfect information on abatement options.** For example, ports might not have access to information that would allow them to make an informed decision about whether ensuring sufficient electricity provision from their port to support shore power or electrified ships is likely to be a worthwhile investment[39].

- **Limitations in regulatory frameworks.** A basic framework for shore power is available in UK legislation as part of the Alternative Fuels Infrastructure Regulations 2017. Regulation 4 (shore-side electricity for seagoing ships) provides that "A statutory harbour authority which operates a shore-side electricity supply installation for seagoing ships which is deployed or renewed after 17th November 2017 must ensure that the installation complies with the requirements set out in paragraph 4 of the Schedule[40]". Paragraph 4 of the Schedule then provides that "Shore-side electricity supply installations for seagoing ships, including the design, installation and testing of the systems, must comply with the technical specifications of the IEC/ISO/IEEE 80005-1 standard"[41]. A review of the Alternative Fuels Infrastructure Regulations is ongoing. Progress has been limited at the IMO, mostly limited to the safety aspects of shore power[42]. By comparison, the EU directive 2014/94/EU mandates EU ports to install shore power by the end of 2025, but it also

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37 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1021927/Quarterly_Energy_Prices_September_2021.pdf

38 https://www.britishports.org.uk/content/uploads/2021/10/BPA_Shore_Power_Paper_May_2020.pdf

39 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816017/potential_demands_on_UK_energy_system_from_port_shipping_notification.pdf

40 https://www.legislation.gov.uk/uksi/2017/897/regulation/4/made

41 https://www.legislation.gov.uk/uksi/2017/897/schedule/paragraph/4/made

42 https://www.britishports.org.uk/content/uploads/2021/02/Shore-power-Tyndall-FINAL-DEC-2020.pdf

specifies that this is required only unless costs are higher than benefits and there's no demand[43].

- **Project complexity (e.g. planning regulation).** The infrastructure requirements of certain shore power projects make them challenging, especially for small ports which might not have immediate access to the necessary skills. For instance, the process of obtaining development consent and land rights is led by the port but is likely to involve both the relevant electricity network operator and the port. This would involve public consultation, assessment of environmental impacts, etc[44].

- **Low vessel demand for shore power.** This is the result of the combined impact of the barriers set out above. The available evidence suggests that retrofitting vessels is more expensive than buying new vessels already equipped with shore power facilities, despite existing vessels having a lower lifespan compared to new ones. Also, the less time a vessel spends at berth, the less likely some operators are to prioritise retrofitting vessels for shore power against measures to reduce emissions whilst the vessel is at sea (e.g. alternative propulsion methods) [45]. However, industry suggested that there are front runners in the usage of shore power e.g. cruise and container lines[46].

Questions. Please provide evidence to support your response.

1. Can you provide any evidence to quantify the current level of GHG and air pollutant emissions from vessels at berth in UK ports? Please disaggregate this information as much as possible (e.g. to cover different ports and vessel types and operational and idle vessels).
2. In your opinion, which technologies and fuels can contribute to reducing vessel emissions at berth and what are their costs, benefits and level of technology readiness? Please include both on-board and land side technologies (e.g. storage) where relevant.
3. In your opinion, what impact would shore power have in reducing emissions at berth for (a) different vessel types and (b) different locations in the UK? Could shore power have any other positive or negative environmental impacts (e.g. any impacts on marine pollution)? Please quantify and disaggregate your responses as much as possible.
4. In your opinion, what are the key (a) barriers and (b) incentives for ship owner, ship operators and ports to invest in shore power?
5. Can you provide estimates of the costs and benefits for any current or future shore power projects in the UK, including emission savings, costs of infrastructure at ports and costs of any upgrades to existing network connections and any reinforcements required to the electricity network? If possible, please provide estimates of cost recovery periods for these projects and estimates of the associated increases in electricity demand?

[43] https://www.britishports.org.uk/content/uploads/2021/10/BPA_Shore_Power_Paper_May_2020.pdf
[44] https://www.britishports.org.uk/content/uploads/2021/02/Shore-power-Tyndall-FINAL-DEC-2020.pdf.
[45] https://www.britishports.org.uk/content/uploads/2021/02/Shore-power-Tyndall-FINAL-DEC-2020.pdf.
[46] https://www.britishports.org.uk/content/uploads/2021/10/BPA_Shore_Power_Paper_May_2020.pdf

6. Can you provide estimates of the total overall costs and benefits if shore power is taken-up commercially at scale across the UK, including the overall emission savings and electricity demand? Please disaggregate these estimates across different locations, if possible?
7. Are you aware of any shore power installation projects underway in the UK? If so, please provide as much detail as possible?

