

ENVIRONMENT IN THE COURTROOM II

Edited by Alastair R. Lucas & Allan E. Ingelson

ISBN 978-1-77385-380-2

THIS BOOK IS AN OPEN ACCESS E-BOOK. It is an electronic version of a book that can be purchased in physical form through any bookseller or on-line retailer, or from our distributors. Please support this open access publication by requesting that your university purchase a print copy of this book, or by purchasing a copy yourself. If you have any questions, please contact us at ucpress@ucalgary.ca

Cover Art: The artwork on the cover of this book is not open access and falls under traditional copyright provisions; it cannot be reproduced in any way without written permission of the artists and their agents. The cover can be displayed as a complete cover image for the purposes of publicizing this work, but the artwork cannot be extracted from the context of the cover of this specific work without breaching the artist's copyright.

COPYRIGHT NOTICE: This open-access work is published under a Creative Commons licence. This means that you are free to copy, distribute, display or perform the work as long as you clearly attribute the work to its authors and publisher, that you do not use this work for any commercial gain in any form, and that you in no way alter, transform, or build on the work outside of its use in normal academic scholarship without our express permission. If you want to reuse or distribute the work, you must inform its new audience of the licence terms of this work. For more information, see details of the Creative Commons licence at: <http://creativecommons.org/licenses/by-nc-nd/4.0/>

UNDER THE CREATIVE COMMONS LICENCE YOU MAY:

- read and store this document free of charge;
- distribute it for personal use free of charge;
- print sections of the work for personal use;
- read or perform parts of the work in a context where no financial transactions take place.

UNDER THE CREATIVE COMMONS LICENCE YOU MAY NOT:

- gain financially from the work in any way;
- sell the work or seek monies in relation to the distribution of the work;
- use the work in any commercial activity of any kind;
- profit a third party indirectly via use or distribution of the work;
- distribute in or through a commercial body (with the exception of academic usage within educational institutions such as schools and universities);
- reproduce, distribute, or store the cover image outside of its function as a cover of this work;
- alter or build on the work outside of normal academic scholarship.



Acknowledgement: We acknowledge the wording around open access used by Australian publisher, **re.press**, and thank them for giving us permission to adapt their wording to our policy <http://www.re-press.org>

Regulating Greenhouse Gas Emissions from International Shipping

*Peter L'Esperance*¹

Introduction

THE INTERNATIONAL SHIPPING SECTOR, SUSTAINABLE DEVELOPMENT, AND CLIMATE CHANGE

The international shipping industry has been described as the “lifeblood” of the global economy, responsible for connecting distant markets, creating linkages in international supply chains, facilitating the exploitation of economies of scale and comparative advantages in production, and ultimately moving a wide range of goods between countries, both developing and developed.²

International shipping is the most cost-efficient mode for transporting goods, with estimates suggesting that international shipping carries as much as 90 percent of the volume of world trade.³ Further, international shipping is the most energy-efficient and least emissions-intensive method of transporting goods between countries, generating an estimated 3–8 grams of greenhouse gases (GHGs) per tonne-kilometre; significantly less than ground and air transportation, which respectively generate 80 and 435 grams of GHGs per tonne-kilometre.⁴

The international shipping industry's superior cost and energy efficiencies coupled with its integral role in facilitating trade and economic development more broadly suggest the industry's continuing importance in facilitating sustainable development, defined as “development which meets the needs of current generations without compromising the ability of future

generations to meet their own needs,” having regard to social, economic, and environmental criteria.⁵

Yet, the international shipping industry does not operate without environmental impacts. The industry generates a wide variety of pollutants: marine and atmospheric, operational and accidental. With regard to climate change, combustion of the heavy fuel oil, marine diesel oil, and liquefied natural gas relied on by the international shipping sector for propulsion generates significant quantities of potent GHG, including carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O).⁶ These emissions join those from other anthropogenic sources to increase overall concentrations in the atmosphere, contributing directly to climate change.

Accordingly, despite international shipping’s characterization as an industry playing an integral role in facilitating global trade and economic growth, it is also an industry that contributes directly to climate change. This contribution has the real potential to compromise sustainable global development.

OVERVIEW

To deconstruct this tension, this paper explores the topic of regulating GHGs generated by the international shipping industry through:

1. quantifying GHG emissions generated by the international shipping sector;
2. exploring the history of and challenges encountered in regulating GHG emissions from international shipping under the *United Nations Framework Convention on Climate Change* (UNFCCC), the *Kyoto Protocol*, and the *Paris Agreement*;
3. exploring the history and evolution of International Maritime Organization (IMO) efforts to regulate GHG emissions from international shipping;
4. constructing a framework to compare the relative effectiveness of current and proposed IMO policies to regulate GHGs from international shipping; and
5. applying the comparative framework to proposed IMO market-based measures regulating emissions from international

shipping with a view to identifying which IMO policy is best positioned to reduce emissions from international shipping to levels consistent with international targets.

Quantifying Emissions Generated by the International Shipping Sector

AGGREGATE EMISSIONS FROM THE INTERNATIONAL SHIPPING SECTOR AS A SHARE OF GLOBAL ANTHROPOGENIC GREENHOUSE GAS EMISSIONS

International shipping is the least emissions-intensive method of transporting goods internationally. Yet, in absolute terms and as a percentage of global emissions, emissions from international shipping remain significant. The *Fourth IMO GHG Emissions Study*, completed in 2020, estimated 2018 emissions for international shipping to equal 1,076 million tonnes of CO₂ equivalent (CO₂e) for GHGs combining CO₂, CH₄, and nitrous oxide N₂O.⁷ As a proportion of global anthropogenic emissions, shipping represented 2.9 percent of CO₂e emissions in 2018.⁸ To provide some context on the international shipping industry's absolute contributions to anthropogenic GHG emissions with reference to those of other states, Canada generated approximately 728 million tonnes of CO₂e in 2018; Germany generated approximately 856 million tonnes of CO₂e in 2018; France generated approximately 452 million tonnes of CO₂e in 2018; and the Russian Federation generated approximately 2,134 million tonnes of CO₂e in 2018.⁹ Note that among Annex I state parties to the *UNFCCC*, only the United States, Russia, and Japan generate a higher volume of CO₂e emissions than the international shipping industry.

PROJECTED INCREASES IN EMISSIONS FROM THE INTERNATIONAL SHIPPING SECTOR FROM 2018–2050

The *Fourth IMO GHG Emissions Study* (the study) projected pathways for shipping emissions from 2018–2050. The IMO based the future pathways on projected increases in demand for maritime transport services, projected improvements in fleet fuel consumption, and projected improvements in operational efficiency. The pathways predict emissions from international shipping to increase between 0–50 percent in the period up to 2050.¹⁰ The range in the projected increases flows from different assumptions regarding demand, improvements in operational efficiency, and projections regarding

fuel type.¹¹ The study reveals that as an emissions source, the international shipping industry is a significant contributor in absolute terms, with absolute emissions that are higher than most *UNFCCC* Annex I countries.¹² Projected increases in shipping emissions from 2018–2050 suggest that the industry’s contribution to anthropogenic GHG emissions—and climate change—will continue to increase. These points provide an important perspective in contextualizing later discussion on the effectiveness of regulatory responses to GHG emissions generated by the international shipping sector.

