The Shipping Sector And GHG Emissions: The Initial Strategy For A Zero-Carbon Pathway

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In 2018, the International Maritime Organization (IMO) announced the first sector-wide emission reduction target for international shipping: to limit emissions by at least 50% by 2050 compared to 2008. The roadmap to achieve this goal is the Initial IMO Strategy on Reduction of GHG Emissions from Ships, which proposes implementation measures for the short-term (2018-2023), mid-term (2023-2030) and long-term (beyond 2030). This article examines one of each type of candidate measures, notably National Action Plans, market-based mechanisms and alternative fuels, all of which are central to the implementation of the Initial Strategy due to their significant practical impact. We argue that National Action Plans, although not a suitable tool to tackle ‘international’ shipping emissions, can play a key role in mobilizing capacity and resources, and directing national action. In relation to market-based mechanisms, we find that a carbon tax might be a more efficient way to incentivize emissions reductions, when compared to emissions trading. Yet ultimately, the sector’s decarbonization can only be truly achieved with zero-carbon fuels that are safe for human health and the environment. We explore the considerable barriers to the development and use of these fuels and consider how leading shipping companies and financial sector are beginning to shift capital and resources to this challenge, spurred by the new IMO targets and understandings of climate-related financial risks and opportunities.

Key words: international shipping, GHG emissions, national action plans, market-based mechanisms, alternative fuels

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1. Introduction

International shipping carries around 80% of the global trade by volume.\(^1\) Dry bulk carriers (iron ore, coal, grain and similar cargo) account for the largest share of the world fleet in dead-weight tonnage, followed by oil tankers (crude oil and by-products) and container ships.\(^2\) While shipping has proven to be one of the most efficient means of transportation for bulk commodities worldwide,\(^3\) in absolute terms shipping is a substantial emitter, accounting for approximately 2.2% of total global greenhouse gas [GHG] emissions.\(^4\) Moreover, with the rapid growth in international trade in recent decades, emissions from international shipping continue to rise,\(^5\) and are predicted to increase between 50% to 250% by 2050, unless action is taken.\(^6\) The primary driver of this predicted increase is market demand in the three most significant sectors: oil tankers, containerships and bulk carriers.\(^7\) Containerships are currently the largest emitters due to the premium they place on speed, as compared with tankers or bulk carriers.\(^8\)

Maritime vessels burn fossil fuels (mainly heavy fuel oil and marine diesel oil) for propulsive power and to generate electricity on-board.\(^9\) This produces both GHG and non-GHG emissions.\(^10\) GHG emissions include carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O).\(^11\) GHG emissions are directly related to total fuel consumption, and this can vary depending on various factors (hull shape and roughness, loading conditions, engine condition, weather conditions etc).\(^12\) The main non-GHG emissions and air pollutants of concern are Sulphur Oxides (SOx), which are harmful to human health and the environment.\(^13\)

For decades, there have been no sector-wide GHG reduction targets in international shipping.\(^14\) Article 2.2 of the 1997 Kyoto Protocol merely directs Annex I parties to pursue limitation of

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2 Ibid, p.23
4 Ibid, p.5490
5 Jun Yuan, Szu Hui Ng, and Weng Sut Sou, ‘Uncertainty Quantification of CO2 Emission Reduction for Maritime Shipping’ (2016) 88 Energy Policy 113
11 Supra note 9
12 Ibid
14 IMO, ‘Second International Maritime Organization (IMO) Green House Gas (GHG) Study 2009’ (*International Maritime Organization*)
GHG emissions from marine bunker fuels by working with the International Maritime Organization (IMO). The maritime transport sector was also excluded from Annex A of the Kyoto Protocol (which lists the sectors where national emission reductions should be attained), and the IMO was singled out as the main regulatory body responsible. The subsequent 2015 Paris Agreement also made no reference to international shipping. Notably, the 1982 United Nations Convention on the Law of the Sea (UNCLOS) does require States to establish international rules and standards through the IMO to prevent vessel-source pollution, as well as pollution of the marine environment from or through the atmosphere. However, UNCLOS does not define specific obligations regarding GHG emissions. As such, although contested by the industry, the general perception is that the shipping sector has by and large ‘escaped’ international obligations under the climate change regime.

Undoubtedly, environmental regulation in international shipping has broadened significantly over time, from oil spills, to ballast water control, invasive species, waste management, air pollutants such as SOx, and more recently GHG emissions. Most progress has been made under the International Convention for the Prevention of Pollution from Ships (MARPOL). Since the late 1990s, the IMO has investigated several policy measures to reduce emissions. The IMO has broad competence to regulate on environmental matters through the Maritime Environment Protection Committee (MEPC). The most significant achievements implemented to date are the technical and operational measures adopted in the form of amendments to Annex VI of MARPOL.

In 2011, the IMO amended MARPOL Annex VI to introduce new mandatory standards on energy efficiency to be achieved through two technical measures: the Energy Efficiency Design
Index (EEDI)\textsuperscript{23} and the Ship Energy Efficiency Management Plan (SEEMP).\textsuperscript{24} These measures do not set sector wide emission reduction targets, but contribute to reduced emissions because more efficient ships use less fuel and emit less GHG. Parallel to these IMO developments, and in response to the regulatory gaps concerning GHG emissions in international shipping, the European Parliament adopted the Regulation on Monitoring, Reporting and Verification on Carbon Dioxide Emissions from Maritime Transport (EU-MRV) in 2015.\textsuperscript{25} This requires shipowners and operators to monitor, verify and report CO2 emissions from vessels larger than 5,000 gross tonnage calling at European ports.\textsuperscript{26}

Apart from the regulations noted above, there are a range of private regulatory measures, such as industry-led voluntary standards, that are increasingly being used in international shipping to address GHG emissions. Prominent examples include the Clean Shipping Index and Right Ship.\textsuperscript{27} Commonly, these standards rank vessels on their GHG emissions or energy efficiency; and tend to be process-oriented, prescribing an appropriate conduct rather than a specific outcome.\textsuperscript{28} To date, the main drivers for these standards are ‘corporate consumers,’ who pay for shipping services and have an economic interest in reducing fuel use through efficiency measures.\textsuperscript{29}

Against this background of growing regulatory attention, the IMO announced in 2018 the first sector-wide emissions reduction target for international shipping: to cut down emissions by at least 50\% by 2050 compared to 2008. The roadmap to achieve this goal is the Initial IMO Strategy on Reduction of GHG Emissions from Ships (Initial Strategy).\textsuperscript{30} Widely celebrated as a ‘watershed moment’,\textsuperscript{31} this resolution comes at a time when there is increasing recognition of the need for urgent climate action to meet the goals of the Paris Agreement. Given projections for ongoing growth in international trade through shipping, it is highly significant that the IMO has shifted beyond its previous focus on emissions intensity and efficiency to put forward an absolute emissions reduction target. This sends an important signal to the industry that rapid innovation is urgently needed.\textsuperscript{32}

The aim of this article is to explore the implementation measures that have been put forward by the IMO to meet the 2050 target and comment on their feasibility and likely effectiveness.

\textsuperscript{23} The Energy Efficiency Design Index (EEDI) introduces minimum efficiency design requirements for all new ships, Resolution MEPC.203(62) adopted at MEPC 62\textsuperscript{nd} session (July 2011); International Chamber of Shipping, World Trade and the Reduction of CO2 Emissions United Nations Framework Convention on Climate Change (UNFCCC) 2014. In 2014, MEPC adopted amendments to the EEDI regulations to extend the scope of EEDI to: LNG carriers, ro-ro cargo ships (vehicle carriers), ro-ro cargo ships, ro-ro passenger ships and cruise passenger ships having non-conventional propulsion, Resolution MEPC.245(66), adopted on 4 April 2014.