3. Options explored as part of this consultation

Our approach

An industry-led Task and Finish Group, in partnership with the Clean Maritime Council[47], proposed potential solutions to the above barriers. Membership of the group included representatives from: the British Ports Association, the UK Major Ports Group, the UK Chamber of Shipping, the National Grid, the Energy Network Association, Innovate UK, Shell, Wightlink, Red Funnel, University College London and the University of Strathclyde.

The options explored in this call for evidence are grouped below.

- **Exploring the potential of government's coordinating function.** For example, commissioning research, producing guidance for port operators on planning and energy network requirements, and facilitating collaborations across the sector as well as information sharing. This could also include exploring other potential measures to unlock private investment.

- **Exploring the potential of government mandates through regulation.** This could include requiring vessels and ports to report on the usage of shore power, requiring vessels to use shore power when in port, and requiring ports to install shore power infrastructure.

- **Exploring the potential of market-based measures.** This could include economic instruments based on the "polluter pays principle[48]", to incentivise the adoption of shore power by vessel and port operators.

Exploring the potential of the government's coordinating function

One option to address the issue of imperfect information on abatement options across market players and the inherent complexity of shore power projects would be to produce guidance for port operators concerning planning as well as energy network requirements for the installation of shore power infrastructure. Such guidance could be delivered in cooperation between the Department for Transport, the Department for Levelling Up, Housing and Communities (DLUHC), the Department for Business, Energy and Industrial Strategy (BEIS) and network operators.

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[47] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf

[48] The polluter pays principle is the principle that those who cause pollution or damage to the environment should be responsible for mitigation or compensation. See also: https://deframedia.blog.gov.uk/2021/03/11/consultation-launched-on-environmental-principles/

Questions. Please provide evidence to support your response.

8. Do you think Government coordinated guidance would be a helpful tool for ports and other operators to navigate the complexity of shore power projects? If so, which topics should be included to maximise the value of such a document?

We recognise that coordination failures can represent a barrier to the take-up of shore power. We therefore invite innovative ideas on how government could intervene to facilitate collaboration across the sector, for instance building on experience in other transport modes or recent initiatives like the Clean Maritime Demonstration Competition. Government could facilitate collaborative work between multiple stakeholders, for instance enabling the formation of industry consortia or facilitating information sharing across the sector, enabling opportunities to share learning and build momentum across shore power projects in the UK.

Questions. Please provide evidence to support your response.

9. In your opinion, how could government's coordinating function be deployed to accelerate collaboration across the maritime sector to facilitate shore power projects? Can you please provide examples?

Innovative commercial finance models might play a part in unlocking private investment, providing ports with greater certainty should they decide to invest in shore power infrastructure. These might play a role in offsetting uncertainties in vessel demand for shore power infrastructure. We are interested in ideas on how such measures could be structured.

Questions. Please provide evidence to support your response.

10. In your opinion, does future revenue uncertainty represent a significant barrier to investment in infrastructure for shore power? Please explain your answer.
11. Can you provide examples of innovative commercial finance models that might help de-risk port investment in shore power infrastructure? Please include as much detail as possible.

The current gap in evidence for the costs and benefits associated with shore power could be filled through further research to understand what it would cost ports to install shore power, the costs of upgrading electricity distributional networks, the costs to ships of fitting shore power, and the impact that this would have on emissions.

Questions. Please provide evidence to support your response.

12. Do you have any other views on the potential of Government's coordinating function in supporting the uptake of shore power?

Exploring the potential of government mandates through regulation

Government could proactively impose regulatory requirements on both ports and shipping operators. Such mandates could provide policy clarity while helping solve the issues of failures of coordination between ports and ship operators and split incentives to invest between charterers and ship owners. A range of potential interventions are set out below.

A requirement for vessels and ports to report on the usage of shore power, where available, could address the lack of information on shore power in the market, providing ports with evidence on the possible scale of shore power demand, and ship operators with evidence on the availability of shore power connections now and potentially in the future, enabling investment to take place. This could also provide government with evidence that could be helpful for designing future regulations and could provide a clear signal to industry on potential utilisation.

A mandate requiring ships to use shore power when at berth could, in theory, help provide more certainty concerning emission abatement and the usage of relevant infrastructure and could address the barrier presented by low vessel demand. Such mandate could only apply to those vessels that are "shore power capable".

Questions. Please provide evidence to support your response.