History of Regulating International Shipping Emissions

In 1992, the United Nations adopted the *UNFCCC* to provide the architecture in which subsequent international negotiations would take place to achieve the *UNFCCC*’s ultimate objective: the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”¹³ Although the *UNFCCC* did not directly address shipping emissions, it established the Subsidiary Body for Scientific and Technological Advice (SBSTA) tasked with conducting preliminary investigations into regulating GHG emissions from international shipping in concert with the IMO.¹⁴ The SBSTA and the IMO identified five primary options for assigning responsibility for emissions from international shipping, specifically:

1. No allocation;
2. Allocation to the country where the bunker fuel is sold;
3. Allocation to the nationality of the transporting company, or to the country where the vessel is registered, or to the country of the operator;
4. Allocation to the country of departure or destination of a vessel. Alternatively, the emissions could be shared between the country of departure and country of arrival; or
5. Allocation to the country of departure or destination of passenger or cargo. Alternatively, the emissions related to the journey of a passenger or cargo could be shared by the country of departure and the country of arrival.¹⁵

The five proposed options generated debate but did not produce any agreement on a preferred allocation option. This early failure to adopt a method for allocating GHG emissions from international shipping among *UNFCCC* parties foreshadowed the exclusion of GHG emissions from international shipping from later protocols developed under the *UNFCCC*, including the *Kyoto Protocol* and the more recent *Paris Agreement*.

In 1997, *UNFCCC* parties established legally binding GHG emission reduction targets through the adoption of the *Kyoto Protocol*.¹⁶ The *Kyoto Protocol* reflected the “common but differentiated responsibilities” (CBDR) principle animating the *UNFCCC*: the concept that all countries have an obligation to undertake action to address climate change but that developed countries should assume greater obligations given their historical responsibility for the bulk of anthropogenic GHG emissions currently effecting climate change.¹⁷ Consistent with the CBDR principle, developed countries committed to reducing GHG emissions to an average of 5 percent relative to 1990 levels over the five-year period between 2008 and 2012.¹⁸ Although international shipping was not included in these targets, Article 2.2 of the *Kyoto Protocol* expresses that the task of regulating emissions and developing emissions reductions targets would fall to the parties working through the IMO.¹⁹

In 2015, 195 members of the *UNFCCC* adopted the *Paris Agreement*: a global, legally binding agreement designed to stabilize increases in global average temperature below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.²⁰ The *Paris Agreement*, like the *Kyoto Protocol*, reflects the CBDR in Article 2(2), which provides that, “[t]his Agreement will be implemented to reflect equity and the principle of common but differentiated responsibilities and respective capabilities, in the light of different national circumstances.”²¹ However, unlike the *Kyoto Protocol*, the *Paris Agreement* makes no explicit reference to emissions from marine bunker fuels or from international shipping.²² Accordingly, the IMO continues to serve as the primary forum through which *UNFCCC* parties and non-parties negotiate emissions reductions targets for the international shipping sector.

International Maritime Organization Regulation of Greenhouse Gas Emissions from Shipping

INTRODUCTION TO THE INTERNATIONAL MARITIME ORGANIZATION

The IMO is the United Nations body responsible for the safety and security of shipping and the prevention of marine pollution by ships.²³ The IMO's membership structure is unique, and accommodates flag states, coastal states, intergovernmental organizations, and non-governmental organizations representing industry and environmental interests.²⁴ Since its establishment in 1958, the IMO has facilitated the development, adoption, and implementation of an impressive constellation of international instruments regulating all facets of shipping, international and domestic. As the international community began to appreciate the relationship between emissions from international shipping and climate change, its focus shifted to regulating GHG emissions generated by the industry. The decision to exempt emissions from international shipping from the *UNFCCC* meant that the IMO would be responsible for fulfilling this task.

In September 1997, parties to the 1973 *International Convention for the Prevention of Pollution by Ships* as amended by the 1978 Protocol (MARPOL)—the primary treaty addressing operational and accidental marine environmental pollution from shipping—adopted the 1997 *Protocol to MARPOL*.²⁵ The 1997 Protocol added Annex VI to MARPOL: *Regulations for the Prevention of Air Pollution from Ships*.²⁶ Annex VI did not address GHG emissions from shipping. Specifically, during negotiations preceding the instrument's adoption, parties agreed that CO₂ was not an air pollutant as such and, therefore, would not be covered by the regulations.²⁷ However, the parties did agree on a separate resolution to address “CO₂ emissions from ships.” The resolution invited the IMO to:

- (a) collaborate with the executive secretary of the *UNFCCC* in exchanging information on the issue;
- (b) commission a study of GHG emissions from ships to establish the amounts and percentage share of GHG emissions from shipping as part of a global inventory of GHG emissions; and

- (c) consider through its Marine Environmental Protection Committee potential emissions reductions measures.²⁸

This resolution formally initiated the IMO's work in developing a regulatory strategy to reduce GHG emissions from ships. Following the resolution, the IMO commissioned its first *IMO Study on GHG Emissions from Ships* in June 2000 to evaluate the shipping sector's absolute and relative contributions to global anthropogenic GHG emissions.²⁹ Since that time, the IMO has commissioned three additional GHG studies in 2009, 2014, more recently in 2020.³⁰ The studies measure the shipping sector's absolute and relative contributions to global GHG emissions, project future increases in the shipping sector's emissions through to 2050, evaluate the potential of technical and operational measures to reduce emissions, evaluate the potential of proposed market based measures to reduce emissions, and, more generally, inform the IMO and its members about the task of developing a GHG reduction regime for the international shipping sector.

Significantly, the CBDR principle, which animates the *UNFCCC* and the *Paris Agreement*, is in tension with foundational principles that have traditionally informed IMO regulatory approaches. Specifically, the CBDR principle conflicts with the IMO principle of equal treatment of ships (also known as “no more favourable treatment” or NMFT).³¹ The ostensible conflict between the two principles is especially evident when one considers that three-quarters of all merchant vessels by deadweight tonnage engaged in international trade are registered in countries traditionally categorized as “developing”; countries that are not subject to binding emissions reduction targets under the earlier *Kyoto Protocol* adopted under the *UNFCCC*.³² This pattern of ship registration automatically makes the traditional approach to IMO regulation via the flag state unsuitable for regulating GHG emissions in a manner sensitive to the CBDR principle.

CURRENT INTERNATIONAL MARITIME ORGANIZATION MEASURES TO REGULATE EMISSIONS FROM INTERNATIONAL SHIPPING

The tables below introduce the GHG reductions options currently developed and proposed by the IMO. The succeeding sections will critically evaluate each option in its ability to achieve the purpose underlying the *Paris Agreement*—regulating emission reductions to stabilize temperature increases below 2°C

by the end of this century. The sections will employ a structured analysis to evaluate the effectiveness of proposed regulatory options based on criteria developed in the *Second IMO GHG Study* and informed by legal regulatory theory. The objective of this analysis will be to attempt to identify the option or collection of options offering the most promise in achieving the stated objective of reducing GHG emissions from the international shipping sector and anticipating those issues which the IMO must address in implementing the particular options identified.