\textsuperscript{24} The Ship Energy Efficiency Management Plan (SEEMP) specifies a technological threshold for all ships to meet energy efficiency requirements, including for example reducing fuel consumption, Resolution MEPC.203(62).


\textsuperscript{26} Chapter II, Article 4 EU-MRV Regulation.

\textsuperscript{27} Supra note 19, p.190.

\textsuperscript{28} Ibid, p.239.

\textsuperscript{29} Ibid, p.232, 253

\textsuperscript{30} Resolution MEPC.304(72), adopted on 13 April 2018 at MEPC 72\textsuperscript{nd} Session (from 9 to 13 April 2018).


The Initial Strategy proposes ‘candidate measures’ to achieve the target over three timeframes (short, medium and long-term). These measures include technical and operational energy efficiency measures, with a focus on improving EEDI and SEEMP frameworks, as well as technical cooperation and capacity building. We identify three particular measures that are central for the implementation of the Initial Strategy: National Action Plans; market-based mechanisms; and alternative fuels. These are categorized as short, medium and long-term candidate measures, respectively. These measures are likely to have significant practical impact, through the creation of supportive domestic policies, introduction of market incentives for cleaner fuels, and shifting of resources and capital towards low or zero-carbon fuels.

After setting out the detail of the new IMO Strategy in Part 2, Part 3 explores the promise and the potential shortfalls of these three implementation measures. We argue that National Action Plans, although not suitable to tackle international shipping emissions, can play a key role in mobilizing national stakeholders and directing domestic action, notably in relation to port operations and infrastructure. With regard to market-based mechanisms, drawing from experience with the Kyoto Protocol’s flexibility mechanisms, we find that a carbon tax might be a more efficient way to incentivize the uptake of alternative fuel options, as compared to emissions trading. Finally, we emphasize that the sector’s decarbonization goal can only be truly achieved through the widespread use of alternative fuels that are safe for human health and the environment in large-scale shipping. However, there remain considerable barriers to the commercial deployment of these fuels at scale. In this context, we explore how leading shipping companies and financial sector actors are beginning to shift capital and resources to this challenge, spurred by the new IMO targets and broader understandings of climate-related financial risks and opportunities. We understand that the success of other candidate measures proposed by the IMO much depends on the commercial availability and reliability of alternative fuels. Given the long asset cycles associated with international vessels and the extent of supporting infrastructure development required, we emphasise the importance of prioritising the development and deployment of alternative fuels immediately, as a focus for ongoing IMO negotiations. It is in this context, that the IMO has perhaps the most important role to play – in ensuring a level-playing field and supporting developing and middle-income countries to access appropriate capacity-building and technical-assistance for the deployment of alternative fuels and associated port infrastructure.

2. Initial IMO Strategy on Reduction of GHG Emissions from Ships

2.1. Aims and Vision

The Initial Strategy, and the GHG emissions targets contained within, apply to all IMO member states and relate to international shipping emissions. The IMO defines international shipping as shipping between ports of different countries. The Strategy sets out three levels of ambition. First, the carbon intensity of ships should decline through the implementation of further phases of the EEDI. Second, the carbon intensity of international shipping should

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33 Initial IMO Strategy on Reduction of GHG Emissions from Ships (Initial Strategy), para 4.1
34 Initial Strategy, para 4.7. (1) (2)
35 Initial Strategy, para 4.7. (7); 4.8 (2); 4.8 (5)
36 Initial IMO Strategy, para. 1.7
37 While Domestic shipping refers to shipping between ports of the same country, see supra note 14
38 Initial IMO Strategy, para 3, p5
decline by reducing emissions per transport work\textsuperscript{39} by at least 40\% by 2030, pursuing efforts towards 70\% by 2050. Third, GHG emissions from international shipping should peak and decline as soon as possible and total annual emissions should be reduced by at least 50\% by 2050 compared to 2008.\textsuperscript{40} It is recognized that technological innovation and alternative bunker fuels and/or energy sources are key to achieving the three levels of ambition.\textsuperscript{41}

Shipping is a commercial activity and regulatory measures adopted by the IMO are likely to impact international trade. For example, measures to reduce emissions (e.g. speed optimization, optimised routing, improved fleet planning and other logistics-based measures) may impact the overall logistical supply chain.\textsuperscript{42} Therefore, the Initial Strategy also requires that emission reduction measures consider potential impacts on States, notably developing countries,\textsuperscript{43} and involve evidence-based decision-making balanced with the precautionary approach.\textsuperscript{44} The Strategy’s guiding principles are those of non-discrimination and no favorable treatment, enshrined in MARPOL and other IMO conventions,\textsuperscript{45} and the UNFCCC principle of Common but Differentiated Responsibilities.\textsuperscript{46}

### 2.2. Implementation

The Initial Strategy proposes ‘candidate measures’ to implement the new emission reduction goals over three timeframes.\textsuperscript{47}

Short-term measures (finalized and agreed between 2018 and 2023) involve improvements to existing energy efficiency frameworks (EEDI and SEEMP),\textsuperscript{48} and future review of EEDI regulations.\textsuperscript{49} Operational measures (e.g. speed optimization, speed reduction, etc.) are also proposed.\textsuperscript{50} It is recognized that the logistics chain, including ports, should also be optimized, for example through developing infrastructure to support alternative low-carbon fuels or to provide on-shore power from renewable sources.\textsuperscript{51} The IMO also encourages countries to develop National Action Plans (NAPs), which will be the basis for future national emissions reduction policies.\textsuperscript{52}

Mid-term measures (finalized and agreed between 2023 and 2030) include the adoption of an implementation strategy for alternative low carbon and zero-carbon fuels, including the update

\textsuperscript{39} Transport work can be defined as Gram of CO2 per tonne-nautical mile gCO2/tnm, see ‘Calculating and Comparing CO2 Emissions from the Global Maritime Fleet’ (Rightship, 2013)

\textsuperscript{40} Initial Strategy, para 3.1, 3, page 6. The industry suggested that the baseline year for measuring shipping’s emissions is 2008, when GHG emissions were at their highest, see ‘Reducing CO2 Emissions to Zero: The Paris Agreement for Shipping,’ (International Chamber of Shipping (ICS), 2018), p. 6.

\textsuperscript{41} Initial Strategy, para 3.1, p5

\textsuperscript{42} Supra note 8, p458

\textsuperscript{43} MEPC 68 (MEPC 68/21, paras 4.18 to 4.19) and their specific emerging needs, as recognized in the Organization’s Strategic Plan (Resolution A.1110(30))

\textsuperscript{44} Resolution MEPC.67(37); Initial Strategy, para 3.2, p.6

\textsuperscript{45} Initial Strategy, para 3.2, p.6

\textsuperscript{46} 2015 Paris Agreement; Initial Strategy. para 3.2, p.6

\textsuperscript{47} Initial Strategy, paragraph 4.1, p.7

\textsuperscript{48} The IMO MEPC 66\textsuperscript{26} Session, from 31 March – 4 April 2014. adopted resolution MEPC.203(62) on Inclusion of Regulations on Energy efficiency for ships in MARPOL Annex VI, introducing a mandatory Energy Efficiency Design Index (EEDI) and the Ship Energy Efficiency Management Plan (SEEMP) measures for the energy efficiency of ships.

\textsuperscript{49} Initial Strategy, para 4.7, p.7

\textsuperscript{50} Initial Strategy, para 4.7, p.8

\textsuperscript{51} Initial Strategy, para 4.7, p.8

\textsuperscript{52} Initial Strategy, para 4.7, p.8
of NAPs to specifically consider such fuels. They continue to include operational energy efficiency measures for both new and existing ships. Any measures adopted should follow a three-step approach that includes: data collection, data analysis, and decision-making on future measures. Other mechanisms, particularly market-based mechanisms, should also be considered as mid-term candidate measures to incentivize emission reductions.

