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WORLD MARITIME UNIVERSITY

Dalian, China

STRATEGY OF MARKET-BASED MEASURES (MBM) TO TACKLE GREEN HOUSE GAS EMISSIONS (GHG) FOR INTERNATIONAL SHIPPING IN CHINA

By

SHEN JIAQIANG

The People's Republic of China

A research paper submitted to the World Maritime University in partial
Fulfillment of the requirements for the award of the degree of

MASTER OF SCIENCE

(MARITIME SAFETY AND ENVIRONMENTAL MANAGEMENT)

2014

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DECLARATION

I certify that all the materials in this research paper that are not my own work have been identified, and that no material is included for which a degree has previously been conferred on me.

The contents of this research paper reflect my own personal views, and are not necessarily endorsed by the University.

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(Date): July 7, 2014

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Professor

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47 students and friends, from different places, came together to the World Maritime University Dalian branch. We study together, live together and play together for one and a half years. It is such a great and precious time for us. I have to say thanks very much to WMU, Dalian Maritime University and China Maritime Safety Administration. It is through your great efforts to make this project come true, to unite so many renowned experts and professors to teach and inspire us to pursue our dreams, And to bring up so many young talents for the development of Chinese shipping industry. We are grateful for what you have done and we will remember you.

I still remember that it was a short chat with President Ma during lunch break that inspired me to look deep into this topic. I am grateful for what President Ma has taught us, help us and inspired us to be. President Ma is a knowledgeable professor, willing to communicate with us, guide us how to promote ourselves, and encourage us to become an expert within our field respectively. You deserve our respect and it's our honor to have this great chance to be your students.

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ABSTRACT

Title of Research Paper: **The Strategy of MBMs to Tackle GHG Emissions For International Shipping in China**

Degree: **Msc**

The research endeavors to tackle GHG emissions from international shipping industry by adopting MBMs developed by IMO. Comparing emission change scheme with the marine emission trade scheme, this research offers recommendations to Chinese maritime authority on how to get better prepared for the upcoming MBMs to curb GHG emission from international shipping industry. In spite of many proposals on the IMO's table, analyses made in this paper are mainly focused on the emission charge and marine emission trade scheme, including the role of IMO, potential market distortion, carbon leakage and etc.

Based on the scenarios developed by IPCC and other international standards, the quantitative analysis method is adopted to calculate the CO_2 emission from Chinese international fleet. The data obtained present a very challenging result. In implementing MBMs by IMO, which could be well expected in the near future, several proposals on data collection, instrument selection and fund establishment were discussed.

KEYWORDS: MBMs, GHG emissions, Emission charge, METS, Statistics.

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LIST OF ABBREVIATIONS

BDN	Bunker Fuel Delivery Note
CO_2	Carbon dioxide
CDM	Clean Development Mechanism
CBDR	Common but Differentiated Responsibility
DO	Diesel Oil
EC	European Commission
EEA	European Environment Agency
EUA	EU Emission Allowances
EEDI	Energy Efficiency Design Index
EU ETS	European Union Emissions Trading Scheme
GDP	Gross Domestic Product
GHG	Greenhouse Gas
HFO	Heavy Fuel Oil
IMO	International Maritime Organization
IEA	International Energy Agency
IMC	International Maritime Centre
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
KP	Kyoto Protocol
LDCs	Least Developed Countries
MBM	Market-based Mechanisms
MCC	Marginal Control Cost
MDC	Marginal Damage Cost
MEPC	Marine Environment Protection Committee
METS	Maritime Emissions Trading Scheme
MARPOL	International Convention for the Prevention of Pollution from Ships
RM	Rebate Mechanism
SOLAS	International Convention for the Safety of Life at Sea
SEEMP	Ship Energy Efficiency Management Plan
U N	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNFCCC	United Nations Framework Convention on Climate Change

Chapter 1 Introduction

1.1 Background

Global climate change has posed a great threat to our ecological system and economic society. One of the main reasons or perhaps the most notable one lies in the anthropogenic GHG emissions. The international community, under the United Nations Framework Convention on Climate Change (UNFCCC), has realized the seriousness of the problem and urged countries to control the temperature increase by 2℃ based on the pre-industrial level in the Copenhagen Accord in 2009. In order to reach this target, GHG emissions in 2050 are expected to decrease 50-85% of current levels according to the Intergovernmental Panel on Climate Change (IPCC). However, all IPCC scenarios indicate significant increase in GHG emissions up to 2050, which presents challenge to the whole world and consequently needs all the countries and the industries to take their best efforts to tackle GHG emissions.

Although GHG emission from marine bunker fuels is not included in the Kyoto Protocol (KP) and stands only a small proportion of the total emissions, shipping discharges a large quantity of GHG into the atmosphere.

> *Shipping is estimated to have emitted 1,046 million tonnes of CO_2 in 2007, which corresponds to 3.3% of the global emissions during 2007. International shipping*

is estimated to have emitted 870 million tonnes, or about 2.7% of the global emissions of CO_2 in 2007. Mid-range emissions scenarios show that by 2050, in the absence of policies, CO_2 emissions from international shipping may grow by a factor of 2 to 3 (compared to the emissions in 2007) as a result of the growth.

(Buhaug et al. 2009)

Various studies also show a very aggressive growth of CO_2 emissions from shipping industry as exhibited in figure 1.1.

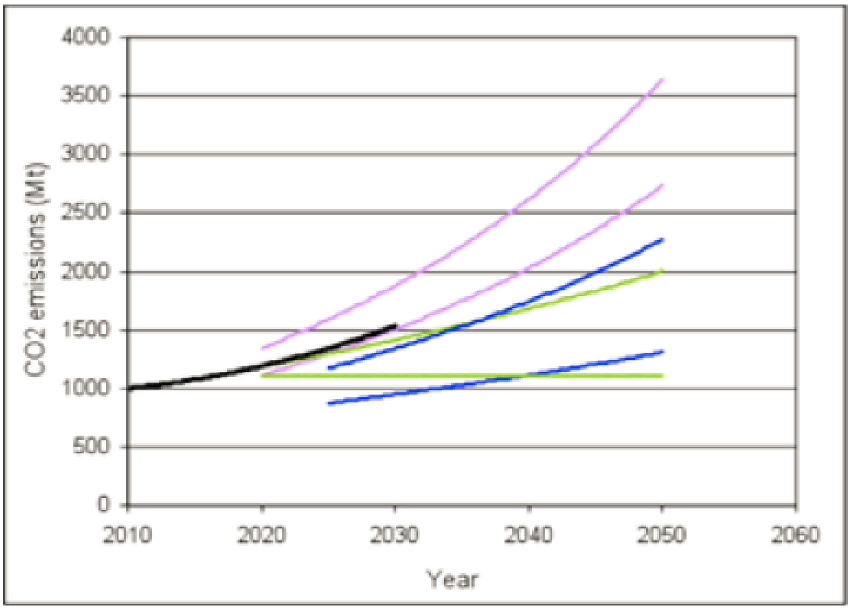

Figure 1.1 – Projected CO_2 emissions from the future fleet from various studies

Source: DNV (2010). *Assessment of measures to reduce future CO_2 emissions from shipping.* Norway: Author.

Notes: Purple – Buhaug et al. 2009 (high-low); Blue – Endresen et al. 2008 (high-low); Green – Eyring et al. 2005 (high-low); Black – DNV 2010 (baseline).