GHG control or reduction measures developed or proposed by the IMO fall into two distinct categories, each of which will be examined in turn:

1. energy efficiency measures (efficiency-based measures), and
2. market-based measures.

Due to space constraints, this chapter applies a comparative analysis that focuses on those measures which IMO GHG studies have identified as the most effective in reducing sector-wide emissions (see Table 28.1 and Table 28.2).

Table 28.1 Efficiency-based Measures

<i>Measure</i>	<i>Description</i>	<i>Status</i>	<i>Base Documents</i>
Energy Efficiency Design Index (EEDI)	Mandatory regulatory mechanism requiring all new ships of prescribed classes to meet a minimum threshold for energy efficient design.	Entered into force January 1, 2013	MEPC.203(62), <i>Amendments to the Annex of the Protocol of 1997: To Amend the International Convention for the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978 Relating Thereto</i> , adopted 17 July 2011 (entered into force 1 January 2013)
Ship's Efficiency Management Plan (SEEMP)	Mandatory regulatory mechanism applicable to all ships within prescribed classes designed to improve the operational energy efficiency of a ship in a cost-effective manner. The SEEMP includes a mechanism to enable ship owners and operators to track ship or fleet efficiency performance over time, the Energy Efficiency Operational Indicator (EEOI).	Entered into force January 1, 2013	MEPC.203(62), <i>Amendments to the Annex of the Protocol of 1997: To Amend the International Convention for the Prevention of Pollution from Ships, 1973, as Modified by the Protocol of 1978 Relating Thereto</i> , adopted 17 July 2011 (entered into force 1 January 2013);

Table 28.2 Market-based Measures

<i>Measure</i>	<i>Description</i>	<i>Proponents</i>	<i>Base Documents</i>
Global Emissions Trading System (ETS) for International Shipping	Establish a sector-wide cap on emissions from international shipping. Auction a number of emissions allowances to the international shipping sector annually, sufficient to meet the pre-set cap. Shipowners/operators can trade emissions allowances to the extent their emissions fall above or below the sector cap.	Norway	MEPC 60/4/22; MEPC 60/4/26; MEPC 60/4/41; MEPC 60/4/54; GHG-WG 3/3/5; GHG-WG 3/3/6; GHG-WG 3/3/8
International Fund for GHG Emissions from Ships	Establish a system requiring shipowners/operators to pay a fee per unit of bunker fuel purchased. Fees collected would be allocated to a separate International Fund for GHG Emissions from Ships, which would further allocate funds to GHG mitigation and adaptation projects in developing countries, and research and development into technical measures for more energy-efficient ship design and propulsion methods.		MEPC 60/4/8

Evaluative Framework

To measure the comparative effectiveness of current and proposed IMO efficiency and market-based policies to reduce GHG emissions from international shipping, this chapter will apply the below framework to each of the policy options identified earlier in the paper (see Figure 28.1).³³

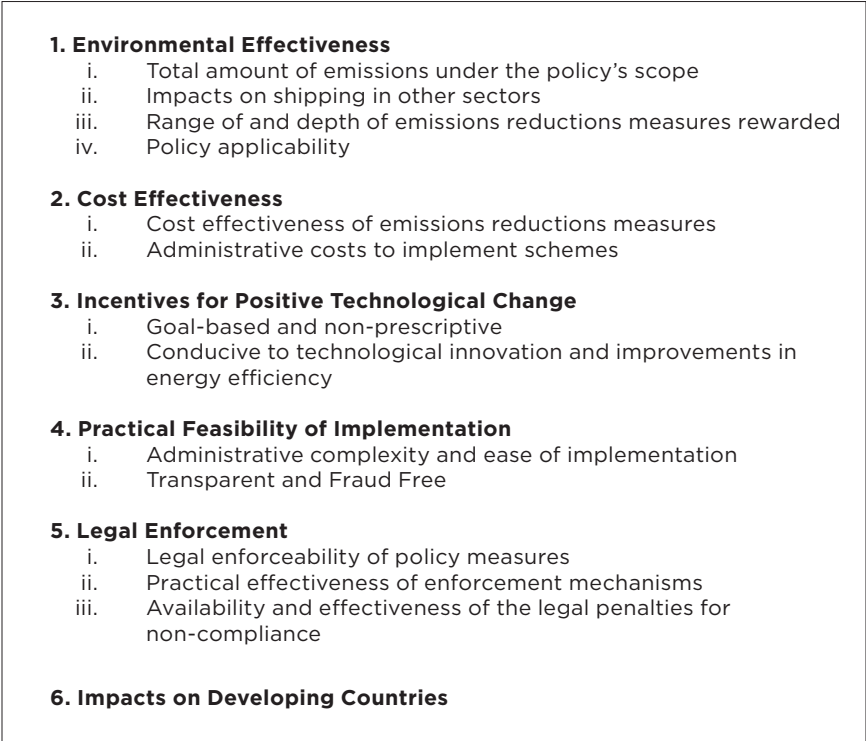


Figure 28.1 Evaluative Framework

Applying the Evaluative Framework to Efficiency and Market-Based Measures

The tables below (see Table 28.3 and Table 28.4) apply these factors to the two primary efficiency-based measures and the two primary market-based measures identified above.

Table 28.3 Evaluative Framework Applied to Efficiency-based Measures

<i>Criteria</i>	<i>EEDI</i>	<i>SEEMP/EEOI</i>
1. Environmental Effectiveness	<i>Strengths</i> - Ensures <i>new ships</i> meet efficiency performance targets and defined emissions intensity reduction targets - Significant long-term emissions reductions potential—<i>regulates incremental improvements in energy efficiency performance</i> - Low predicted impacts on other sectors - Low risks of policy evasion	<i>Strengths</i> - Mandatory obligation to possess a valid SEEMP applies to <i>new and old ships of prescribed types 400 gross tonnage and above</i> - <i>Increased short term emissions reduction potential</i> relative to the EEDI - Obligation to prepare a SEEMP makes it more likely for ship owners/operators to adopt the measures articulated in the management plans - Low predicted impacts on other sectors
	<i>Weaknesses</i> - Only applies to <i>new ships of prescribed types 400 gross tonnage and above</i> - <i>Limited ability to impose an absolute cap on emissions</i> - Potential rebound effects	<i>Weaknesses</i> - <i>No obligation to implement SEEMP measures nor to use EEOI to track energy efficiency performance</i> - <i>Substantive implementation of the policy entirely dependent on ship owner/operator uptake, something which in turn depends on multiple market factors</i> - Cost-effectiveness appears to be the limit on adoption - <i>Limited ability to impose an absolute cap on emissions</i>