The long-term measures (finalized and agreed beyond 2030) do not specify any particular mechanisms or approaches but commit more broadly to the development and use of zero-carbon or fossil-free fuels as a way to decarbonize the sector in the second half of the century. There are a number of short and mid-term measures which underpin these longer term goals including initiating research and development activities addressing alternative and zero carbon fuels, developing incentives for first movers to develop and take up new technologies, developing a robust lifecycle GHG/carbon intensity guidelines for all types of alternative fuels, and developing an implementation program for their effective uptake.

In late 2018, MEPC approved a programme of follow up actions to 2023, when the Strategy will be revised. In 2019, MEPC adopted specific measures to support the implementation of the Initial Strategy, including a forthcoming 4th IMO GHG Study, further cooperation with ports, an impact assessment procedure to evaluate measures adopted under the Strategy, and a multi-donor trust fund for tackling GHG emissions. Moreover, it was agreed that the third phase of EEDI should enter into effect earlier than initially planned (2022 instead of 2025) for several ship types. MEPC has also called intersessional working group sessions to speed up the agreement on candidate measures.

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53 Initial Strategy, para 4.8, p.9
54 Maritime Environment Protection Committee (MEPC) 68 (May 2015) agreed on this 3-step approach, IMO Regulation MEPC.263(68).
55 Initial Strategy, para 4.8, 3, p.9
56 Initial Strategy, para 4.9, 1, p.9
57 Initial Strategy, para 4.7, 9, 10 and 11, p.7-8
58 Initial Strategy, para 4.8, 1, p.8
59 Adopted at MEPC 73rd session, 22-26 October 2018.
61 MEPC, 74th session, 13-17 May 2019
62 MEPC, 73rd session, 22-26 October 2018, MEPC 73/7.
63 MEPC 323 Resolution, 74th session.
64 MEPC 73/8 also approved the procedure for assessing impacts on States of candidate measures for reduction of GHG emissions from ships. It identifies four steps: 1) initial impact assessment, to be submitted as part of the initial proposal to the Committee for candidate measures, 2) submission of commenting document(s), if any, 3) comprehensive response, if requested by commenting document(s), 4) comprehensive impact assessment, if required by the MEPC.
65 MEPC 73/7/4 agreed to establish a voluntary multi-donor trust fund ("GHG TC-Trust Fund"), to provide a dedicated source of financial support for technical cooperation and capacity-building activities.
66 MEPC 74 agreed that the third phase of EEDI should enter into effect in 2022 for several ship types with up to 50% carbon intensity reduction for largest containerships, and established a correspondence group working on possible introduction of EEDI phase 4 (after 2025). The EEDI will be implemented in phases. Currently, it is in phase 1 (2015 to 2019). Phase 2 will run from 2020 to 2024 and Phase 3, from year 2025 onwards, See ‘IMO Train the Trainer Course, Energy Efficiency Shipping Operation’ (International Maritime Organisation, 2016) <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/IMO-Train-the-Trainer-Course.aspx> accessed 12 March 2020
3. The Promise and Shortfalls of Candidate Measures

3.1. National Action Plans

The Initial Strategy encourages countries to develop National Action Plans (NAPs) which propose policies and strategies to address GHG emissions from international shipping. NAPs must be developed in accordance with IMO guidelines (which are yet to be adopted), and should take into account the need to avoid unilateral or regional measures.67

National action plans or strategies are commonly used in multilateral environmental agreements, such as in the 1992 Convention on Biological Diversity (CBD)68 or 1973 Convention on International Trade in Endangered Species of Fauna and Flora (CITES).69 For example, the CBD requires States to develop National Biodiversity Strategy and Action Plans (NBSAP),70 which reflect how the country intends to fulfil the objectives of the CBD, taking into consideration the national needs and circumstances.71 The NBSAPs set up specific national actions and are recognised as an important tool for the implementation of the CBD used by nearly all member States.72 This is similar to the aviation sector, which through the International Civil Aviation Organization (ICAO), calls on States to submit action plans outlining their domestic policies and actions, and annual reporting to ICAO on international aviation CO2 emissions.73

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68 Article 6 (a), 1992 Convention on Biological Diversity (CBD). Also, according to Target 17 of Aichi Biodiversity. The main CBD COP decision that provide guidance for NBSAP are Decision IX/8 and Decision X/2.

69 CITES) has also used national action plans, for example by requesting some member States to adopt National Ivory Action Plans as a practical domestic tool to control illegal trade in ivory At the Sixty-fourth meeting of the Standing Committee Bangkok (Thailand), 14 March 2013 SC64 Doc. 2, China, Kenya, Malaysia, Philippines, Thailand, Uganda, the United Republic of Tanzania and Viet Nam were requested to finalize their national ivory action plans, with time frames and milestones, and submit them to the CITES Secretariat.

70 1992 Convention on Biological Diversity (CBD), Article 6 (a). Also, according to Target 17 of Aichi Biodiversity, each Party should develop and adopt by 2015 an updated National Biodiversity Strategy and Action Plan (NBSAP). The main CBD COP decision that provide guidance for National Biodiversity Strategy and Action Plans (NBSAP) are Decision IX/8 and Decision X/2.


72 Currently only 6 parties to the CBD have not yet submitted their NBSAPs, Convention on Biological Diversity <https://www.cbd.int> accessed 12 March 2020

73 Resolution A37-19: Consolidated statement of continuing International Civil Aviation Organization (ICAO) policies and practices related to environmental protection – Climate change, para 9
National action plans are useful for a number of reasons. They create or strengthen domestic law and policies, help inform how MEAs are implemented domestically, allow the sharing of information and best practices and facilitate a more coherent treaty implementation. Importantly, NAPs help to mobilise different sectors - public and private sectors as well as civil society - to work together towards a common goal. NAPs are a sensible tool for the management of natural resources within national jurisdictions, such as plants, animal species and their natural habitats, as observed through the experience of the CBD or CITES. However, they may not be an ideal instrument to handle issues that transcend national boundaries, such as international shipping. By definition, emissions from international shipping occur between ports of different countries. Even if individual countries have NAPs in place, these cannot tackle emissions that occur when a ship goes from country A to B.

To say that NAPs are not well-suited to reduce emissions from international shipping does not mean that they have no value or should not be used. NAPs are a national policy tool that can guide domestic action, such as by incentivizing energy efficiency measures in ports (providing onshore power supply from renewable sources, optimizing port calls, facilitating just-in-time arrival of ships, and improving shipping logistics and supply chains). NAPs are particularly useful for improving port operations and infrastructure, as such measures can only be implemented domestically. Moreover, as observed with the CBD and other treaties, NAPs help engage national stakeholders and mobilise capacity and funding. As noted earlier, the IMO will adopt guidelines setting up common expectations and standards for NAPs. If all NAPs are prepared according to IMO guidelines and organised around meeting the new IMO targets, they can also be a coordinating mechanism to align national action towards global goals. As such, NAPs play a similar role to Nationally Determined Contributions (NDC) which intend to align domestic actions with the goals of the Paris Agreement.