Due to the anticipated growth, it would be very difficult to control the GHG emissions. The 2℃ increase in temperature of UNFCCC combined with challenging scenarios within shipping sector put the International Maritime Organization (IMO) under great pressure. Since then, a series of regulations and measures have been discussed and adopted by IMO, including technical, operational measures and market-based measures (MBMs). In July 2011, IMO adopted new regulations on energy efficiency for ships, adding a new chapter 4 to Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL). It developed the Energy Efficiency Design Index (EEDI) for new ships, and the Ship Energy Efficiency Management Plan (SEEMP) for all ships mandatory. It aims to achieve 50% CO_2 reduction per tonne of cargo with transporting distance of one kilometer by 2050.

Many parties doubt whether implementation of technical and operational related measures only is enough and whether they can achieve the expected target. Jack Devanney from Center for Tankship Excellence even argues that the EEDI approach would not only be a horribly inefficient (high resource cost) means of reducing CO_2 emissions, but extremely dangerous in terms of safety and oil pollution (Devanney, 2011). Against this backdrop, IMO along with its Member States are developing MBMs to try to find the most cost effective means of reducing CO_2 emissions from ships. Maritime Environmental Protection Committee (MEPC) of IMO has already received a number of proposals, and a working group was established to assess these proposals. The detailed information could be found in the MEPC files.

1.2 Development of regulations on reduction of GHG emissions from shipping

For the inadequacy of emission reduction provisions in UNFCCC, KP was adopted in 1997 and entered into force in 2005. It legally binds developed countries to emission reduction targets. However, GHG emissions from aviation and marine bunker fuels were left to the International Civil Aviation Organization and the IMO respectively in KP. Since then, MEPC has made great efforts to control the GHG emissions from ships, and in July 2011, a package of technical measures for new ships and operational reduction measures for all ships over 400 gross tonnage were adopted by MEPC. The adopted measures added to MARPOL Annex VI (Regulations on the prevention of air pollution from ships) a new Chapter 4 entitled "Regulations on energy efficiency for ships", making mandatory the EEDI, and SEEMP, which are, consequently, the first ever mandatory international treaty binding on an entire industry globally.

> *The EEDI requires a minimum energy efficiency level (CO_2 emissions) per capacity mile (e.g. tonne mile) for different ship type and size segments. With the level being tightened every five years, the EEDI will stimulate continued technical development of all the components influencing the fuel efficiency of a ship. Reduction rates are set until 2025-2030 when a 30% reduction is mandated over the average efficiency for ships built between 2000 and 2010. The EEDI is non-prescriptive, performance based tool that leaves the choice of technologies to use in a specific ship design to the industry. The EEDI has been developed for the largest and most energy intensive segments of the world merchant fleet and will embrace about 70% of emissions from new ships.*
>
> (IMO, 2010a)

The SEEMP is an operational measure that establishes a mechanism to assist the shipping industry in achieving cost-effective efficiency improvements in its operations using the Energy Efficiency Operational Index (EEOI) as a monitoring tool and benchmark. It may include slow steaming, optimal trim, hull and propeller condition monitoring, optimal voyage planning and etc.

The new technical and operational measures are expected to help ship operators save $34 to 60 billion in fuel costs in 2020, as well as reduce CO_2 emissions from international shipping by up to 180 million tonnes annually by 2020, a figure that, by 2030 will increase to 390 million tonnes (IMO, 2010b). However, it is estimated that the technical and operational measures are not sufficient to reduce the GHG emission from international shipping as expected in the projection of the growth of world seaborne transportation. Hence, MBMs have been considered. Although there is still a long way to go before finalizing the form that would apply to the shipping industry, under the pressure of UNFCCC and European Commission (EC), a broad consensus has been reached among Member States in the latest MEPC meeting that there is necessity to establish a mandatory global system for collecting accurate data on CO_2 emissions, which could be done through the amendments of MARPOL for monitoring and reporting fuel consumption of individual ships. We could anticipate that the relevant regulations will be promulgated very soon.

1.3 Structure and purpose of the dissertation

1.3.1 Structure of the dissertation

The dissertation is comprised of 6 chapters. Chapter 2 makes an introduction on the economic instruments for CO_2 emission reduction, and presents the main proposals on the IMO's table. Chapter 3 analyzes the advantages and disadvantages of MBMs. Questions are raised about the role of the IMO, how to harmonize the contradiction of UNFCCC's "common but differentiated responsibility" (CBDR) and IMO's non-discriminatory principles? How to avoid the distortion of the Carbon trading market? Chapter 4 and 5 mainly focuses on the Chinese market. Through the calculation of the potential CO_2 emissions from Chinese international fleet, we could identify that China is under a great pressure and would be affected by MBMs significantly on trading, seaborne transportation and etc. Based on the discussion about the MBMs, chapter 5 provides several recommendations for the Chinese government authority, including data collection, comparison and selection of instruments and establishment of fund in China.

1.3.2 Purpose of the dissertation

The new amendments to MARPOL Annex VI on the energy efficiency for ships represent the first ever global and legally binding CO_2 reduction regime for an international shipping industry. However, recognizing the potential growth of shipping associated with economic development, IMO realizes that additional measures are needed in addition to technical and operational measures. Therefore, MBMs also have been considered, which could be mainly categorized into three groups emission charge (Fund), marine emission trading scheme and violence punishment. Whatever form it takes, it will significantly affect the international community significantly, especially countries like China.

As a major shipping country, China has to get involved in this process more actively and contribute our own intelligence. So this dissertation serves firstly as an introduction of the MBMs to Chinese government authority. MBMs represent the trend of the future. In adversely, it will go through the negotiations and come into force, so we have to understand the principles on how it works, what it could be done and how to bring its best to be in line with our own national interests.

Secondly, it illustrates a picture, in which the Chinese international shipping get involved in. The forecast on the development of Chinese international shipping and GHG emissions makes it very clear that we would be under a great pressure in following the international standards. We have to be geared up for the introduction of tougher environmental regulations and provide IMO with more solid reports and proposals about the issue, considering the interests of developing countries more carefully and thoroughly.

Thirdly, it provides a hint and inspires more people to do the relevant study and research. Up till now, there is inadequacy of solid and sound reports about the MBMs in IMO. The industry needs more talented people to get involved in this study, and provide the community with more creative and feasible methods.

Chapter 2 Economic Instruments for CO_2 Emission Reduction

MBMs to tackle GHG emissions have been a hot issue both under UNFCCC and IMO domain at present. As there is still no final conclusion on which form it will be in the shipping industry. Basically, economic instruments usually come in the form of emission charges (tax or pollution levy) and tradable emission permits where, for example, shipping companies receive an incentive for pollution abatement on a sustainable basis.

2.1 Emission charges

An effluent charge is a tax or financial penalty imposed on polluters by government authorities. The charge is specified on the basis of dollars or cents per unit of effluent emitted into the ambient environment (Hussen, 2004a, p106). It implies, for instance, that shipowners have to pay for the pollutents emitted into the air by their ships. Figure 2.1 shows how the companies would have greater incentive to invest in pollution control technology than under emission standards under the emission charge regime.