<i>Criteria</i>	<i>EEDI</i>	<i>SEEMP/EEOI</i>
2. Cost-effectiveness	<i>Strengths</i> - Straightforward/lowest cost to implement and enforce - Many measures feature negative emissions abatement costs	<i>Strengths</i> - Cost-effective with potential for negative emissions abatement costs—many operational measures have low/non-existent capital costs - Straightforward/low cost to implement and enforce
	<i>Weaknesses</i> - Limits ship owners/operators to adopting prescribed technical measures	<i>Weaknesses</i> - Limits ship owners/operators to adopting prescribed operational measures
3. Incentives for Positive Technological Change	<i>Strengths</i> - Goal-based/non-prescriptive within the range of prescribed technologies - Ensures international shipping fleet adopts and implements leading technology over time	<i>Strengths</i> - Goal-based and non-prescriptive - Rewards a broader set of measures than does the EEDI - Although conditional on ship owner/operator uptake, potential to reward an increased range of measures and volume of emissions reductions on an ongoing basis
	<i>Weaknesses</i> - Does not appear to reward compliance over and above the prescribed threshold - Effectiveness will depend on the degree to which EEDI targets fall below EEDI reference level	<i>Weaknesses</i> - No incentive for ship owners/operators to implement measures contained in the SEEMP

Table 28.3 (*continued*)

<i>Criteria</i>	<i>EEDI</i>	<i>SEEMP/EEOI</i>
4. Practical Feasibility of Implementation	<i>Strengths</i> - Most straightforward and low cost to implement	<i>Strengths</i> - Straightforward and low cost for ship owners/operators to develop and implement
5. Legal Enforcement	<i>Strengths</i> - Mandatory - Monitoring compliance and enforcement straightforward and low cost - Compliance and enforcement provisions dovetail with those already required under <i>MARPOL</i>	<i>Strengths</i> - Straightforward and low cost for both flag and port states to enforce possession of a valid SEEMP through registration and inspection
6. Impacts on Developing Countries	<i>Strengths</i> - 4-year waiver provision for states seeking to delay implementation	<i>Strengths</i> - 4-year waiver provision for states seeking to delay implementation
	<i>Weaknesses</i> - No explicit provision for CBDR	<i>Weaknesses</i> - No explicit provision for CBDR - No penalties for non-compliance appear to be developed

Table 28.4 Evaluative Framework Applied to Market-based Measures

<i>Criteria</i>	<i>GHG Fund</i>	<i>ETS</i>
1. Environmental Effectiveness	<i>Strengths</i> - Potential to reduce emissions by 13–40% by 2030 relative to business-as-usual emissions measured in 2007—<i>highest estimated emissions reductions potential</i> - Potential to impose an <i>industry cap</i> on emissions through reliance on external emissions reductions credits - Potential to apply to <i>all ships</i>, regardless of size, type, function, or build date - <i>Potential to reward all emissions reductions measures</i>—both operational and technical on an ongoing basis - <i>Dual effect of incentivizing decreased fuel consumption and mobilizing funding for mitigation and adaptation activities</i>, including in- and out-of-sector mitigation and adaptation activities, and research and development for in-sector energy efficiency improvements - Policy may be applied to non-party states purchasing at bunker fuel suppliers located in the territories of state parties	<i>Strengths</i> - Potential to reduce emissions by 13–40% by 2030 relative to business-as-usual emissions measured in 2007—<i>highest estimated emissions reductions potential</i> - Potential to impose an <i>industry cap</i> on emissions through reliance on external emissions reductions credits - Potential to apply to <i>all ships</i>, regardless of size, type, function, or build date - <i>Potential to reward all emissions reductions measures</i>—both operational and technical on an ongoing basis - <i>Dual effect of incentivizing decreased fuel consumption and mobilizing funding for mitigation and adaptation activities</i>, including in- and out-of-sector mitigation and adaptation activities, and research and development for in-sector energy efficiency improvements
	<i>Weaknesses</i> - Potential to cause a price increase, modal shift, and carbon leakage for short sea marine shipping services provided that prices for air- and land-based modes of transportation do not increase simultaneously - Risks of evasion medium unless policy universally adopted	<i>Weaknesses</i> - Potential to cause a price increase, modal shift and carbon leakage for short sea marine shipping services provided that prices for air- and land-based modes of transportation do not increase simultaneously - Risks of evasion high unless policy universally adopted

Table 28.4 (continued)

<i>Criteria</i>	<i>GHG Fund</i>	<i>ETS</i>
2. Cost-effectiveness	<i>Strengths</i> - Provides ship owners/operators with maximum latitude to develop and implement all technical and operational measures to reduce fuel consumption and GHG emissions for ships of varying size, type, function, and operational route - Enables the industry to access external emissions reductions and mitigation opportunities, which may have smaller or negative emissions abatement costs - Many ship owner/operator obligations dovetail with those already required under MARPOL, Annex VI - Administrative costs low relative to other market-based measures	<i>Strengths</i> - Provides shipowners/operators with maximum latitude to develop and implement all technical and operational measures to reduce fuel consumption and GHG emissions for ships of varying size, type, function, and operational route - Enables the industry to access external emissions reductions and mitigation opportunities, which may have smaller or negative emissions abatement costs - Many ship owner/operator obligations dovetail with those already required under MARPOL, Annex VI
	<i>Weaknesses</i> - Administrative costs higher than under EEDI/SEEMP	<i>Weaknesses</i> - Administrative costs significantly higher than under the GHG Fund or EEDI/SEEMP
3. Incentives for Positive Technological Change	<i>Strengths</i> - <i>Goal-based non-prescriptive</i>—significant and ongoing incentive for technological change	<i>Strengths</i> - <i>Goal-based non-prescriptive</i>—significant and ongoing incentive for technological change
	<i>Weaknesses</i> - Access to out-of-sector emissions mitigation/adaptation activities may limit in-sector investment	<i>Weaknesses</i> - Access to out-of-sector emissions mitigation/adaptation activities may limit in-sector investment - <i>Volatility in emissions allowance/carbon price may impede investment in efficiency improvement or emissions reductions technology</i>

<i>Criteria</i>	<i>GHG Fund</i>	<i>ETS</i>
4. Practical Feasibility of Implementation	<i>Strengths</i> - Relatively low cost/straightforward compared with other market-based measures - Precedent in IOPF Administrator	<i>Strengths</i> - Precedent in European Union ETS
	<i>Weaknesses</i> - Relatively more administratively complex than EEDI/SEEMP	<i>Weaknesses</i> - Administratively complex - <i>Estimated to be significantly more expensive to establish and maintain than GHG Fund</i> - <i>Industry opposition</i>
5. Legal Enforcement	<i>Strengths</i> - Flag/coastal state compliance and enforcement obligations dovetail with those already applicable under <i>MARPOL</i>	<i>Strengths</i> - Flag/coastal state compliance and enforcement obligations dovetail with those already applicable under <i>MARPOL</i>
	<i>Weaknesses</i> - Requirement to develop a legal structure to establish and govern international GHG Fund administrator operations	<i>Weaknesses</i> - Requirement to develop a legal structure to establish and govern ETS system

Table 28.4 (continued)

<i>Criteria</i>	<i>GHG Fund</i>	<i>ETS</i>
6. Impacts on Developing Countries	<i>Strengths</i> - GHG Fund may direct funding to mitigation/adaptation activities, research and development in least developed countries, landlocked developing countries, and small island developing states - Provision for involvement of least developed countries, landlocked developing countries, and small island developing states in fund allocation process	<i>Strengths</i> - Proceeds of potential auction of emissions allowances may be directed to mitigation/adaptation activities, research and development in least developed countries, landlocked developing countries, and small island developing states - Exemptions for approved voyages to developing countries
	<i>Weaknesses</i> - Increased cost of shipping may negatively impact the export capacity of developing countries—may be mitigated through inclusion of rebate mechanism	<i>Weaknesses</i> - Increased cost of shipping may negatively impact export capacity of developing countries—may be mitigated through inclusion of rebate mechanism

The efficiency-based EEDI and SEEMP measures perform complementary roles in regulating the technical and operational aspects of ship design, construction, and operations with a view to maximizing energy efficiency and minimizing emissions.