In response to the Initial Strategy, the UK and Norway have already formulated NAPs: the UK Clean Maritime Plan and the Norwegian Action Plan for Green Shipping, both adopted in 2019. The UK commits to zero emission ships by 2050, by creating non-tax incentives, fostering innovation through a Green Finance Initiative for shipping, among other measures. The UK will also measure emissions from vessels operating domestically (including inland waterway vessels), extend North Sea Emissions Control Areas in internal waters and develop guidelines for ports to develop Air Quality Plans. The Clean Maritime Council is the agency created to implement those commitments. The UK recognizes that significant levels of investment in innovation will be required to trigger the scale of emission reductions required. As such, the government will also explore alternative fuels, particularly hydrogen, ammonia, onboard batteries and electric engines, and work on improving ports infrastructure for

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74 For example, the process of design and implementation of Brazil’s NBSAP involved various sectors of society (federal, state and municipal governments, academia, corporations, civil society, representatives of indigenous peoples and traditional communities), see supra note 71, Part 1.3
75 For example, the UK Clean Maritime Plan has been developed in close cooperation with the maritime industry and other stakeholders and created a Clean Maritime Council, see ‘Clean Maritime Plan’ (United Kingdom Department for Transport, 2019) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815664/clean-maritime-plan.pdf> accessed 12 March 2020, p. 5
76 Ibid, p 7
77 Ibid, p. 21
78 Ibid, p. 21
79 Ibid, p. 42
80 Ibid, p. 26
alternative fuels’ transportation and bunkering. A Maritime Emissions Regulation Advisory Service (MERAS) will be created in 2020 to support innovators using zero emission propulsion technologies. The UK Clean Maritime Act also envisages the adoption of new safety regulations for the storage of alternative fuels, and for the planning and permissions required for new bunkering infrastructure. Notably, UK’s NAP establishes aspirational goals, rather than mandatory targets.

Norway’s NAP commits to reducing emissions from domestic shipping and fisheries by 50% by 2030 and developing low and zero-emission solutions for all types of vessels. It establishes specific measures for each category of vessels. For example, cruise ships and ferries sailing in the West Norwegian Fjords, are expected to be emission-free by 2026. The Government also envisages to renew the cargo fleet with funding from different domestic sources (Norwegian Export Credit Guarantee Agency, Export Credit Norway and Innovation Norway). It also commits to reduce emissions from cargo ships in short sea shipping, through incentive schemes and including zero-emission transport requirements in public procurement processes. Similar to the UK, Norway’s NAP will focus on technological innovation for the uptake of alternative fuels and building related port infrastructure. The aim is for ports to be emission-free by 2030. Certain Norwegian ports are already offering onshore power facilities particularly for cruise ships, and discounts for ships based on their Environmental Ship Index (ESI) performance.

The IMO currently has several initiatives to assist member States in reducing domestic shipping emissions. One of these is the Global Maritime Energy Efficiency Partnerships Project (GloMEEP), which supports ten pilot countries to adopt energy efficiency measures and cut down GHG emissions, by introducing legal and policy reforms, and developing capacity-building and public-private partnerships. GloMEEP has formulated various national guidelines, for example to control emissions and introduce energy efficiency measures for

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81 Ibid, p. 34
82 Ibid, p. 44
83 Ibid, p. 34
84 Ibid, p. 27
86 Ibid, p. 38
87 Ibid, p. 43
88 Ibid, p. 43
89 Ibid, p. 55
90 Ibid, p. 55
91 Ibid, p. 55
93 The Lead Pilot Countries of the GloMEEP project are: Argentina, China, Georgia, India, Jamaica, Malaysia, Morocco, Panama, Philippines and South Africa.
ships in port areas,\textsuperscript{94} optimise energy consumption\textsuperscript{95} and to assist countries in developing ship and port emission reduction strategies.\textsuperscript{96}

A draft IMO resolution agreed in November 2019 proposes guidelines for countries to develop their NAPs.\textsuperscript{97} It suggests that NAPs could include but are not limited to: a) improving domestic institutional and legislative arrangements for the implementation of IMO instruments, b) developing activities to enhance the energy efficiency of ships, c) initiating research and advancing the uptake of low and zero-carbon fuels, d) accelerating port emission reduction activities, e) fostering capacity-building, awareness-raising and regional cooperation, f) facilitating the development of infrastructure for green shipping. Member States that have already prepared NAPs are encouraged to share their experiences with the IMO, while the other States are invited to submit their NAPs as soon as possible. The text of the draft resolution will be put forward to the next MEPC session for adoption.

As observed in the UK and Norway, NAPs are a national policy tool which can build on, coordinate, and guide national actions among IMO member States to improve energy efficiency in shipping, enhance port infrastructure and operations, and to develop alternative fuels and technology. If NAPs are designed in alignment with the new IMO targets and guidelines, they can also be a coordination instrument to ensure that member States work towards common goals.

\subsection*{3.2 Market-Based Mechanisms}

The use of market-based mechanisms (MBMs) is one of the most controversial candidate measures under the Initial Strategy and there is, as yet, no agreed MBM for the sector.\textsuperscript{98} The IMO has discussed their use as a policy instrument for cost-effective abatement for many years,\textsuperscript{99} in the form of a carbon tax, emissions trading under a cap and trade scheme, or a hybrid mechanism (combining tax and trading).\textsuperscript{100} Yet the shipping industry remains skeptical of MBMs as a means to incentivize emission reductions, particularly the use of emissions trading at a regional scale,\textsuperscript{101} preferring instead a globally applied bunker fuel levy.\textsuperscript{102} Recently, the aviation sector, which has also developed GHG emissions approaches outside the framework

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\textsuperscript{94} GloMEEP Project Coordination Unit, IMO, Emissions Control and Energy Efficiency Measures for Ships in the Port Area, 2015.
\textsuperscript{95} GloMEEP Project Coordination Unit, IMO, Study on the optimization of energy consumption as part of implementation of a Ship Energy Efficiency Management Plan (SEEMP) 2016.
\textsuperscript{96} GloMEEP Port Emissions Toolkit, Development of Port Emissions Reduction Strategies (Guides No 1 and 2) 2018; and Ship Emissions Toolkit, Development of Port Emissions Reduction Strategies (Guides No 1, 2 and 3), 2018.
\textsuperscript{97} IMO Draft Resolution MEPC.75/7/2 agreed by the IMO Intersessional Working Group on Reduction of GHG Emissions from Ships. It will be submitted to the 75th MEPC session, which was scheduled to take place from 30 March to 3 April 2020, but has been recently postponed, see <http://www.imo.org/en/MediaCentre/MeetingSummaries/Pages/Default.aspx> accessed 13 March 2020.
\textsuperscript{98} Supra note 40, p.7
\textsuperscript{99} In MPEC 59, the overwhelming majority agreed that MBMs should be a part of a comprehensive package of measures to regulate greenhouse gas emissions from international shipping, see Tsung-Chen Lee, Young-Tae Chang, and Paul T.W. Lee, ‘Economy-wide impact analysis of a carbon tax on international container shipping’ (2013) 58 Transportation Research 87–102, 88.
\textsuperscript{101} Supra note 40, p.13
\textsuperscript{102} Ibid, p.13
\end{flushright}
of the UNFCCC, opted for a global MBM scheme in the form of a Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA), which aims to address annual increases in total CO2 emissions from international civil aviation above 2020 levels. CORSIA also introduced a Monitoring, Reporting and Verification (MRV) process for aircraft operators undertaking international flights.

Experience with emissions trading in other relevant contexts, combined with the particular challenges of the international shipping sector, suggest that establishing a maritime Emissions Trading Scheme (ETS) could be administratively complex, highly contested, as well as time and resource intensive. A maritime ETS would require the adoption of an internationally agreed baseline of emissions for international shipping and the establishment of an MRV process, similar to CORSIA, to ensure that emissions are measured and reported in a standardised and comparable manner. The IMO will have the responsibility to create the institutional and legal frameworks governing such a scheme, and to oversee its functioning. The development of each component of the ETS requires time, as their rules must be internationally agreed. Significant capacity and funding is also required.