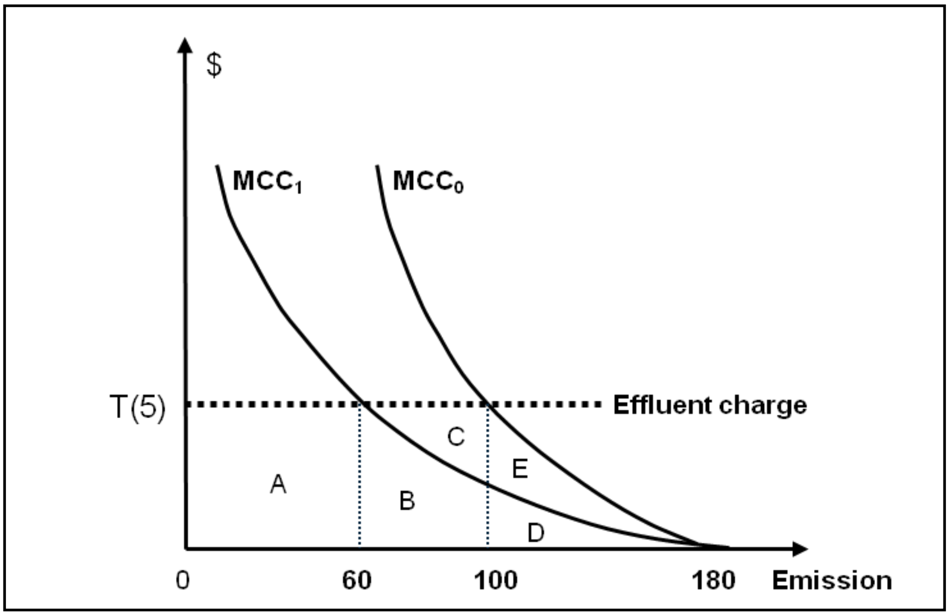

Figure 2.1 – An effluent charge and a firm's incentive to invest in new technology
Source: Ma, S. (2013). *Maritime Economics*. Unpublished lecture handout, World Maritime University, Malmo, Sweden.

Suppose that there is a shipping company, a polluter, without an emission charge, he would have emitted a total amount 180 since there is no external cost. If an emission charge T is imposed, and given the marginal emission control cost being MCC, it would be the company's interest to control the emission to 100 as it would cost less to reduce the emission than to pay the tax.

What happens if the new technology is implemented onboard ship to control CO_2 emission? As illustrated by Figure 2.1, the marginal control cost shifts from MCC_0 to MCC_1. Before adoption of new technology, the company emitted 100 units, and controlled 80 units (180-100) of its pollutants. The authority, then, is entitled to collect tax of $500, represented by A+B+C. For cleaning up 80 units, the company needs to pay an amount equitable to D+E, Which makes the total expenditure up to A+B+C+ D+E. Likewise, if the new technology is adopted, area A+B+D will represent the total expenditure of this company for tax and pollutants cleaning.

Direct cost-saving would be C+E, with C as tax cost saving and E as saving from new control method.

It is also clear that if "command-and-control" regulatory standard is enforced, for instance at level 100, even though the new technology is available, it is most likely for the company not to apply it and keep its emission at 100 instead of the optimal point 60. Area C then represents an extra incentive for the shipping company to invest in new technology.

2.2 Transferable emission permits

> *Essentially, the main idea behind transferable emission permits is to create a market for pollution rights. A pollution right simply signifies a permit that consists of a unit (pound, ton, etc.) of a specific pollutant. Under the transferable emission permit approach, government authorities basically have two functions. They determine the total allowable permits, and decide the mechanism to be used to distribute the initial pollution permits among polluters.*
>
> (Hussen, 2004b, p113)

In order to make the transferable emission permits instrument work properly, the following postulates need to be satisfied:

(1) A polluter, for example, a ship should obtain a legal right to pollute;

(2) These rights are clearly clarified;

(3) Government authorities decide the total permits and assign the initial rights. Polluters emitting in excess of their allowances are subject to a stiff penalty;

(4) Pollution permits are freely transferable.

On the above mentioned four conditions, figure 2.2 illustrates how the transferable emission permits instrument works. Suppose that there are two ships emitting CO_2, without control, both ships would have emitted 300 tons of CO_2. To curb the GHG emission, government authority decides to cut the total emission by half on the basis of equal criteria, each ship is allocated 150 tons allowances. If, as exhibited by figure 2.2, two ships implement different technologies with different marginal control costs, there is a possibility that these two ships could be engaged in mutual trading. Given that both ships discharge 150 tons of CO_2 (ship 1 operating at point R, while ship 2 operating at point S), MCCs for the last unit emission for ship 1 and ship 2 are $500 and $2500 respectively. It costs ship 2 five times as much as ship 1. Since permits are free tradable rights, it would be in the best interest of ship 2 to buy a permit from ship 1 provided its price is less than $2500. Similarly, ship 1 will be willing to sell a permit as long as the price is greater than $500. The mutual exchange will continue until point E, where MCC1 = MCC2. At point E, ship 1 emits 100 tons of CO_2, while ship 2 emits 200 tons of CO_2. The total amount of CO_2 emitted is, as set by the government, 300 tons. However, through the transferable emission permits instrument, ship 2 could buy 50 tons allowances in the market to fill its deficit and ship 1 could sell 50 tons allowances by investing in new technology, and the whole industry could achieve its objective in a much more cost-effective method.

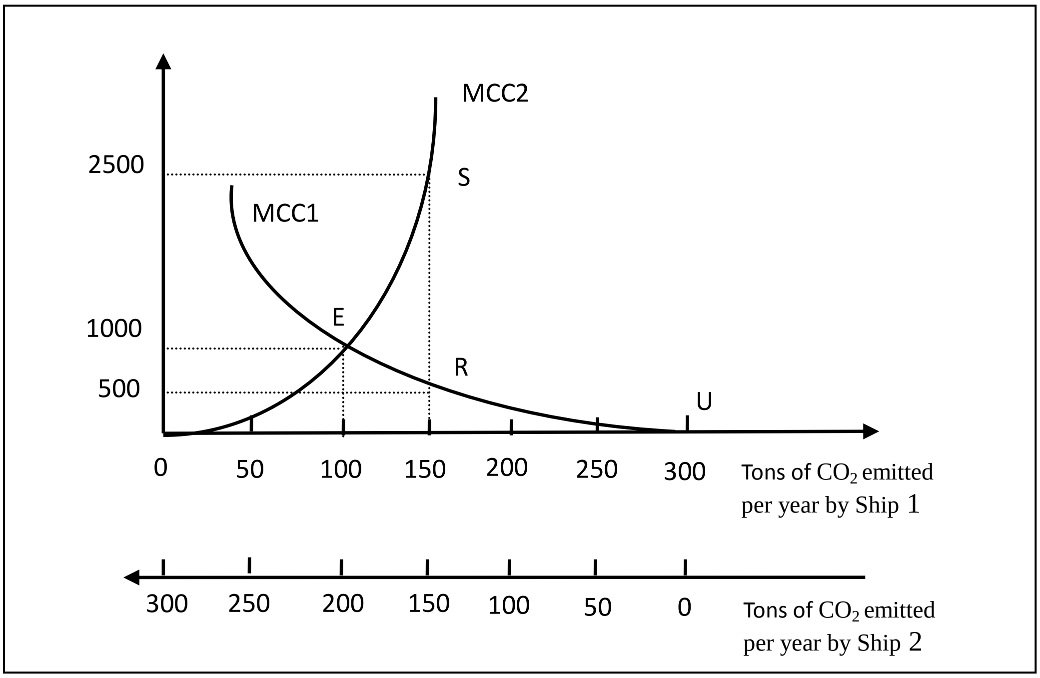

Figure 2.2 - How transferable emission permits works

Source: Hussen, A.M. (2004). *Principle of Environmental Economics* (2nd ed., pp.113). New York: Routledge.