The EEDI's application to new ships means that it will target a small albeit increasing share of emissions generated by the global fleet. This means that the measure's potential to achieve emissions reductions through regulation in the short term is low, while its potential to do so in the long term is high. Moreover, the EEDI's administrative simplicity suggests that it is a cost-effective measure well suited to ensuring fleet-wide improvements in energy efficiency and corresponding reductions in emissions intensities. The critical ingredients to the measure's success will be the degree to which the EEDI reference level mandates improvements in energy efficiency over and above those which would apply at business-as-usual levels of investment.

The mandatory requirement to prepare EEOI and SEEMP measures for both *old* and *new* ships suggests that the policy's potential to achieve emissions reductions across the global fleet is high. However, the fact that implementing the measures contained in a ship's SEEMP or implementing the EEOI is purely *voluntary* significantly diminishes the policy's effectiveness in regulating emissions reductions. Moreover, cost-effectiveness appears to impose a ceiling on shipowner/operator investment in operational measures to improve energy efficiency.

As efficiency-based measures, the policy's ability to impose a cap or restrict industry emissions is limited. For these reasons, IMO members recognize that reliance on efficiency-based measures alone will not be adequate to restrict emissions from international shipping to a level consistent with that required under the *UNFCCC*.³⁴

On the basis of the comparative evaluations above, the GHG Fund appears to be better positioned to regulate emissions generated by international shipping to levels consistent with the *UNFCCC* objective to stabilize global increases in temperature below 2°C relative to pre-industrial levels.

The IMO estimates both the GHG Fund and ETS policies to have an equal ability to reduce sector-wide emissions by between 13 percent and 40 percent by 2030 relative to business-as-usual emissions measured from a 2008 base year.³⁵ Both policies have the practical effect of incentivizing decreased fuel consumption and decreased emissions, while simultaneously mobilizing funding for mitigation and adaptation activities. However, the GHG Fund

appears to be positioned to achieve these emissions reductions through a simpler mechanism at a reduced cost. With regards to administrative costs borne by ship owners/operators, the IMO estimates potential additional onboard workload costs for the GHG Fund policy to be \$0.1 billion compared with \$0.7 billion for the maritime ETS policy. The IMO estimates gross administrative costs for the GHG Fund policy to range from US\$8–11 billion in 2020 to US\$15–25 billion in 2030.³⁶ Contrast this with gross administrative costs for the ETS estimated to range from US\$24–27 billion in 2020 to US\$40–49 billion in 2030.³⁷ These estimates suggest that the GHG Fund is positioned to deliver equal emissions reduction potential for approximately half the costs of a maritime ETS—supporting that measure’s superior cost-effectiveness.

Admittedly, the ETS is better positioned to impose a cap on absolute levels of GHG emissions from the international shipping industry. However, in theory, the GHG Fund also has the ability to control absolute levels of emissions through a combination of adjusting the contribution price or relying on approved out-of-sector emissions reductions credits.

Under both the GHG Fund and the ETS policies, linkages to external carbon markets and the relationship between the contribution or allowance price and external carbon prices will play an important role in determining the level of investment in the in-sector efficiency improvement and emissions reductions technologies. Access to external emissions reductions opportunities are positive in the sense that it may enable industry to access a broader, more cost-effective range of emissions reductions opportunities. Further, purchasing out-of-sector emission reductions credits may enable the industry to meet a sector-wide cap on emissions without compromising growth after the potential for reasonably cost-effective in-sector emissions reductions measures have been exhausted. Arguably, however, financing in-sector energy-efficiency improvements is the most effective way of reducing the international shipping industry’s actual and ongoing contributions to reductions in anthropogenic GHG emissions.

Both policies provide ship owners/operators with maximum latitude to develop and implement *all* technical and operational measures to reduce fuel consumption and GHG emissions for ships of varying size, type, function, and operational route. Both policies are positioned to incentivize ship owners/operators to develop and implement ongoing emissions reductions measures. However, the fixed levy price under the GHG Fund proposal is positioned to provide ship owners/operators with greater certainty surrounding returns

on investment in efficiency improvement and emissions reductions measures. Uncertainty or volatility in the emissions allowance or emissions reductions prices within the ETS may impede investment in efficiency improvement/emissions reductions technology.

Both policies are of some administrative complexity. However, the GHG Fund’s significantly lower administrative costs relative to the ETS suggest it will face fewer barriers to practical implementation. Moreover, the international shipping industry has expressed a preference for a levy-based rather than a cap-and-trade-based GHG regulation policy suggests the GHG Fund will face fewer *political* barriers to implementation.

Both policies appear positioned to reconcile both the CBDR principle as well as the IMO NMFT principle. However, the ability of the ETS policy to do so will be contingent on emissions allowances being allocated by means of auctioning, a policy feature that remains uncertain.

Recent Developments

In October 2016, the seventieth session of the IMO’s Marine Environment Protection Committee (MEPC 70) approved a roadmap for the development of a “comprehensive IMO Strategy on the reduction of GHG emissions from ships” for application within the international shipping industry.³⁸ The roadmap adopted a three-phase approach to ship energy efficiency towards the development of a revised IMO GHG strategy for implementation in 2023. The key phases for the adoption of the revised strategy are set out as follows:³⁹

Spring 2018 (MEPC 72)	Adoption of the <i>Initial IMO Strategy on Reduction of GHG Emissions from Ships</i> (the Initial Strategy), ⁴⁰ including, inter alia, a list of candidate short-, mid-, and long-term further measures with possible timelines, to be revised as appropriate as additional information becomes available
January 2019	Start of phase 1: data collection (ships to collect data)
Spring 2019 (MEPC 74)	Initiation of <i>Fourth IMO GHG Study</i> using data from 2012–2018
Summer 2020	Data from 2019 to be reported to IMO
Autumn 2020 (MEPC 76)	Start of phase 2: data analysis (no later than autumn 2020) Publication of <i>Fourth IMO GHG Study</i> for consideration by MEPC 76

Spring 2021 (MEPC 77)	Secretariat report summarizing the 2019 data pursuant to regulation 22A.10 Initiation of work on adjustments on initial IMO strategy, based on data collection system data
Summer 2021	Data for 2020 to be reported to IMO
Spring 2022 (MEPC 78)	Phase 3: decision step Secretariat report summarizing the 2020 data pursuant to regulation 22A.10
Summer 2022	Data for 2021 to be reported to IMO
Spring 2023 (MEPC 80)	Secretariat report summarizing the 2021 data pursuant to regulation 22A.10 Adoption of revised IMO strategy, including short-, mid- and long-term further measure(s), as required, with implementation schedules