Experience implementing the three market-based mechanisms of the 1997 Kyoto Protocol (Joint Implementation, Clean Development Mechanism and Emissions Trading) also underscore the need for careful design of MRV processes and the likely administrative complexity of developing a maritime ETS. Those mechanisms (known as flexibility mechanisms) generated emission reduction units that were used by developed countries (Annex I Parties) to meet reduction commitments under Article 3. They were governed by an intricate set of rules and guidelines developed over time. During the lifetime of the Kyoto Protocol, such rules and procedures were created to ensure ‘transparency, efficiency and accountability’ through independent auditing and verification of project activities. Consequently, a dedicated institutional structure, involving several designated bodies, was created to oversee their functioning. The flexibility mechanisms have been widely discussed in academic literature, where they have generally been criticized for creating complex, non-

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103 International aviation defines as civil aviation flights that depart in one country and arrive in a different country, Paragraph 5, Resolution A39-3: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Global Market-based Measure (MBM) scheme.
105 1997 Kyoto Protocol (Kyoto Protocol), Article 6
106 Kyoto Protocol, Article 12
107 Kyoto Protocol, Article 17
108 The objective was to reduce their overall emissions of such gases by at least 5% below 1990 levels in the first commitment period, from 2008 to 2012, Kyoto Protocol, Article 3
109 For example, the rules regarding the Clean Development Mechanism (CDM) were established under the Marrakesh Accords & Declaration, a set of agreements reached at the 7th Conference of the Parties (COP 7) to the United Nations Framework Convention on Climate Change, in 2001.
110 Kyoto Protocol Article 6 (2), Article 12 (7), Article 17
transparent and overly bureaucratic procedures.\textsuperscript{113} If a maritime ETS is created, the IMO is likely to encounter similar challenges.

In light of the above challenges and complexities, we argue that a maritime carbon tax is a more suitable tool to incentivize emission reductions. Currently, fuel prices do not fully reflect associated environmental costs or externalities (climate change, health hazards, etc.).\textsuperscript{114} A maritime carbon tax would take into account those negative externalities.\textsuperscript{115} Generally, a carbon tax tracks the actual quantity of GHG emitted by the consumption of fossil fuels.\textsuperscript{116} A maritime carbon tax would set up a price on GHGs emitted by ships engaged in international voyages,\textsuperscript{117} based on fuel consumption. Put simply, the more emissions a ship generates, the more it pays.\textsuperscript{118} In terms of institutional architecture, a carbon tax would require setting up tax levels and a phase-in schedule.\textsuperscript{119} This may involve battles among countries to win tax concessions, but at least the core rule - a carbon tax based on carbon content - can form the base policy while the concessions are hammered out.\textsuperscript{120} There are also examples of carbon taxes successfully being used at the national level. For example, Norway was one of the first countries to introduce a carbon tax in 1991, and currently more than 80% of Norwegian emissions are subject to a carbon tax.\textsuperscript{121}

If a maritime carbon tax is introduced, ship owners could choose to invest in clean technologies and alternative fuels so that they do not pay or pay lower carbon taxes.\textsuperscript{122} Alternatively, if they choose to pay the carbon tax, the tax revenue could be used to develop new technologies, alternative maritime fuels and support adaptation measures in ports located in vulnerable countries affected by climate change. The International Chamber of Shipping (ICS) has expressed support for a bunker fuel levy payable to a potential IMO climate fund, with some of the funds deployed to support research into new low carbon technologies, and the rollout of the expensive new bunkering infrastructure that will be required to supply low carbon fuels, particularly in the ports of developing nations.\textsuperscript{123}

\textsuperscript{113} The criticisms also relate to the fact that CDM has failed to deliver significant sustainable development benefits to communities, involved limited public participation and focused on limited types of projects, Srikanth Subbarao, Bob Lloyd, ‘Can the Clean Development Mechanism (CDM) deliver?’ (2011) 39 Energy Policy 1600-1611, 1610.
\textsuperscript{114} UK CMP, p. 28.
\textsuperscript{115} Shi-Ling Hsu, ‘The Case for a Carbon Tax, Getting Past our hang-ups to Effective Climate Policy’ (2011) Island Press
\textsuperscript{116} Ibid, p. 87.
\textsuperscript{119} Supra note 115, p.87
\textsuperscript{120} Ibid
\textsuperscript{121} Norwegian Action Plan, p. 61
\textsuperscript{122} Tsan-Ming Choi, ‘Carbon footprint tax on fashion supply chain systems’ (2013) 68 Int J Adv Manuf Technol 835–847, 837
\textsuperscript{123} Supra note 40, p 8
In the complicated world of domestic and international climate policy, one of the key advantages of a carbon tax is its breadth, simplicity, and ability to piggyback on existing regulatory frameworks. This is particularly true to complex and transnational sectors such as international shipping. As pointed out by ICS, the shipping industry has a ‘sound dislike of unnecessary complication.’ Given the complications of many other GHG reduction policies and mechanisms, a carbon tax is probably the simplest and most straightforward approach.

3.3 Alternative Fuels

Operational and efficiency measures, such as slow steaming and improvements in ship design, many of which are addressed by existing regulations or proposed as short-medium term measures, have an important role to play in reducing fuel consumption and therefore GHG emissions. However, in order to realise the ambitious new IMO emissions reduction target, it is also widely recognized by the shipping industry, and in the Initial Strategy, that such measures are only part of the solution. The development and deployment of alternative low or zero-carbon fuels and/or energy sources for international shipping is critical to achieving decarbonisation targets.

The Initial Strategy commits, as a short-term measure, to develop robust lifecycle GHG/carbon intensity guidelines for all types of alternative fuels, in addition to other related research and development measures. Given the significant differences between the decarbonization potential of different alternative fuel options, as well as considerable variation in availability, cost and infrastructure requirements, these measures are critical to underpin long term decarbonization.

3.3.1 Decarbonisation potential and viability of alternative fuels

Heavy fuel oil is currently the dominant fuel for international shipping due to its economy and availability. However, given that fuel oil costs account, on average, for more than 50% of a ship’s operating expenses, there are in-built incentives for efficiency measures and potential uptake of alternatives once they are cost-competitive. Global oil prices are volatile, and

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124 Supra note 115
125 ICS, World Trade and the Reduction of CO2 Emissions United Nations Framework Convention on Climate Change (UNFCCC) 2014. The shipping industry comprises thousands of companies, most of which are Small and Medium Sized Enterprises (SMEs), see supra note 40, p 13
126 Supra note 115, p. 146
128 Supra note 40, p 10
129 Initial Strategy para 3.1, p.5.
130 Supra note Error! Bookmark not defined., at 81. For a summary of the literature on the potential emissions reductions associated with energy efficiency, ship design and fuel changes, see also Bouman EA, Lindstad E, Rialland AI, and Stromman AH, ‘State-of-the-art technologies, measures, and potential for reducing GHG emissions from shipping – a review’ (2017) 52 Transp Res Part D: Transp Environ 408–21.
131 Initial Strategy para 4.7, 11, p.8
132 Supra note 127, 4.7, 11, p.8
133 Ibid, 80.
Previous experiences of price fluctuations have prompted the uptake of alternative fuels such as liquified natural gas (LNG) as well as early research into hydrogen fuels.\textsuperscript{134}