2.3 MBMs proposed to IMO

In response to the call for action in resolution A.963 (23), MEPC 55 had approved the work programme to identify and develop the mechanisms needed to achieve the limitation or reduction of CO_2 emissions from international shipping. The work plan reiterated the call to consider technical, operational and MBMs for dealing with GHG emissions. On the one hand, following the second IMO GHG study, EEDI and SEEMP has been introduced into the revised MARPOL Annex VI and entered into force on January 2013. On the other hand, MEPC 59 had agreed by overwhelming majority that MBMs were needed as part of a comprehensive package of measures for GHG emission reduction. Hence, a dozen of proposals, by the methodology of fund collection or trade, were submitted to IMO to curb CO_2 emission from shipping industry. A full report of the work undertaken by the Expert Group on feasibility study and impact assessment of possible MBMs was submitted to MEPC 61 analyzing the impacts of ten proposed MBMs based on the agreed 9 principles[1]. A brief description on these proposals is as follows:

(1) An international Fund for GHG emissions from ships (GHG Fund) proposed by Cyprus, Denmark, the Marshall Islands, Nigeria and IPTA (MEPC 60/4/8)

This method would establish a global reduction target for international shipping, set by either UNFCCC or IMO. Emissions above the target line would be offset largely by purchasing approved emission reduction credits. The offsetting activities would be financed by a contribution paid by ships on every tonne of bunker fuel purchased. It is envisaged that contributions would be collected through bunker fuel suppliers or via direct payment from shipowners. The contribution rate would be adjusted at regular intervals to ensure that sufficient funds are available to purchase project credits to achieve the agreed target line. Any additional funds remaining would be available for adaptation and mitigation activities via the UNFCCC and R&D and technical co-operation with the IMO framework.

(2) The United States proposal to reduce GHG emissions from international shipping, the Ship Efficiency and Credit Trading (SECT) (MEPC 60/4/12)

It is designed to focus on emission reduction activities just in the shipping sector. Under SECT, all ships, including those in the existing fleet, would be subject to mandatory energy efficiency standards, rather than a cap on emissions or a surcharge on fuel. As one means of complying with the standard, SECT would establish an efficiency-credit trading program. The stringency level of these efficiency standards

[1] Referring to MEPC/61/INF.2

would be based on energy efficiency technology and methods available to ships in the fleet. These standards would become more stringent over time, as new technology and methods are introduced. Similar to the EEDI, these efficiency standards would be based on a reduction from an established baseline and would establish efficiency standards for both new and existing ships. The SECT is designed to achieve relative GHG reductions, i.e. reductions in emissions per tonne mile and not to set an overall target for the sector.

Following the original proposal, The United States made several submissions to IMO to further detail the proposal. Two major changes were made. First, instead of using design-based, technical criteria to establish energy efficiency standards, the revised proposal recognizes the merit in seeking to develop standards based on total fuel consumption, which captures both technical and operational measures. Second, the revised proposal calls for a phased approach: a data collection phase, a pilot phase to test the standards established, and then a full implementation phase.

(3) The Global Emission Trading System (ETS) for international shipping proposal by Norway (MEPC 61/4/22)

The proposal would set a sector-wide cap on net emissions from international shipping and establish a trading mechanism to facilitate the necessary emission reductions, be they in-sector or out-of-sector. The use of out-of-sector credits allows for further growth of the shipping sector beyond the cap. In addition the auction revenue would be used to provide for adaptation and mitigation (additional emission reductions) through UNFCCC processes and R&D of clean technologies within the maritime sector. A number of allowances (ship emission units) corresponding to the cap would be released into the market every year. It is proposed that the units would be released via a global auctioning process. Ships would be required to surrender one ship emission unit, or one recognized out-of-sector allowance or one recognized out-of-sector project credit, for each tonne of CO_2 they emit. The ETS would apply to all CO_2 emissions from the use of fossil fuels by ships engaged in international trade above a certain size threshold. The proposal also indicates that limited exemptions could be provided for specific voyages to small island developing states (IMO, 2010c).

In addition to the proposals above, more proposals are on the table as follows:

- Leveraged Incentive Scheme (LIS) to improve the energy efficiency of ships based on the international GHG Fund proposed by Japan;
- Achieving reduction in GHG emissions from ships through Port State arrangements utilizing the ship traffic, energy and environment model, STEEM (PSL) by Jamaica;
- Vessel Efficiency System (VES) proposal by World Shipping Council;
- Global Emissions Trading System (ETS) for international shipping proposal by the United Kingdom;
- Further elements for the development of an Emissions Trading System (ETS) for international shipping by France;
- Market-Based Instrument: a penalty on trade and development proposal by the Bahamas;
- A Rebate Mechanism (RM) for a market-based instrument for international shipping by IUCN.

Chapter 3 Analysis of MBMs to Control GHG Emissions

3.1 Advantages of MBMs

3.1.1 Cost effectiveness

Compare with the traditional regulatory method, the biggest advantage of MBMs is cost effectiveness. Figure 3.1 explains the reasons why the uniform standard is not cost effective. Suppose that there are different technologies to control CO_2 emission applied by two ships, which would result in different marginal control costs. We assume the total amount of emission is 600 tonnes each year, and the objective of our government authority is to cut it by half. It means that each ship would have to control its emission level to 150. For ship1, the total control cost is represented by area D, while, for ship2, the total cost is covered by areas A+B+C. The total control cost for these two ships is A+B+C+D. Is this the most economical method to control the emission? The answer is no. If the MBM is used, two ships could, through mutual trade or economic incentive, optimize their emission level to 200 and 100 respectively for ship1 and ship2. The total cost was then changed to A+B+D, with a net saving C. it could be concluded from the figure 3.1 that the most efficient way of controlling a set amount of emission happens when MCC1 equals MCC2.

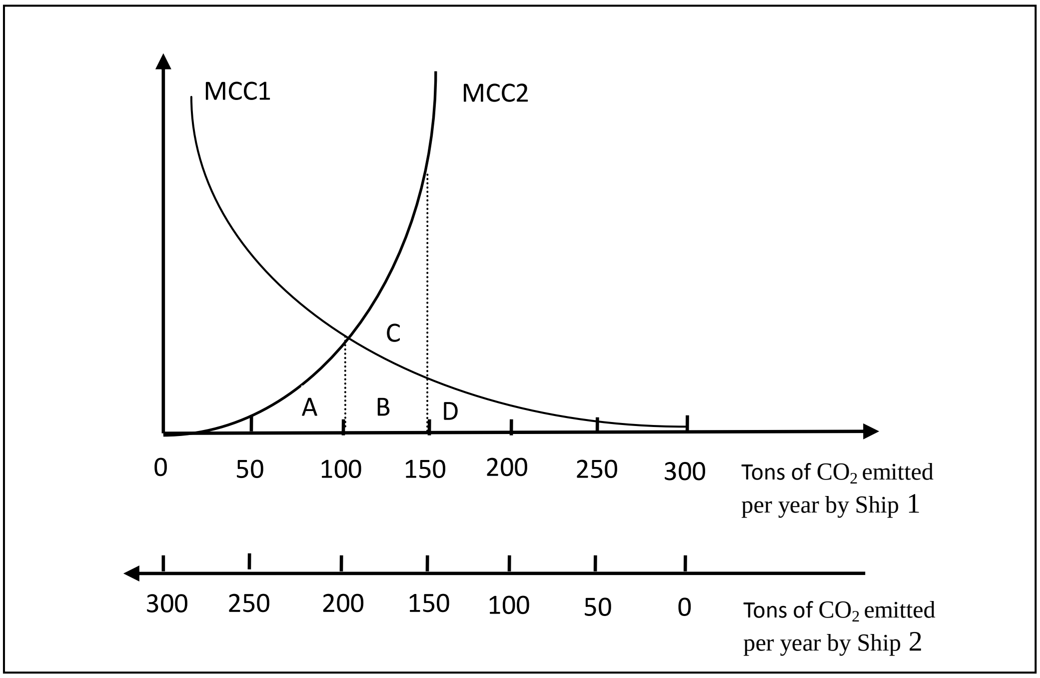

Figure 3.1 - The cost effectiveness of emission standards

Source: Hussen, A.M. (2004). *Principle of Environmental Economics* (2^{nd} ed., pp.101). New York: Routledge.