The adoption of the Initial Strategy in 2018 was aimed at enhancing IMO's contribution to global emissions reductions measures consistent with the *Paris Agreement* and identifying actions and measures to be implemented by the international shipping sector in achieving these objectives.⁴¹ The strategy prescribes a first-time reduction in total GHG emissions by at least 50 percent by 2050 compared to 2008 levels, while at the same time, working to phase out the use of carbon fuel sources in the industry.⁴² In achieving these goals, the Initial Strategy is structured around commitments or "levels of ambition" for the international shipping sector, which, once implemented, will allow the IMO to achieve emissions targets consistent with the *Paris Agreement*.⁴³ The levels of ambition are listed as follows:

1. Carbon intensity of the ship to decline through implementation of further phases of the EEDI for new ships—to review with the aim to strengthen the energy efficiency design requirements for ships with the percentage improvement for each phase to be determined for each ship type, as appropriate;
2. Carbon intensity of international shipping to decline—to reduce CO₂ emissions per transport work, as an average across international shipping, by at least 40 percent by 2030, pursuing efforts towards 70 percent by 2050, compared to 2008; and
3. GHG emissions from international shipping to peak and decline—to peak GHG emissions from international shipping as

soon as possible and to reduce the total annual GHG emissions by at least 50 percent by 2050 compared to 2008 whilst pursuing efforts towards phasing them out as called for in the vision as a point on a pathway of CO₂ emissions reduction consistent with the *Paris Agreement* temperature goals.⁴⁴

Phases 1 and 2 of the roadmap, which involved data collection and the creation of the *Fourth IMO GHG Study 2020*⁴⁵ and its executive summary⁴⁶ by the secretariat, have since been executed. The IMO website summarized the results of this study as follows:

The Fourth IMO GHG Study 2020 estimated that total shipping emitted 1,056 million tonnes of CO₂ in 2018, accounting for about 2.89% of the total global anthropogenic CO₂ emissions for that year, and that under a voyage-based allocation method, the share of international shipping represented 740 million tonnes of CO₂ in 2018. According to a range of plausible long-term economic and energy business-as-usual scenarios, emissions could represent 90–130% of 2008 emissions by 2050.⁴⁷

In achieving these levels of ambition, the Initial Strategy identifies a number of short-, medium-, and long-term candidate measures to be implemented and agreed upon by the member states. The candidate short-term measures focus on improving existing emissions reductions mechanisms, including EEDI and SEEMP, encouraging states to adopt national action plans to address GHG emissions, and developing an “Existing Fleet Improvement Program.”⁴⁸ The medium-term measures include measures intended to directly reduce emissions from ships and support action to reduce GHG emissions, including encouraging the use of alternative low-carbon fuels, developing operational energy-efficiency measures for new and existing ships, and developing market-based measures to incentivize GHG emissions reduction.⁴⁹ For the long-term measures, the Initial Strategy invites IMO members to pursue the development of zero-carbon or fossil-fuel-free fuels to assist in the decarbonization of the global shipping industry and encourage and facilitate new and innovative reductions measures.⁵⁰

The Initial Strategy identifies that in adopting GHG emissions reductions measures, specific attention should be paid to the needs of developing

counties and small island developing states. The Initial Strategy recognizes that certain emissions reductions approaches may have a disproportionately negative impact on developing counties, which must be addressed in considering the implementation of each measure. In an application of the CBDR principle, the Initial Strategy calls for member states to consider potential impacts, such as geographic remoteness, connectivity to main markets, cargo value and type, transport dependency, transport cost, food security, disaster response, cost-effectiveness, and socio-economic progress and development.⁵¹ The recognition of the presence of potential disproportionate impacts differs from the measures previously adopted by the IMO, which favoured the equal application of measures over the CBDR principle.⁵²

In furtherance of the objectives of the Initial Strategy, member states also approved a four-step procedure for identifying and assessing the potential disproportionate impacts of proposed candidate measures on developing countries, small island development states, and particularly, the world's least developed nations.⁵³ Initially adopted at MEPC 73 and formally approved in May 2019 (MEPC 74), the procedure allows for the submission of commentary by member states and, if necessary, a comprehensive response or evidence-based impact assessment process. The steps of the approved procedure can be summarized as follows:

Step 1: initial impact assessment, to be submitted as part of the initial proposal to the MEPC for candidate measures;

Step 2: submission of commenting document(s), if any;

Step 3: comprehensive response, if requested by commenting document(s); and

Step 4: comprehensive impact assessment, if required by the MEPC.⁵⁴

Since the adoption of the Initial Strategy, the IMO and member states have taken a number of steps towards its final implementation. In October 2018, member states approved a follow-up program to the Initial Strategy (the Program) to be used as a planning tool to meet the short-, medium-, and long-term deadlines identified within the Initial Strategy.⁵⁵ The Program sets

out a timeline of necessary actions up to 2023 for each category of measure and sets out the draft terms of reference for a *Fourth IMO GHG Study*.⁵⁶

The IMO has also taken steps to adopt and implement the energy-efficiency measures outlined within the Initial Strategy. Most notably, member states adopted amendments to MARPOL Annex VI to accelerate the commencement of phase 3 of the EEDI from 2022 to 2025 and strengthen the energy efficiency requirements for new ships.⁵⁷ These measures include enhanced energy efficiency standards for a number of different ship types. For container ships, for example, the EEDI reduction rate is enhanced, significantly for larger ship sizes, as follows:

- For a containership of 200,000 deadweight tonnage and above, the EEDI reduction rate is set at 50 percent from 2022
- For a containership of 120,000 deadweight tonnage and above but less than 200,000, 45 percent from 2022
- For a containership of 80,000 deadweight tonnage and above but less than 120,000, 40 percent from 2022
- For a containership of 40,000 deadweight tonnage and above but less than 80,000, 35 percent from 2022
- For a containership of 15,000 deadweight tonnage and above but less than 40,000, 30 percent from 2022.⁵⁸

In May 2019, member states took additional steps to encourage emissions reduction throughout the shipping sector. Resolution MEPC.323(74) invites member states to encourage ports within their jurisdiction to adopt regulatory, technical, operational, and economic procedures to facilitate the reduction of GHG emissions from ships.⁵⁹ The resolution provides that such measures could include working with ports in their jurisdiction to enhance onshore power supplies, safe and efficient bunkering of alternative low-carbon and zero-carbon fuels and support the optimization of port calls.⁶⁰ Although these measures are voluntary, it demonstrates the forward progression on some of the measures identified within the Initial Strategy.

The Initial Strategy was intended to be a framework for further action, identifying and envisioning approaches that could be implemented to curb GHG emissions within the industry. The Initial Strategy represents an

important step forward in the development of a comprehensive emissions reductions regime within the international shipping industry. The developments outlined above are encouraging, and have, in some cases, led to concrete emissions reductions measures, but only time will tell as to whether the Initial Strategy will lead to the adoption of meaningful and comprehensive reduction measures in the international shipping sector. This success will be subject to further negotiation and approval.