Conventional heavy fuel oil has a high Sulphur (SOx) content.\textsuperscript{135} With the introduction of increasingly stringent fuel standards to manage non-GHG air pollutants such as SOx through MARPOL,\textsuperscript{136} as well as the introduction of Emissions Control Areas [ECAs] with even stricter standards,\textsuperscript{137} there is already considerable pressure on shipping companies to transition to alternative fuels with low sulphur. However, not all of these options align well with the Initial Strategy’s decarbonisation target. For example, driven largely by fuel availability and competitive fuel cost,\textsuperscript{138} LNG ships are already in commercial operation or under construction, particularly in Europe and the United States. While LNG fuels are compatible with new non-GHG air pollution standards, the decarbonization potential of LNG is far lower than the other alternative fuels discussed below, and in many situations may not be considerably better than current marine fuels.\textsuperscript{139}

There are a number of fuels or energy sources with high decarbonization potential that are being actively pursued by industry.\textsuperscript{140} One of the most prominent is biofuels. Biofuels are generally classified as ‘conventional’ (e.g. made from the sugars and oils in food crops grown on arable land), or ‘advanced’ (e.g. made from biomass waste by-products of food cultivation or other non-food biomass, including algae).\textsuperscript{141}

Generally speaking, biofuels have considerably lower NOx, SOx and particulate emissions than conventional marine fuels.\textsuperscript{142} Advanced biofuels also have significantly lower GHG emissions and many might be classified as ‘carbon neutral’, although the way in which


\textsuperscript{135} Deniz C, Zincir B, ‘Environmental and economical assessment of alternative marine fuels’ (2016) 113 J Cleaner Prod, 438–49.

\textsuperscript{136} In 2008, MARPOL regulations regarding air pollution from shipping were significantly strengthened to include the 0.5% Sulphur limit in bunker fuels through Regulation 14, to be operative from 1 January 2020: Sulphur oxides (SOx) and Particulate Matter (PM) – Regulation 14; IMO Resolution MEPC.280(70). To ensure compliance and a ‘level playing field’, the IMO imposed a prohibition, from 1 March 2020, on the carriage of non-compliant fuel oil and adopted guidelines to support the consistent implementation of the sulphur limit. See ‘Guidance to Shipping Companies and Crews on Preparing for Compliance with the 2020 ‘Global Sulphur Cap’ for Ships’ Fuel Oil in Accordance with MARPOL Annex VI’, (International Chamber of Shipping) \textless \url{http://www.ics-shipping.org/docs/default-source/resources/guidance-for-compliance-with-the-2020-global-sulphur-cap-july-2019.pdf?sfvrsn=24} \textgreater accessed 12 March 2020

\textsuperscript{137} Since 1 January 2015, the sulphur limit for fuel oil used by ships operating in Emission Control Areas (ECAs) designated by IMO for the control of sulphur oxide emissions (SOx) has been 0.10% m/m. The ECAs established under MARPOL Annex VI for SOx are: the Baltic Sea area; the North Sea area; the North American area (covering designated coastal areas off the United States and Canada); and the United States Caribbean Sea area (waters around Puerto Rico and the United States Virgin Islands). ‘The 2020 Global Sulphur Limit: Frequently Asked Questions’ (International Maritime Organization) \textless \url{http://www.imo.org/en/MediaCentre/HotTopics/GHG/Documents/2020%20sulphur%20limit%20FAQ%202019.pdf} \textgreater accessed 12 March 2020

\textsuperscript{138} Supra note 127, 76, and supra note 134, 373.

\textsuperscript{139} While GHG emissions are also lower at the point of combustion, there is the potential for these emissions gains to be significantly eroded via methane (a highly potent GHG) leakage during combustion or in the value-supply chain. If methane emissions cannot be reduced, then the global warming potential of LNG is not radically different from existing conventional fuel oils: supra note 127, 76-77; supra note 134, 368-369; supra note 135, 373.

\textsuperscript{140} For example, A.P. Moller Maersk, ‘Sustainability Report’ (2018), 14-15.

\textsuperscript{141} Supra note 134, 368.

\textsuperscript{142} Supra note 127, 77-78.
emissions are accounted for in relation to biofuels is complex and contested. In terms of viability, it is possible to ‘drop in’ some types of biofuels to existing ships without expensive retrofitting measures, and these approaches are being explored by leading shipping companies. However, the fuels themselves are currently significantly more expensive than conventional fuels, especially for advanced biofuels where production processes are immature. As such, cost and availability remain significant barriers.

Hydrogen fuel cell technology is also receiving considerable attention, with the International Energy Association urging its accelerated development as part of the emerging low and zero carbon energy economy, and many nations preparing strategic research and development plans to pursue these opportunities.

While hydrogen fuel cells do not create direct GHG emissions, emissions associated with the hydrogen supply chain can be significant depending on its source. Much commercially available hydrogen is currently produced from fossil fuel feedstocks, for example via gasification of coal. Zero-emissions hydrogen can be produced in two ways – renewable electricity can be used to split water into hydrogen and oxygen (electrolysis), or hydrogen can be produced from coal or methane, with carbon capture and storage (CCS) used to capture emissions. CCS technology is however far from being proven at scale. Further, producing hydrogen using electrolysis demands significant water resources and reliable renewable energy supply.

Despite the recent policy hype, there remain numerous barriers to fuel cell deployment at scale, and there are only a small number of hydrogen shipping projects at different stages of development. Current fuel cell technology does not yet meet the required power demand to propel large ships. Costs of production, transport and storage remain prohibitively high. While some existing natural gas infrastructure could potentially be used for hydrogen, such infrastructure is itself not uniformly available among countries. Fuel storage requirements

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143 For example, for a biofuel to be considered carbon neutral, the total carbon sequestered by the energy crop must compensate for all above ground emissions (e.g. cultivation, processing, land use change etc)? See discussion in supra n 127, 78. See also, Slade R, Bauen A and Gross R, ‘The Global Bioenergy Resource’ (2014) 4 Nature Climate Change
150 Supra note 127, 78-9; supra note 134, 369
Electric propulsion systems also potentially offer decarbonization potential in the longer term, where renewable energy sources are used to achieve stored energy.\textsuperscript{154} Currently, due to the low energy density of batteries relative to other fuels, batteries are only suitable for short voyages and generally as part of a hybrid system where they are used to boost output, optimise efficiency and reduce fuel consumption. However, in the longer term, larger high capacity batteries could conceivably be used as the primary energy source for larger ships and longer voyages.\textsuperscript{155} While such large batteries are presently prohibitively expensive, costs are falling rapidly. Similarly, costs of renewable electricity for recharging are dropping.\textsuperscript{156} Nonetheless, cost and availability remain key concerns. Further, a battery-powered shipping fleet would also potentially require considerable changes to global shipping routes to allow for battery recharging at port, as well as the development of a global recharging infrastructure.

Finally, wind and solar assisted ship propulsion is being pursued in some contexts. Given the size of the majority of global cargo ships, wind power is generally considered unsuitable as a sole energy source.\textsuperscript{157} However conventional sails (and modern alternatives) can assist with ship propulsion and allow ships to greatly reduce fuel consumption yet maintain desired speed. For smaller cargo ships, wind power may be particularly effective.\textsuperscript{158} Wind assistance systems are however in early development stages. Solar systems are also likely to have some potential application, either as wind/solar hybrid systems, or in augmenting on-board power requirements.\textsuperscript{159}

### 3.3.2. Driving private sector investment in alternative fuels

As discussed above, the most promising alternative fuel options for the shipping industry face considerable barriers to widespread commercial uptake due to their early stage of development and the level of investment required in ship retrofit, new ship build technology or associated fuel supply chain and port infrastructure.