We discussed in section 2.1 that an emission tax instrument would incentivize each individual ships to adjust its marginal control cost to the tax level. If all ships do this, then we can deduce that MCCs for all ships are the same, which equals the tax. It is the perfect condition to allocate the resources in a most cost effective way. For an emission trade scheme, it works in the same way through the mutual trading to achieve an equal MCC. So, at this point, we could conclude that MBMs are more cost-effective than regulatory standards.

3.1.2 Promotion of new technology

As discussed in chapter 2, economic instruments usually come in the form of emission charges or tradable emission permits where, for example, shipping companies receive an incentive for pollution abatement on a sustainable basis. And most of all, producers are encouraged to adopt new and advanced technologies of pollution abatement (Ma, 2013, p159). Figure 3.2 helps us to understand the reason why the regulatory standards discourage ship owners into investing in new technologies.

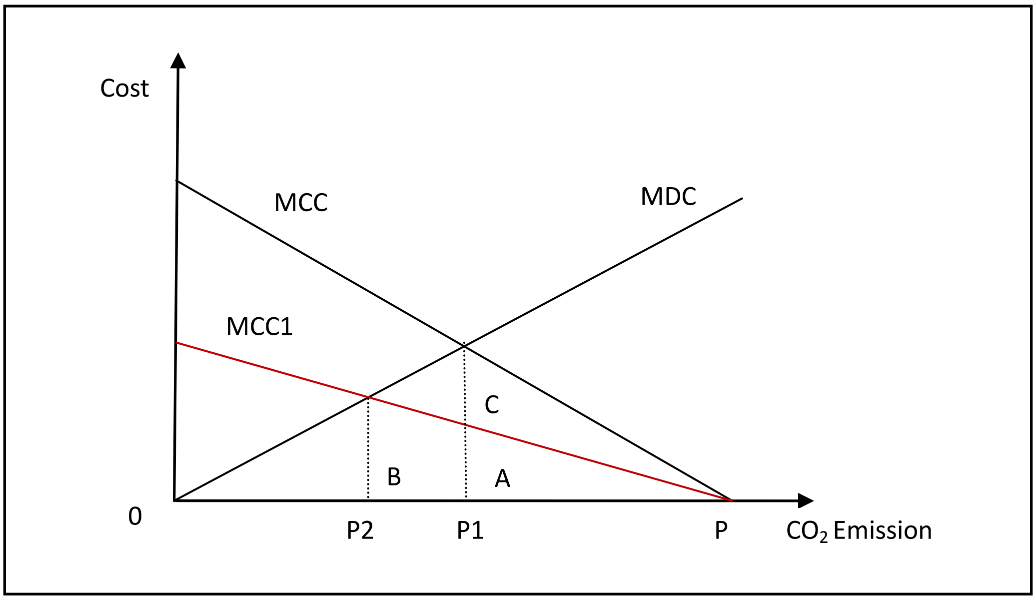

Figure 3.2 – The effect of the regulatory instrument on the use of new technology

Source: Ma, S. (2013). *Maritime Economics*. Unpublished lecture handout, World Maritime University, Malmo, Sweden.

We well understand that without any regulation on the emission control, a ship would have discharged all its pollutants into the air at point P. We further assume that through a trial-and-error process, the government authority finally establish the initial standard at the optimal emission level P1, where MCC and MDC intersect. At point P1, the total pollution control cost is represented by area A+C. If a ship owner implements a new technology onboard the ship to control CO_2 emission, being convinced that the cost saving would be bigger than the investment, the MCC will be reduced to MCC1 most likely. Suppose that the regulatory standard does not change, then, the net saving for the ship owner is C. However, with the change of MCC, the authority would advocate stricter rules. The new standard will be set at point P2 following the economic rule where MCC and MDC reach the new equilibrium. And cost saving will be changed to B-C only with new technology.

An important implication could be drawn from the above discussion that the greater the technology improvement is, the bigger the reduction of the pollution control cost will be. It means that the standards will get more and more stringent. It is not difficult to anticipate that with continually developing technology, a break-even point will be reached, the extra cost represented by area B will exceed cost saving C. That's why the shipping industry seems not interested in the more advanced and latest pollution control technologies.

3.1.2 Other merits of MBM

In addition to the above two merits, MBMs also boast the following advantages:

(1) It requires less administrative intervention and consequently saves administrative expenditure.

(2) It generates revenues, which could be used in further research and development of new technologies, to help developing countries to improve their infrastructure, facilitate implementation of MBMs, and maintain the smooth operation of the MBMs, etc.

(3) It provides a level playing field for ship owners and countries who committed to a cleaner and sustainable shipping industry.

3.2 Uncertainties associated with MBM

3.2.1 The Legal Role of IMO

IMO is the United Nations specialized agency with responsibility for the safety and security of shipping and the prevention of marine pollution by ships. Its principal objective is to provide machinery for co-operation among governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade.

(Convention on the IMO, 1948)

It makes the IMO essentially a standard-setting organization. The treaty instruments adopted by IMO in whatever forms, conventions, protocols, or codes etc, will bind States only when they agree to be bound by it. It is for Flag States to incorporate them into their domestic legislations or promulgate national laws to implement the IMO treaty instruments. There is no authority for IMO as an organization to implement or enforce any regulations or standards on any ships or any States. The whole basis of the "regulatory function" of the organization is that it develops, by international co-operation, standards and regulations which are to be implemented and enforced by States, individually or collectively, as appropriate (Balkin, 2000).

Shipping is an international industry. The CO_2 emission could only be curbed by following a uniform international standards and regulations. Whether it is in the form of effluent tax or tradable emission permits, it would be preferable that an international body is dedicated to set the uniform tax standard or to decide the total emission allowances and distribute them. It is likely that one country may set a very stringent standard, while another country may adopt a less strict standard, it would leave the country that set a higher standard in a commercial disadvantage position. Then, does the IMO have the mandate to establish the tax standard or decide and distribute the emission allowance? IMO's mandate, as derived from the IMO convention and United Nations Convention on the Law of the Sea (UNCLOS) is presumably based on the establishment of treaty laws on the general consensus principle in most cases. The contradiction of the requirement of universal participation of MBMs and the nature of treaty law, which only bind on countries who have agreed to be bound by it, brings the IMO in a not favorable position to implement the MBMs to combat CO_2 emission from the international shipping industry.

I strongly believe that it is the responsibility of each individual State to decide the level of effluent tax, and emission allowances in the national economic context. MBMs may work within some regions like EU, but there are lots of uncertainties for the developing and less developed countries. An irresponsible country may raise the tax level much higher than optimal level to collect money from the industry. The emission allowances could also be over-supplied to knock down the carbon market. Since the shipping is truly a business across borders, MBMs will most probably not achieve the anticipated effect until the whole industry to form an equal, uniform, worldwide standard applicable to all States involved in the shipping business.

3.2.2 Relation to UNFCCC

Article 2.2 of KP states "The parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively" (UN, 1998) There was a hot debate about the question whether this provision applies to the countries listed in Annex I only or whether it should be adopted across borders just as other conventions adopted by IMO. We know that IMO is a specialized agency of the United Nations (UN), and essentially a standard-setting organization. Only after signing and ratifying a convention, the member state is bound by its provisions. The problem arises that if the MBM policy adopted by IMO is not accepted by all of Member States, then the effect of MBM would have been very limited. The shipping industry is a thoroughly international business. A ship owner from a developed country could register his ship in a developing country and locate the headquarter in a third one. In addition, since the ship is sailing internationally, then, the emission from the ship could not be easily defined. To avoid being bound by the onerous regulations, a ship owner tends to switch the registry of his ships to another country. All these issues lead to the complication of the issue under IMO domain.