Conclusion

For the international community to avoid the most devastating effects of climate change, the Intergovernmental Panel on Climate Change predicts that it must reduce anthropogenic CO₂ emissions by 41–72 percent by 2050 relative to 2010 levels and by 78–118 percent by 2100 relative to 2010.⁶¹ Recognizing this, UNFCCC parties convened in Paris in December 2015 to negotiate the *Paris Agreement*: a global, legally binding agreement designed to stabilize increases in a global average temperature below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.⁶²

Yet, the *Paris Agreement* excluded emissions from the international shipping industry, which produces an estimated 1,076 million tonnes of GHGs annually, accounts for 2.9 percent of global anthropogenic GHG emissions, and whose GHG emissions are projected to increase by 0–50 percent between the present and 2050.⁶³ Consequently, the IMO remained the international organization responsible for regulating international shipping’s significant and growing share of global anthropogenic GHG emissions.

Atmospheric GHG concentrations are cumulative. If the international community aspires to achieve the emissions reductions required to stabilize atmospheric GHG concentrations and global temperatures, the shipping industry must be part of that solution. The IMO must develop and implement emissions reductions measures in coordination with UNFCCC parties. To do otherwise risks compromising the achievement of the UNFCCC’s ultimate objective: the “stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system.”⁶⁴

This chapter employed a structured analysis to evaluate the comparative effectiveness of current and proposed IMO measures in reducing emissions in a manner sensitive to the industry’s international character and role as

an instrument of sustainable global development. The efficiency-based EEDI and SEEMP/EEOI measures are a good start in approaching the task of regulating GHG emissions from international shipping. However, reliance on efficiency-based measures alone will not be adequate to restrict emissions from international shipping to a level consistent with those required under the *UNFCCC*.⁶⁵ This chapter concludes that the GHG Fund policy is the market-based measure best situated to regulate emissions from the international shipping industry, based on the proposed policy's: (1) environmental effectiveness; (2) cost-effectiveness; (3) incentives for positive technological change; (4) practical feasibility of implementation; (5) legal enforcement; and (6) impacts on developing countries. This conclusion is consistent with that of two similar studies,⁶⁶ as well as others comparing the relative effectiveness of a levy rather than a cap-and-trade scheme.⁶⁷

The author suggests that in approaching the task of regulating GHG emissions from international shipping, the IMO should focus its efforts on the GHG Fund policy. Because uncertainty in a policy's application can detract from the consensus required to implement that policy, the IMO should undertake a comprehensive evaluation of the design, implementation, and anticipated effects of the GHG Fund policy, that provides for special consideration of the policy's effects on developing countries. Experience from the *UNFCCC* context suggests that ensuring that the policy is designed and implemented in a manner conforming to the CBDR principle will be critical to the policy's success, both practical and political.

NOTES

- 1 Associate at McInnes Cooper Halifax, with assistance from Dan Vancleave.
- 2 International Chamber of Shipping (ICS), "ICS Film—International Shipping: Lifeblood of World Trade" (25 September 2009), online: YouTube <www.youtube.com/watch?v=x_G_kfcR_QQ> from <https://www.ics-shipping.org/>.
- 3 ICS, "Shipping and World Trade: Driving Prosperity" (accessed 12 July 2021), online: <www.ics-shipping.org/shipping-facts/shipping-and-world-trade>.
- 4 ICS, "Shipping, World Trade and the Reduction of CO₂ Emissions: United Nations Framework Convention on Climate Change" (London: ICS, 2014).
- 5 World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987), online (pdf): <sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf> [Brundtland Report].
- 6 In 2018, 79 percent of the international shipping fleet fuel used was heavy fuel oil (marine bunkers). More specifically, in 2018 international shipping consumed an estimated 221.8 million tonnes of heavy fuel oil, 61.5 million tonnes of marine diesel oil,

and 11.3 million tonnes of liquefied natural gas, all expressed in heavy fuel oil equivalent tonnes: *Fourth IMO Greenhouse Gas Study 2020* (London: IMO, 2020), online (pdf): [IMO <www.wcdn.imo.org/localresources/en/OurWork/Environment/Documents/Fourth%20IMO%20GHG%20Study%202020%20-%20Full%20report%20and%20annexes.pdf>](http://www.wcdn.imo.org/localresources/en/OurWork/Environment/Documents/Fourth%20IMO%20GHG%20Study%202020%20-%20Full%20report%20and%20annexes.pdf) at 1 and 97 [*Fourth IMO GHG Study*].

7 *Ibid* at 1.

8 *Ibid.*

9 United Nations Framework Convention on Climate Change, “Greenhouse Gas Inventory Data—Flexible Queries Annex I Parties” (accessed 14 June 2021), online: <di.unfccc.int/flex_annex1>. The figures exclude emissions from land use, land-use change, and forestry [UNFCCC, *National Greenhouse Gas Inventory Data*].

10 *Fourth IMO GHG Study*, *supra* note 6 at 236.

11 *Ibid.*

12 UNFCCC, *National Greenhouse Gas Inventory Data*, *supra* note 9.

13 *United Nations Framework Convention on Climate Change*, 9 May 1992, 1771 UNTS 107, art 16 (entered into force 21 March 1994) [UNFCCC].

14 *Ibid*, art 9.

15 Iulian Florin Vladu & Bernd Hackmann, “International Maritime Transport under the UNFCCC Process” in Regina Asariotis & Hassiba Benamara, eds, *Maritime Transport and the Climate Change Challenge* (New York: Routledge, 2012), 61 at 67.

16 *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, 11 December 1997, 2303 UNTS 148 (entered into force 16 February 2005) [*Kyoto Protocol*].

17 *Ibid.*

18 Vladu & Hackmann, *supra* note 15 at 67.

19 *Kyoto Protocol*, *supra* note 16, art 2(2).

20 *Adoption of the Paris Agreement*, FCCC/CP/2015/L.9/Rev.1 art 2(1)(a) (12 December 2015) [*Paris Agreement*].

21 *1978 Protocol Relating to the 1973 International Convention for the Prevention of Pollution from Ships*, 17 February 1978, 1340 UNTS 61 (entered into force 2 October 1983); *1997 Protocol to Amend the 1973 International Convention for the Prevention of Pollution from Ships*, as modified by the 1978 Protocol, 26 September 1997, [2007] ATS 37 (entered into force 19 May 2005) [MARPOL].

22 See “COP21: Paris Remains Silent on Shipping and Aviation” (14 December 2015), online: *Offshore Energy* <worldmaritimeneews.com/archives/178732/cop21-paris-remains-silent-on-shipping-and-aviation/>; and “Shipping Dropped from Paris Climate Deal” (10 December 2015), online: *Offshore Energy* <worldmaritimeneews.com/archives/178438/shipping-dropped-from-paris-climate-deal/>.

23 IMO, “Introduction to IMO”, online: <www.imo.org/en/About/Pages/Default.aspx>.

24 IMO, “Membership”, online: <www.imo.org/en/About/Membership/Pages/Default.aspx>.

25 *1997 Protocol to Amend the International Convention for the Prevention of Pollution by Ships, as Modified by the 1978 Protocol*, 26 September 1997, [2007] ATS 37 (entered into force 19 May 2005) [*1997 Protocol to MARPOL*].