In Part 3.1 above, we argued that NAPs are an important mechanism to coordinate national action around ports and infrastructure and to support innovation in alternative fuels. In Part 3.2, we suggested that a maritime carbon tax would incentivise the development of low carbon shipping and noted that the revenue from such a tax could be directed to supporting research and development and providing incentives for the uptake of alternative fuels. To build on this discussion, we now consider how new understandings of climate change as a financial risk and/or opportunity may help to drive the private sector to allocate capital and resources to support alternative fuel development and deployment. This discussion extends the 2016 analysis by Professor Joanne Scott and colleagues of private regulatory standards addressing GHG emissions in international shipping.\textsuperscript{160} These early standards generally sought to measure

\textsuperscript{154} Supra note 128, 10.
\textsuperscript{155} Ibid. See also, supra note 151.
\textsuperscript{156} Supra note 127, 79.
\textsuperscript{157} Supra note 127.
\textsuperscript{158} Supra note 127, 79-80.
\textsuperscript{159} Ibid.
and rank ships on their energy efficiency and emissions intensity, with associated limitations in helping to shift the industry as a whole towards absolute or cumulative emissions reductions. Shipping companies, their corporate customers, financiers and institutional investors are now under increasing pressure to identify and manage climate-related financial risks. We suggest that this development has significant potential to expand upon existing private standards and initiatives in ways which are particularly focused on developing alternative fuels and achieving absolute emissions reductions.

Since the finalisation of the Paris Agreement, climate change has been increasingly treated as a source of unprecedented financial risk to businesses and investors. ¹⁶¹ In the international shipping context, these risks may manifest as follows. For shipping companies, the IMO emission targets currently take the form of non-binding, aspirational indicators of the direction of travel, with much of the detail on the pathways to achieve these targets still to be developed. However, given the recent regulatory activity of the IMO,¹⁶² increased regulation in this area is not only possible but likely. Shipping companies may also be under increasing pressure from their corporate customers to offer low-carbon shipping options. These companies are themselves driven by regulatory and market pressures to address GHG emissions in their supply and value chains. Further, in the longer term, there is increasing uncertainty about future international trade in fossil fuel products, such as coal and oil, which currently make up a large proportion of total international shipping.¹⁶³ As importing countries move to phase out fossil fuel energy generation and transport systems in favour of renewables and electric transport, such trade is likely to decline and eventually collapse.¹⁶⁴ In addition, physical climate change impacts – such as increased storm activity, coastal flooding and sea level rise – may disrupt and add costs to international shipping operations, as well as interfere with supply chains for fuel and commodity transport. On the flipside, there are a range of business opportunities that emerge in the transition to a clean shipping sector, including in the development and deployment of new alternative fuel technologies and supply chain infrastructure.

These types of risks and opportunities are not only directly relevant to shipping companies and their corporate customers, but also to banks, institutional investors and other financial sector actors, who are increasingly concerned about their own exposure to climate risks through their lending arrangements, equity holdings or debt investments. For example, for banks and investors, the concern is that these risks may manifest as loan defaults and reductions in asset values and investment returns.¹⁶⁵

Framing climate change as a financial risk issue has the effect of enlivening legal obligations to disclose these risks in financial reporting under company and securities law frameworks.¹⁶⁶

¹⁶² See discussion of MARPOL regulation of non-GHG emissions: supra note 136.
¹⁶³ Supra note 7
¹⁶⁴ For example, see discussion of risks to South Africa’s coal export industry in Matthew Huxham, Muhammed Anwar, David Nelson, ‘Understanding the impact of a low carbon transition on South Africa’ (2019) Climate Policy Institute.
Best practice approaches for climate risk disclosure are quickly consolidating in many jurisdictions around the recommendations of the Taskforce on Climate-related Financial Disclosures (TCFD), an industry-led voluntary standard. The TCFD recommends that businesses and investors use scenario analysis to determine the potential financial impacts and opportunities associated with different climate change mitigation and energy transition scenarios and position their business strategy accordingly. One of the key drivers for these developments in investor-owned companies is pressure from institutional investors. In many jurisdictions, financial regulators are also increasingly scrutinising the disclosure of climate-related financial risks through their oversight of mainstream financial reporting.

In parallel with the increased recognition of climate change as a financial risk issue, there is also a growing international emphasis on the critical role that financial stakeholders (particularly lenders and investors) play in society’s response to climate change, given their considerable leverage over the flow of capital and resources. European policy developments in this area are particularly advanced and serve as model for similar initiatives elsewhere. In 2018, the European Commission adopted an Action Plan on Sustainable Finance, setting out a range of strategies to build a sustainable finance system, and program of implementation (including new legislation) is already underway. Of particular interest is the EU-wide classification system (or taxonomy) which sets out a list of economic activities classified according to their contribution to sustainability policy objectives (including climate change).

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168 TCFD, supra note 161, s D. The TCFD also published further guidance on scenario analysis: ‘Technical Supplement: The Use of Scenario Analysis in Disclosure of Climate-Related Risks and Opportunities’ (TCFD, June 2017).
169 For example, Climate Action 100+ is a coalition of 450 institutional investors representing US$ 4 trillion assets under management that is strategically engaging with the world’s largest corporate GHG emitters. One of the engagement demands is that companies disclose climate-related financial risks as per TCFD recommendations: ‘Global Investors Driving Business Transition’ (Climate Action 100+) <http://www.climateaction100.org> accessed 12 March 2020
173 These include measures to clarify the legal duties of institutional investors regarding sustainability; to improve transparency around how sustainability is taken into account in investment decisions; to classify a taxonomy of sustainable activities to help direct finance to these activities; and to develop consistent sustainability benchmarks for financial products. See, Susanna Rust, ‘European Commission unveils sustainable finance legislative proposals’ (IPE, 24 May 2018) <https://www.ipe.com/news/esg/european-commission-unveils-sustainable-finance-legislative-proposals/10024869.article> accessed 12 March 2020
mitigation).\textsuperscript{174} The taxonomy is intended to ‘enable capital markets to identify and respond to investment opportunities that contribute to environmental policy objectives,’ either by allocating capital to these activities or allowing financial stakeholders to engage with companies to influence their activities in line with sustainability criteria. Transport is one of the sectors for which substantial work has already been undertaken to identify sustainable activities and propose technical screening criteria to guide investment and financing decisions. To date, the main focus has been on land transport;\textsuperscript{175} however sustainability criteria for maritime shipping will be developed in more detail in the next phase and is likely to involve prescriptions around zero direct emissions fleets and efficiency measures.\textsuperscript{176}

There is some evidence that the developments described above are driving leading companies and investors to shift capital and resources to alternative fuel development. While the international shipping sector is characterized by considerable heterogeneity,\textsuperscript{177} and smaller, privately-owned enterprises may not be subject to the same pressures, nor have access to the same resources as larger, investor-owned companies, the emerging trends are nonetheless quite powerful. They illustrate that the private sector is perceiving a business case for clean energy transition, based on risk assessments that customers are increasingly prepared to pay for their carbon footprint, that new technology will eventually be cheaper than oil and that the international community will unite to address climate change.\textsuperscript{178}

For example, in 2018, A.P. Moller Maersk (Maersk), the world’s largest shipping container company announced its intentions to be net-zero carbon by 2050, with an intermediate goal to cut emissions by 60% (relative to 2008 levels) by 2030.\textsuperscript{179} In order to meet this target, Maersk has already invested in substantial efficiency gains, and is now focusing on alternative fuel development, committing to have carbon neutral vessels commercially viable and in operation by 2030.\textsuperscript{180} Maersk is leading the industry in trialling the use of advanced biofuels in large scale shipping, partnering with some of its biggest clients and fuel suppliers.\textsuperscript{181} The company is also involved in a range of projects developing hydrogen and battery options. Maersk notes that one of the key drivers is the ‘investment community’s increased focus on climate change and its impact on businesses seen from a financial risk perspective.’\textsuperscript{182}


\textsuperscript{175} Ibid, 324-357

\textsuperscript{176} Ibid, 328

\textsuperscript{177} The shipping industry comprises thousands of companies, most of which are Small and Medium Sized Enterprises (SMEs) International Chamber of Shipping (2018), supra note 128, 13.