Secondly, how an MBM can reconcile both the UNFCCC principle of common but differentiated responsibilities and respective capabilities (CBDR) with the IMO's non-discriminatory approach? In view of the historical contribution to the GHG emission of developed countries, UNFCCC established the CBDR principle and demands the developed countries to take the lead in combating climate change and the adverse effects. When we apply CBDR principle in designing MBMs instrument, question would arise immediately. How do we implement the CBDR principle to exempt certain countries from complying with or linking to place where fuel is bought, or based on ownership of ships? As discussed above, a ship owner could change the nationality of a ship to another country, or choose to bunker fuel oil at places exempting from additional fuel tax. So, MBMs could fall down as clearly MBMs cannot work properly in an under-competitive market environment.

Some States proposed that global MBMs could be established by compensating the developing countries properly through a rebate approach. It sounds a reasonable resolution, but the point is how to quantify the costs and damages incurred following the MBM. Is the compensation confined to the costs incurred in the shipping sector or the whole economy? We understand well that some States, especially those reliant on the shipping industry and developing countries that still need to develop their economy to improve their citizens' livelihood, will be affected by MBMs substantially as a result of increased sea transport freight. Some States even worry about their food security as the food price would increase as a result of higher freight due to MBM.

In addition, by implementation of MBMs, ships would be pushed to apply new technologies to improve the energy efficiency. By now, these new technologies are owned mostly by developed countries. It will turn out that countries without proper technologies, mainly developing countries, would have to buy these technologies from developed countries. The fund collected or compensation paid to developing countries will eventually flow to developed countries.

3.2.3 Inadequacy of data base

The basis to establish a market-based mechanism and to make it work smoothly is the correct and abundant data about the fuel consumption and CO_2 emission from international shipping. In IMO second GHG study, two methodologies, activity data based method and fuel statistics based method, were adopted for the estimation of fuel consumption by ships. As illustrated in the report, uncertainties existed in both methods. For the activity-based model, the greatest uncertainty is the estimates of engine load factor and of the number of days at sea (engine running hours) (Buhaug et al. 2009). While for top-down fuel statistics model, the fuel consumption is based on the reports of the U.S. Energy Information Administration (EIA) and the International Energy Agency (IEA). Doubts were cast upon the reliability of the statistics. Firstly, since some countries are not bound by the IEA treaty to provide data according to their specific methodologies and standards, data for non-member States could be less accurate. Secondly, IEA database contains fuel bunkering not only for international marine bunkers but also for domestic and fishing ships. EIA data includes bunkers to ships and to aircrafts home and abroad. A gap between the results of the two different methods for the calculation on historical emission is ranging from 30% to 50%, making neither of them reliable for a credible market-based mechanism (Buhaug et al. 2009).

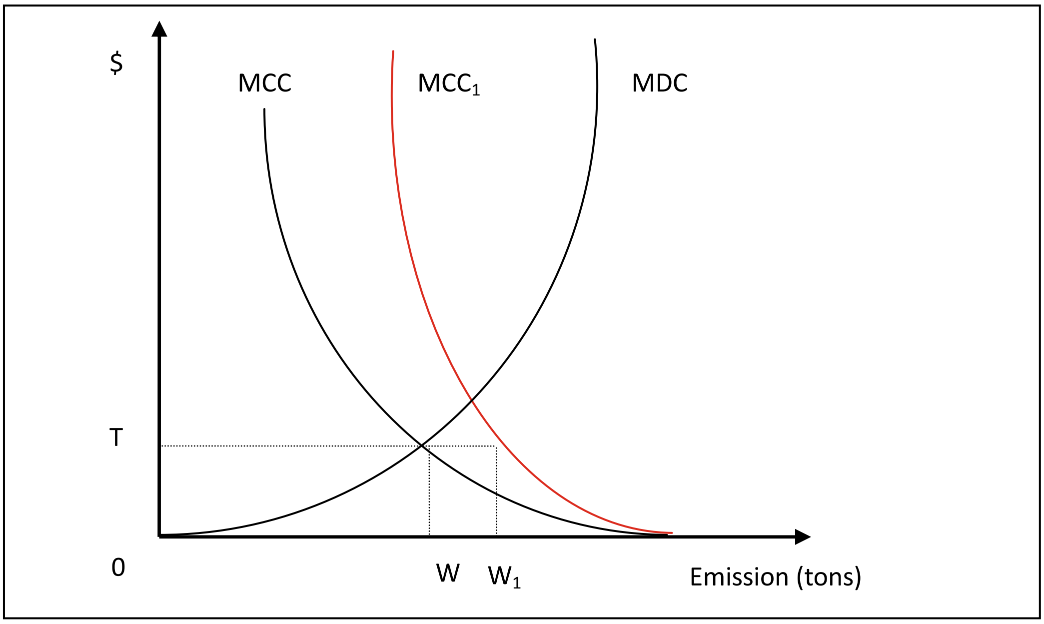

Figure 3.3 - The optimal level of effluent charge

Source: Hussen, A.M. (2004). *Principle of Environmental Economics* (2nd ed., pp.109). New York: Routledge.

For the tax-based MBMs, from the economic point of view, the optimal level of emission tax (T) corresponds to the point, where MCC and MDC intersect with each other (see figure 3.3). The total amount of CO_2 emission should not exceed W, the optimal level of discharge. MCC here represents the aggregate marginal control cost for all the international trading ships. Since the rigorous data about CO_2 emission can't be collected, the real emission tax will always deviate from the optimal level T. Due to the uncertainty, if the government authority bases the tax level on the MCC, which turns out to be smaller than the reality MCC_1, the allowed CO_2 emission W_1 would be greater than the optimal level. Although it is certainly that we cannot get all the information about the collective MCC and MDC to decide the optimal tax level, but still we have to collect data about ship fuel consumption and CO_2 emission as much as possible to make the designed tax to be close to T.

For allowance trade scheme, inaccurate quantitative data could easily make the market fall down. The recent turmoil of EU-ETS market, which I will discuss it in details in the next chapter, exhibits the importance of accurate measurement elaborately

3.2.4 Market distortion

MBM is a market instrument to control GHG emissions, and naturally is governed by the principle of demand and supply for emission allowances, especially in terms of ETS proposed by EU countries. If the context, on which the policy was based, is changed, the trading market could be affected significantly and even discourage industry to control the GHG emission. In the following context, the market distortion based on the case of EU-ETS will be discussed.

To facilitate the achievement of Kyoto targets by EU member States, the EU-ETS was introduced by the Emissions Trading Directive and entered into force on 1 January 2005. The working process has been illustrated in the section "Transferable emission permits" in the previous section. According to EU directive, the tradable commodity in the EU-ETS market is the EU CO_2 emission allowances (EUA), and one unit of EUA equals to one tonne of CO_2. In 2004, the linking directive was passed to allow ETS member states to use the reduction through joint implementation (JI) and clean development mechanism (CDM) instruments to offset their emission. Consequently, two international credits (ERUs & CERs) were also allowed to be traded in the market, and could also be transferred to the allowances of EUA.

Recently, EU-ETS has received a lot of criticisms, and the biggest one is the low price of EUA. The spot price of EUA has gone through different phases since 2005 (see Figure 3.1). During the first trading period, the EUA price reached price levels between EUR 20 to EUR 25, but dropped significantly when a surplus of allowances are available and slumped to level of almost zero at the end of 2007, for banking was not allowed between first and second trading period. During the second phase, the EUA price first reached levels of between EUR 25 and EUR 30, but decreased substantially on two occasions. First it dropped to EUR 10 as a result of the financial and economic crisis in 2009, which curtailed the demand. A second drop incurred in 2011, when it became clear that the crisis would last longer and that a considerable surplus of allowances would be built up by the end of the period. This decreased EUA price further to around EUR 7 by the end of 2012. Meanwhile, CER price traded at less than EUR 1 at the end of the second phase (European Environment Agency [EEA], 2013, p.40).