12. In your view, what would the impacts of a mandate on vessels to use shore power while at berth be on (a) ship owners (b) ship operators (c) UK ports and (d) the wider UK economy?
13. Do you think that any mandate on vessels to use shore power while at berth in the UK should be accompanied by a mandate on ports to install the related shore power infrastructure? Please explain your answer.

A requirement for UK ports to install shore power infrastructure would also be subject to the issue of a lack of evidence on impacts. This measure is currently being implemented in mainland Europe, based on EU directive 2014/94/EU which requires EU ports to install shore power facilities by the end of 2025 "unless there is no demand and the costs are disproportionate to the benefits, including environmental benefits"[49]. The package of proposals presented by the EU Commission on 14 July 2021 – the "Fit for 55 package" – includes binding targets for, among other things, shore power supply for ships at ports. However, concerns have been raised by ports about the additional costs relating to rolling out infrastructure[50].

Questions. Please provide evidence to support your response.

14. In your view, what would the impacts of a mandate on port operators to install shore power infrastructure be on (a) ship owners (b) ship operators (c) UK ports, (d) energy network operators, and (e) the wider UK economy?

[49] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0094

[50] https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698795/EPRS_BRI(2021)698795_EN.pdf

We are not clear about the merit of considering a mandate on vessel operators to ensure that vessels are "shore power capable". First, we are not sure whether such a mandate would incentivise the usage of shore power on the part of vessels. Also, it is not clear how this mandate could be implemented in UK legislation, as shipping design is mandated by the IMO's Energy Efficiency Design Index. Even if that was possible, industry have suggested that it would be difficult to mandate design criteria to vessel manufacturers as vessels are bespoke. Industry also suggested that, if applied to domestic manufacturers, a design mandate might risk putting UK designed vessels and yards at a disadvantage against international competition.

Questions. Please provide evidence to support your response.

15. In your view, what would the impacts of a mandate that all vessels are "shore power capable" by design be on (a) ship owners (b) ship operators (c) UK ports and (d) the wider UK economy?
16. Do you have any other views on the potential implications of Government mandates, or any other regulatory intervention, to support the take-up of shore power? Please include evidence where possible, including references to international case studies where relevant.

We do not currently have access to a well-developed evidence base concerning the impacts of implementing any of these mandates for ports and vessel operators.

Exploring the potential of market-based measures

Market-based measures are a type of economic instrument. Economic instruments can play a valuable role in enabling the efficient achievement of targets and supporting the transition to zero emission shipping. Crucially, economic instruments are very context specific and there is no single design that can easily be replicated from one context to another. The outcomes and impacts of an economic instrument are very dependent on the design and context in which they are implemented, so careful analysis of options would be necessary to inform policy makers' decisions[51].

When deciding on the most appropriate economic instruments and their more detailed design, several important and related issues will need to be considered. These include distributional issues in terms of differential impacts on sub-sectors within the shipping industry; potential costs to businesses; the economic, environmental and social benefits that could be achieved, including the opportunity to incentivise new low emission innovations; implications for trade- flows and competitiveness; differences in impacts across geographies; the international context in which the domestic economic instrument is implemented; and the cost of the economic instrument to the public purse.

[51] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816020/potential-role-targets-economic-instruments.pdf

Furthermore, the design of the instrument should consider how to manage the following trade-offs[52]:

- Encouraging behaviour to ensure short-term compliance as well as alignment with longer-term aims.
- Providing incentives to change behaviour to reduce emissions, while also being mindful of the cost implications for sub-sectors within the shipping or other industries and consumers; and
- Ensuring appropriate monitoring and compliance while also balancing data requirements and associated verification or administrative costs.

Some industry suggestions referred to the potential of market-based measures to support the uptake of shore power. By placing a price on these emissions, economic instruments could be one of the options to strengthen the incentive for ship operators to reduce their emissions while at berth[53]. The Transport Decarbonisation Plan committed the government to further investigate the use of economic instruments to drive maritime decarbonisation. This call for evidence is part of that ongoing work[54].

Questions. Please provide evidence to support your response.

17. Are you aware of economic instruments deployed internationally to address emissions at berth? If so, please provide details, including their cost and environmental impacts.
18. In your view, how could similar economic instruments be used in the UK to address emissions at berth? What would the impacts be on (a) ship owners (b) ship operators (c) UK ports and (d) the wider UK economy?

Wider questions. Please provide evidence to support your response.

19. In your view, which alternative levers, including economic instruments, would support the commercial take-up of shore power in the UK? Please provide as much detail as possible, including on potential impacts.
20. In your opinion, what uptake of shore power do you expect in the UK between now and 2050, in the absence of further Government intervention?
21. Do you have any other information or evidence that you would like to submit as part of your consultation response?