26 *Ibid.*

27 Andreas Chrysostomou & Eivind S Vågslid, “Climate Change for IMO Too” in Regina Asariotis & Hassiba Benamara, eds, *Maritime Transport and the Climate Change Challenge* (New York: Earthscan, 2012) 75 at 78.

- 28 Conference of Parties to MARPOL, “Resolution to Address CO₂ Emissions from Ships”, 22 October 1997, MP/CONF.3/35, 1997 [Conference of Parties]; IMO, *Second IMO GHG Study 2009* (London: IMO, 2009) at 1.2 [Second IMO GHG Study 2009]; Chrysostomou & Vågslid, *supra* note 27 at 78.
- 29 *Study of Greenhouse Gas Emissions from Ships: Final Report of the International Maritime Organization* (London: IMO, 2000).
- 30 Conference of Parties, *supra* note 28; *Second IMO GHG Study 2009*, *supra* note 28 at 1.2; IMO, *Third IMO GHG Study 2014* (London: IMO, 2014); *Fourth IMO GHG Study*, *supra* note 6.
- 31 Nadine Heitmann & Seterah Khalilian, “Accounting for Carbon Dioxide Emissions from International Shipping: Burden Sharing under Different UNFCCC Allocation Options and Regime Scenarios” (2011) 35 *Marine Policy* 682 at 684. See also Article 1(b) of the *International Convention on the International Maritime Organization*, adopted 6 March 1948, 289 UNTS 48 which articulates the organization’s purpose as “[t]o encourage the removal of discriminatory action and unnecessary restrictions by Governments affecting shipping engaged in international trade so as to promote the availability of shipping services to the commerce of the world without discrimination.”
- 32 For information on global fleet ownership and registration, see UNCTAD, *Review of Maritime Transport 2015* (New York: United Nations, 2015) at 36 and 42; Heitmann & Khalilian, *supra* note 31 at 684.
- 33 The authors selected the evaluative criteria based on the work of the IMO, “Report of the Marine Environment Protection Committee on Its Fifty-Seventh Session” (7 April 2008) MEPC 57/21 at 4.107.
- 34 IMO, “Report of the Marine Environment Protection Committee on Its Fifty-Ninth Session” (27 July 2009) MEPC 59/24 para 4.106 [MEPC, 59/24].
- 35 IMO, “Reduction of GHG Emissions from Ships: Full Report of the Work Undertaken by the Expert Group on Feasibility Study and Impact Assessment of Possible Market-Based Measures” (13 August 2010) MEPC 61/INF.2] at para 14.37 [MBM Feasibility Study and Impact Assessment].
- 36 *Ibid* at table 9-3.
- 37 *Ibid* at table 14-3.
- 38 IMO, “Initial IMO Strategy on Reduction of GHG Emissions from Ships” (13 April 2018) Resolution MEPC.304(72), online (pdf): <unfccc.int/sites/default/files/resource/250_IMO%20submission_Talanoa%20Dialogue_April%202018.pdf> [Initial Strategy] at Annex 2, para 36. Note that the full text of the IMO Initial Strategy was included within the IMO’s submission to the Talanoa Dialogue established by the UN Climate Change secretariat for countries and stakeholders to contribute information regarding climate action.
- 39 *Ibid* at art 6.2.
- 40 *Supra* note 38.
- 41 *Ibid* at art 1.7.
- 42 *Ibid* at art 3.3.
- 43 *Ibid* at art 3.1.
- 44 *Ibid*.
- 45 *Fourth IMO GHG Study 2020*, *supra* note 6.
- 46 *Ibid* at 5.

- 47 IMO, “Greenhouse Gas Emissions” (accessed 22 September 2021), online: <www.imo.org/en/OurWork/Environment/Pages/GHG-Emissions.aspx>.
- 48 *Ibid* at art 4.7.
- 49 *Ibid* at art 4.8.
- 50 *Ibid* at art 4.9.
- 51 IMO, *Reducing Greenhouse Gas Emissions from Ships* (2019), online: <www.imo.org/en/MediaCentre/HotTopics/Pages/Reducing-greenhouse-gas-emissions-from-ships.aspx>.
- 52 *Ibid* at art 4.10–4.12.
- 53 *Supra* note 38.
- 54 *Ibid*.
- 55 IMO, *Next Steps to Deliver IMO GHG Strategy* (2018), online: <www.imo.org/en/MediaCentre/PressBriefings/Pages/18-MEPCGHGprogramme.aspx>.
- 56 *Ibid*.
- 57 IMO, “UN Agency Pushes Forward on Shipping Emissions Reduction” (20 May 2019), online: <www.imo.org/en/MediaCentre/PressBriefings/Pages/11-MEPC-74-GHG.aspx>.
- 58 *Ibid*; see also IMO, “2018 Guidelines on the Method of Calculation of the Attained Energy Efficiency Design Index (EEDI) for New Ships” (26 October 2018) Resolution MEPC.308(73), online (pdf): <[wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Air%20pollution/MEPC.308\(73\).pdf](http://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Air%20pollution/MEPC.308(73).pdf)>.
- 59 IMO, “Invitation to Member States to Encourage Voluntary Cooperation between the Port and Shipping Sectors to Contribute to Reducing GHG Emissions from Ships” (17 May 2019) Resolution MEPC.323 (74), online (pdf): <wwwcdn.imo.org/localresources/en/KnowledgeCentre/IndexofIMOResolutions/MEPCDocuments/MEPC.323%2874%29.pdf>.
- 60 *Ibid*.
- 61 International Panel on Climate Change, *Climate Change 2014 Synthesis Report Summary for Policymakers Chapter* (Geneva, Switzerland: IPCC, 2014), online (pdf): <www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf> at 22 [IPCC Report 2014].
- 62 *Paris Agreement*, *supra* note 20 art 2(1)(a).
- 63 *Fourth IMO GHG Study*, *supra* note 6.
- 64 *United Nations Framework Convention on Climate Change*, 9 May 1992, 1771 UNTS 107, art 2 (entered into force 21 March 1994) [UNFCCC].
- 65 IMO, “Report of the Marine Environment Protection Committee on its Fifty-Ninth Session” (27 July 2009) MEPC 59/24 para 4.106 [MEPC, 59/24].
- 66 Yubing Shi, “Reducing Greenhouse Gas Emissions from International Shipping: Is It Time to Consider Market-based Measures?” (2016) 64 *Marine Policy* 123 at 128 at 129; see also Harliaos N Psaraftis, “Market-based Measures for Greenhouse Gas Emissions from Ships: A Review” (2012) 11 *World Maritime University Journal of Maritime Affairs* 212 at 222.
- 67 See Congressional Budget Office, *Policy Options for Reducing CO₂ Emissions* (February 2008), online (pdf): <www.cbo.gov/sites/default/files/110th-congress-2007-2008/reports/02-12-carbon.pdf>; see also Friends of the Earth, “Clearing the Air: Moving on from Carbon Trading to Real Climate Solutions” (November 2010), online (pdf): <web.archive.org/web/20131024075840/http://www.foe.co.uk/resource/reports/clearing_air.pdf>.