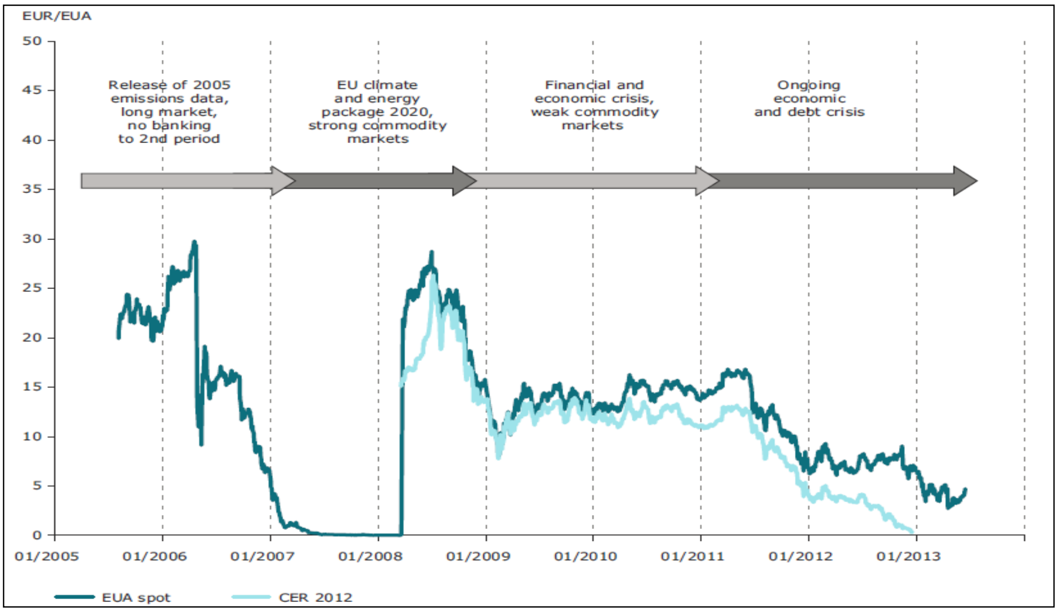

Figure 3.4 - Price trends for EUAs and CERs, 2005-2012

Source: European Environment Agency. (2013). *Trends and projections in Europe 2013*. Denmark: Author.

So if IMO adopt the ETS as the option for the MBM to control GHG in the future, several questions are needed to be clarified to ensure the MBM function as it should be.

1. Is ETS confined to the shipping sector or incorporated into other existing ETS markets?

A large portion of Member States in IMO proposes that the MBM should be confined to the shipping sector to allow the resources to be utilized by the shipping industry only. And it could also push the industry to reduce GHG emission by itself instead of buying allowances from other sectors. If so, the market would be relatively small and be less vulnerable to the world economic context just as the case of EU-ETS. Consequently, it could result in the manipulation of the market.

If the MBM is incorporated into other existing markets or could buy allowances from other sectors, it could be influenced easily by external factors such as tumbling price of EU-ETS. International shipping emitted approximately 870 million tones of CO_2, accounting for about 2.7% of the global emission in 2007, while in the same year EU-ETS issued 2193 million EUAs for free, and the cumulated surplus stood at 1754 million at the end of 2012. It would just incentivize ship owners to buy cheap emission allowances rather than improve the ship energy efficiency.

By comparing the both options, I believe the first choice would be a better start in the pilot phase, as long as we could get as much as possible the information about damage and total social control cost, through which we could decide the optimal level of emission allowances.

2. How do we design the mechanism to decide and distribute the emission allowances?

"As a policy instrument designed to curb the abuse of the natural environment, the success of a transferable permit scheme very much depends on the total size of pollution permits" (Hussen, 2004c, p.113). The data about the CO_2 emission of each ship is very important for the success of ETS instrument. As to today, Member States are still discussing about the amendments to MARPOL for monitoring and reporting of individual ships' fuel consumption[2]. There is simply no ground or foundation to build an ETS instrument to curb CO_2 emission.

Although article 2.2 of KP states that the reduction of GHG emissions from marine bunker fuel shall be pursued through IMO, it does not mean that IMO has the mandate to decide and distribute the emission allowances for individual countries. In

[2] Following the implementation of regulation of monitoring, reporting and verification of CO_2 emissions (MRV) from maritime transportation in EU, many members and ICS proposed a framework for a global data collection system for maritime transport covering fuel consumption, CO_2 emissions and energy efficiency at MEPC 66 meeting.

my opinion, it is IMO's task to draft the technical conventions and the individual States to decide if participate in a MBM instrument or not, and to distribute the emission allowances to its ship owners and companies. If this is true, then we have to bear in mind the possibility that there may be some irresponsible States, who would issue unlimited allowances to exchange money. Market will fall down and collapse eventually.

Chapter 4 Analysis of CO_2 Emissions from Chinese International Fleet

4.1 Perspective of Chinese international seaborne trade and fleet

4.1.1 Developments in international seaborne trade

GHG emission from shipping is directly linked to the seaborne transportation, which is driven by the world economy. Due to the economic crises starting in 2008 and international imbalance, the world economy still has a very slack performance. Economic growth in China reached 7.7 % in 2013, the lowest rate in the decade. However, the total value of import and export of China was still 4.16 trillion dollars, making up about 12% of whole world in 2013.

Table 4.1 – World economic growth 2008-2013 (Annual percentage change)

Country/Region	2008	2009	2010	2011	2012	2013
World	1.5	-2.2	4.1	2.8	2.2	2.1
United States	-0.3	-3.1	2.4	1.8	2.2	1.7
Japan	-1.0	-5.5	4.7	-0.6	1.9	1.9
EU	0.3	-4.3	2.1	1.6	-0.3	-0.2
China	**9.6**	**9.2**	**10.4**	**9.3**	**7.8**	**7.7**
India	6.2	5.0	11.2	7.7	3.8	5.2
South Korea	2.3	0.3	6.3	3.7	2.0	2.3
Brazil	5.2	-0.3	7.5	2.7	0.9	2.5
Russia	5.2	-7.8	4.5	4.3	3.4	2.5

Source: UNCTAD (2013). Review of maritime transport 2013, Switzerland: Author.

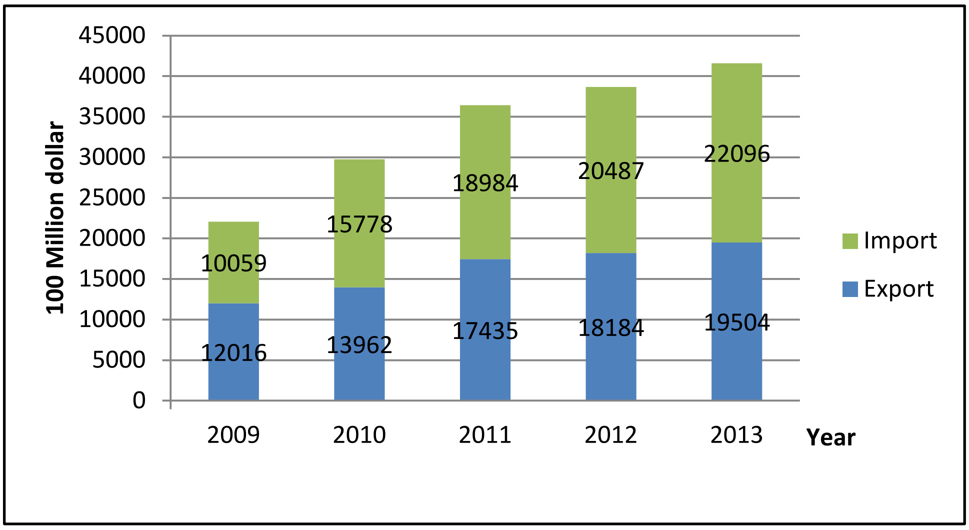

Figure 4.1- Value of annual cargo import/export 2009-2013 (China)
Source: Compiled by author based on statistics from national bureau of statistics of China (2014).