[52] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/816020/potential-role-targets-economic-instruments.pdf

[53] A negative externality is any difference between the private cost of an action or decision to an economic agent and the social cost. In simple terms, a negative externality is anything that causes an indirect cost to individuals.

[54] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009448/decarbonising-transport-a-better-greener-britain.pdf

What will happen next

A summary of responses will be published within three months of the call for evidence ending. These responses will be used to inform further policy development and future consultation on specific proposals to support the uptake of shore power. Pending the results of this consultation process, we will announce a set of interventions to support the uptake of shore power in the UK as part of the refresh of the Clean Maritime Plan in 2023. Paper copies will be available on request.

If you have questions about his consultation please contact:
MaritimeTDPConsultation@dft.gov.uk

Annex A: Full list of consultation questions

Questions. Please provide evidence to support your response.

1. Can you provide any evidence to quantify the current level of GHG and air pollutant emissions from vessels at berth in UK ports? Please disaggregate this information as much as possible (e.g. to cover different ports and vessel types and operational and idle vessels).
2. In your opinion, which technologies and fuels can contribute to reducing vessel emissions at berth and what are their costs, benefits and level of technology readiness? Please include both on-board and land side technologies (e.g. storage) where relevant.
3. In your opinion, what impact would shore power have in reducing emissions at berth for (a) different vessel types and (b) different locations in the UK? Could shore power have any other positive or negative environmental impacts (e.g. any impacts on marine pollution)? Please quantify and disaggregate your responses as much as possible.
4. In your opinion, what are the key (a) barriers and (b) incentives for ship owner, ship operators and ports to invest in shore power?
5. Can you provide estimates of the costs and benefits for any current or future shore power projects in the UK, including emission savings, costs of infrastructure at ports and costs of any upgrades to existing network connections and any reinforcements required to the electricity network? If possible, please provide estimates of cost recovery periods for these projects and estimates of the associated increases in electricity demand?
6. Can you provide estimates of the total overall costs and benefits if shore power is taken-up commercially at scale across the UK, including the overall emission savings and electricity demand? Please disaggregate these estimates across different locations, if possible?
7. Are you aware of any shore power installation projects underway in the UK? If so, please provide as much detail as possible?
8. Do you think government coordinated guidance would be a helpful tool for ports and other operators to navigate the complexity of shore power projects? If so, which topics should be included to maximise the value of such a document?

9. In your opinion, how could government's coordinating function be deployed to accelerate collaboration across the maritime sector to facilitate shore power projects? Can you please provide examples?
10. In your opinion, does future revenue uncertainty represent a significant barrier to investment in infrastructure for shore power? Please explain your answer.
11. Can you provide examples of innovative commercial finance models that might help de-risk port investment in shore power infrastructure? Please include as much detail as possible.
12. Do you have any other views on the potential of government's coordinating function in supporting the uptake of shore power?
13. In your view, what would the impacts of a mandate on vessels to use shore power while at berth be on (a) ship owners (b) ship operators (c) UK ports and (d) the wider UK economy?
14. Do you think that any mandate on vessels to use shore power while at berth in the UK should be accompanied by a mandate on ports to install the related shore power infrastructure? Please explain your answer.
15. In your view, what would the impacts of a mandate on port operators to install shore power infrastructure be on (a) ship owners (b) ship operators (c) UK ports, (d) energy network operators, and (e) the wider UK economy?
16. In your view, what would the impacts of a mandate that all vessels are "shore power capable" by design be on (a) ship owners (b) ship operators (c) UK ports and (d) the wider UK economy?
17. Do you have any other views on the potential implications of government mandates, or any other regulatory intervention, to support the take-up of shore power? Please include evidence where possible, including references to international case studies where relevant.
18. Are you aware of economic instruments deployed internationally to address emissions at berth? If so, please provide details, including their cost and environmental impacts.
19. In your view, how could similar economic instruments be used in the UK to address emissions at berth? What would the impacts be on (a) ship owners (b) ship operators (c) UK ports and (d) the wider UK economy?
20. In your view, which alternative levers, including economic instruments, would support the commercial take-up of shore power in the UK? Please provide as much detail as possible, including on potential impacts.
21. In your opinion, what uptake of shore power do you expect in the UK between now and 2050, in the absence of further government intervention?
22. Do you have any other information or evidence that you would like to submit as part of your consultation response?

Annex B: Consultation principles

The consultation is being conducted in line with the government's key consultation principles which are listed below. Further information is available at https://www.gov.uk/government/publications/consultation-principles-guidance

If you have any comments about the consultation process please contact:

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