\textsuperscript{179} A.P. Moller Maersk supra note 140, 12-16.


\textsuperscript{181} Wienberg, supra note 144

\textsuperscript{182} Ibid
Strategic business coalitions are also emerging to drive progress on decarbonisation. For example, *Getting to Zero* is a coalition of more than 80 companies across the maritime, fuels and infrastructure value chains, as well as the finance sector. The coalition aims to operationalise commercially viable, deep sea vessels powered by zero emissions fuels by 2030 and recognises that this will involve both developing the vessels and the future fuel supply chain. Despite the magnitude of the challenge, collective industry-led action of this nature can help build momentum and confidence throughout the sector.

Shipping companies are also facing increasing pressure from corporate customers to offer low carbon options. For example, Maersk reports that almost a quarter of their top 150 customers have set their own science-based emission reduction targets which include reducing emissions in the supply and value chain. In 2014, Maersk partnered with DB Schenker, a global supply chain management and logistics company, to reduce GHG emissions on a per container basis by 20% by 2018. Maersk’s recent biofuels trial noted above was supported by a range of key customers including H&M Group who have themselves set carbon neutral targets throughout their value chain and are seeking to reduce transport emissions in order to meet these targets. Similarly, the international mining and resource company, BHP Billiton (BHP), has announced commitments to disclose and set targets to reduce scope 3 GHG emissions throughout their value chain. Transportation emissions are singled out as an area in which BHP has the ability to influence service providers to reduce emissions. BHP has developed a program to measure emissions from their chartered marine fleet, benchmark the emissions performance of individual vessels, and implement vetting criteria to exclude vessels with poor emissions performance. As a result, the company reports reduced emissions from transportation; and notes that related shipping companies are responding by investing in technical and operational improvements to reduce emissions.

A number of recent developments also suggest that shipping companies will need to demonstrate alignment with IMO decarbonisation targets in order to access finance. For example, the Poseidon Principles is a recent initiative in the banking sector aiming to integrate climate considerations into lending decisions to promote decarbonisation of the shipping sector. Signatories commit to measure and report, on an annual basis, the carbon intensity of their shipping portfolios relative to IMO decarbonisation trajectories produced for each ship.

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184 A.P. Moller Maersk supra note 140, 15. A science-based target is a GHG emissions reduction target aligned with climate science and the goals of the Paris Agreement. The Science-based Target Initiative provides technical guidance and a process to assess and approve company targets: ‘About the Science Based Targets Initiative’ (<https://sciencebasedtargets.org/about-the-science-based-targets-initiative/>) accessed 12 March 2020


186 Wienberg, supra note 144.

187 Scope 3 emissions refer to indirect emissions that occur in the value chain of the reporting company and may include upstream emissions (related to purchased or acquired goods or services) and downstream emissions (related to sold goods and services). See, ‘Corporate Value Chain (Scope 3) Accounting and Reporting Standard’ (*GHG Protocol*).<https://ghgprotocol.org/standards/scope-3-standard> accessed 12 March 2020


189 Ibid
type and size class; and to work with clients and partners to require emissions data on vessels within the portfolio in accordance with technical guidance requirements.\(^{190}\)

The above discussion has focused particularly on initiatives which are being led and championed by the private sector. As Chircop notes, in maritime regulation, technology and commercial practices are likely to be significantly ahead of the regulator.\(^{191}\) Nonetheless, it is important to also acknowledge the critical ongoing role to be played by the IMO (and its member States) to support, coordinate and facilitate these developments, as well as to ensure that developing and middle income countries are able to access appropriate capacity-building and technical-assistance to ensure that they are not disadvantaged. This is particularly important for least developed countries whose economies depend on international shipping for access to export markets and are likely to face considerable barriers in establishing new fuel industries and related supply chain and port infrastructure. The IMO has a number of projects already in place to support the industry to align with the goals of the Initial Strategy. These include technical and capacity-building programs with various levels of external funding, many of which target developing nations.\(^{192}\) In May 2019, the IMO also established a voluntary multi-donor trust fund to provide a dedicated source of financial support for technical cooperation and capacity-building activities.\(^{193}\) As such, while there are some support structures in place, much of this is dependant on voluntary contributions by member States and international donors. Going forward, the IMO can play an important coordinating role in strengthening this assistance.

4. Conclusions

The Initial Strategy provides the roadmap to achieving the new emission reduction target and signals the development of a new regulatory framework, which is likely to involve a mix of voluntary and compulsory candidate measures. In the coming years, IMO member States will negotiate and agree on the measures that will be used to implement the Strategy. Given the importance and the urgency of decarbonising the shipping industry, this article has explored the promise and shortfalls of three of the central candidate measures: National Action Plans (short-term), market-based mechanisms (mid-term) and alternative fuels (long-term) and made some recommendations for maximising their timeliness and effectiveness.

\(^{190}\) ‘About’ (Poseidon Principles) \(<\text{https://www.poseidonprinciples.org/about/}>\) accessed 12 March 2020


\(^{192}\) For example, the Global Industry Alliance is a new public-private partnership initiative of the IMO under the framework of the IMO GLOMEEP project that aims to bring together maritime industry leaders to collectively identify and develop innovative solutions to address common barriers to the uptake and implementation of energy efficiency technologies and operational measures: ‘Global Industry Alliance Overview’ (GLOMEEP) \(<\text{https://glomeep.imo.org/global-industry-alliance/global-industry-alliance-gia/}>\) accessed 12 March 2020

While NAPs are not considered to be a suitable tool to deal with international shipping emissions, early examples in the UK and Norway show that they do have an important role to play in mobilising national stakeholders, building capacity and funding for national action. NAPs are particularly relevant for domestic activities related to port operations, logistics and infrastructure as these measures can only be implemented at the country-level, but they can also be used to support innovation on alternative fuels. As the IMO develops guidelines and establishes common expectations and standards for NAPs, there is potential for NAPs to operate as a coordinating mechanism to align national action towards global goals, similar to NDCs in the framework of the Paris Agreement.

In terms of MBMs, we conclude that a maritime carbon tax is a simpler way to achieve emission reductions and incentivise the use of low-carbon fuels, when compared with an IMO-led emissions trading scheme. A carbon tax avoids some of the complexities associated with emissions trading schemes, as observed with the Kyoto Protocol’s flexibility mechanisms. It would give a clear price signal to the industry: if shipping companies are required to pay for their emissions, this will drive them to invest in low-carbon fuels and technology, and ultimately pay a lower price for fuel consumption. The benefits of this measure will be amplified if the revenue from such a tax is directed to supporting the development and uptake of alternative fuels and ensuring access for developing countries.

Finally, given the long asset cycles associated with international vessels and the extent of supporting infrastructure development required, we emphasise the importance of prioritising the development and deployment of alternative fuels immediately as a main focus for ongoing IMO negotiations. While there is some encouraging evidence that the private sector is beginning to shift resources and capital to address this challenge, driven particularly by recognition of related financial risks and opportunities and the important signalling provided by the IMO decarbonisation target, it is important to note that it is large, well-resourced shipping companies that are currently investing in alternative fuels. When these alternatives become a more mainstream option for the sector, smaller companies and developing countries will require financial and technical assistance to adjust. It is in this context that the IMO has perhaps the most important role to play in ensuring a level-playing field and supporting developing countries to benefit from the development and deployment of alternative fuels.