With the strong demand for crude oil, raw materials, grain etc., the annual growth rate of seaborne trade looks still very affirmative, with an average 10% of annual growth rate. As to today, of top 10 world container ports, 7 of them are located in China. From these statistics, we could well predict that, in the near future, the booming economy of China will stimulate the international trade with other regions and countries. In return, more ships will come to China, especially those mega ships transporting bulk cargo. To curb GHG emissions, China obviously has an important role to play.

Table 4.2 - Volume of seaborne trade 2004-2013 (China)

Year	Volume of Port handling（100 million tonnes）	Annual percentage change (%)	Volume of international trade (100 million tonnes）	Annual percentag e change (%)	Container trade (10000TEU)	Annual percentage change (%)
2013	106.1	8.5	33.1	9.2	18 878	6.7
2012	97.4	6.8	30.1	8.8	17 651	8.1
2011	90.7	11.9	27.5	10.8	16 231	11.4

2010	80.2	15.0	24.6	13.6	14 500	18.8
2009	69.1	8.2	21.4	8.6	12 082	5.8
2008	58.7	11.5	19.2	7.0	12 835	12.2
2007	52.1	13.4	17.8	12.6	11 179	21.5
2006	45.6	15.6	15.7	16.8	9 300	23.0
2005	49.0	17.7	13.6	18.0		
2004	40.0	21.3	11.5	18.4	6 150	

Source: Compiled by author based on statistics from national bureau of statistics of China (2014).

4.1.2 Structure and ownership of Chinese international fleet

As of 1 January 2013, China has become the largest ship-owning country in terms of vessel quantity, with 5,313 ocean-going merchant ships, out of which about half fly the national Chinese flag. This makes more nationally flagged Chinese-owned ships than nationally flagged ship from Greece, Japan and Germany combined (UNCTAD, 2013). The Deadweight tonnage reached around 190 million tonnes. Table 4.3 provides the profile of top 10 ship-owning countries and their deadweight tonnage.

Table 4.3 - Top 10 countries and territories with the largest owned fleets, as of 1 January 2013 (Dwt)

	Number of vessels			**Deadweight tonnage**				
Country or territory of ownership[1]	National flag	Foreign and international flag[2]	Total	National flag	Foreign and international flag	Total	Foreign and international flag as a percentage of total	Total as a percentage of world
Greece	825	2 870	3 695	69 644 624	175 205 954	244 850 578	71.56	15.17
Japan	738	3 253	3 991	17 216 128	206 598 880	223 815 008	92.31	13.87
China	**2 665**	**2 648**	**5 313**	**66 936 002**	**123 142 833**	**190 078 835**	**64.79**	**11.78**

Germany	396	3 437	3 833	16 641 757	109 136 771	125 778 528	86.77	7.79
Republic of Korea	764	812	1 576	16 624 445	58 471 361	75 095 806	77.86	4.65
Singapore	1 090	798	1 888	32 711 136	31 441 668	64 152 804	49.01	3.98
United States	768	1 175	1 943	8 671 669	49 606 395	58 278 064	85.12	3.61
United Kingdom	415	822	1 237	10 447 630	39 857 066	50 304 696	79.23	3.12
Norway	414	1 494	1 908	2 190 036	43 802 209	45 992 245	95.24	2.85
Taiwan Province of China	102	712	814	3 311 133	40 948 712	44 259 845	92.52	2.74
Total			24 290			1 122 606 409		69.56

Source: UNCTAD (2013). Review of maritime transport 2013, Switzerland: Author.
Note: Vessels of 1000 GT and above, ranked by deadweight tonnage.

As for the Flags of registration, China ranks No. 8, representing 4.29% of world total vessels, and if we add the fleet registering in Hong Kong (China), the share will reach 6.84%, becoming the second largest registry country in the world. Table 4.4 shows the details of the 10 flags of registration with the largest registered fleets. It shows that China registry also has a very high year-on-year growth rate, increasing by 16.87% and 9.83% respectively for Hong Kong special administrative region and mainland China.

Table 4.4 - Top 10 flags of registration of the world as of 1 January 2013 (Dwt)

Flag of registration	**Number of vessels**	**Share of world total, vessels**	**Deadweight tonnage(thousands dwt)**	**Share of world total (Percentage dwt)**	**Cumulated share (Percentage dwt)**	**National ownership (percentage)**	**Dwt growth 2013/2012 (percentage)**
Panama	8 580	9.87	350 506	21.52	21.52	0.14	5.03
Liberia	3 144	3.62	198 032	12.16	33.68	0.01	5.83
Marshall Islands	2 064	2.37	140 016	8.60	42.27	0.11	11.08
Hong Kong (China)	2 221	2.55	129 806	7.97	50.24	12.15	16.87

Singapore	3 339	3.84	89 697	5.51	55.75	36.60	16.62
Greece	1 551	1.78	75 424	4.63	60.38	92.60	5.13
Bahamas	1 446	1.66	73 702	4.52	64.91	1.18	1.44
Malta	1 794	2.06	68 831	4.23	69.13	0.35	8.18
China	3 727	4.29	68 642	4.21	73.35	98.18	9.83
Cyprus	1 030	1.18	31 706	1.95	75.29	19.51	7.61
Total	28 896	33.22		75.30			

Source: UNCTAD (2013). Review of maritime transport 2013, Switzerland: Author.

Note: Propelled seagoing merchant vessels of 100 GT and above; ranked by deadweight tonnage.

From table 4.3 and table 4.4, we could identify that Chinese international fleet (including Hong Kong) accounts for a large portion of world fleet. Ships under China's control makes 13.29% of total world tonnage and 6.84% of total world vessels are registered in China. Considering that the age of ships are relatively old and individual tonnage is small, ships are not as energy efficient as those of many counterparts'. If MBMs are going to be implemented in the shipping industry either in form of emission levy or tradable emission permits, China will be definitely influenced significantly.

4.2 Scenarios for future emissions from international shipping of Chinese fleet

To predict the CO_2 emissions from Chinese international shipping of year 2014-2050 is a very difficult task as it involves so many uncertain factors over such a long span. Hence, methodology of scenarios planning, developed by IPCC, is applied, which is a common tool for researchers evaluating uncertain futures[3]. The prediction thus is based on these scenarios.

As recommended in "2006 IPCC Guidelines for National Greenhouse Gas

[3] In 1992, the IPCC began to develop a set of emissions scenarios that would provide both a contextual setting and emissions data for their climate models. The main scenarios are named A1F1, A1B, A1T, A2, B1 and B2, according to different driving forces, including population, economy, technology, energy, land-use, and agriculture

Inventories", the most common methodology used to predict CO_2 emission is to combine information on the extent to which a human activity takes place (called activity data or AD) with coefficients which quantify the emissions or removals per unit activity. These are called emission factors (EF). The basic equation is therefore:

$$CO_2 \text{ Emission} = AD \times EF \tag{1}$$

In shipping sector, activity data is represented as fuel consumption, and is determined by the demand of transport and transport efficiency. Formula (1) then could be transformed into formula (2):

$$CO_2 \text{ Emission} = TD \times TE \times EF \tag{2}$$

TD: Turnover of seaborne transportation; TE: Transport efficiency.

4.2.1 Determination of parameters

4.2.1.1 Turnover of Chinese international seaborne trade

(1) Turnover prediction synchronized with the world seaborne trade

"IMO GHG Study 2009" made a world seaborne trade turnover prediction based on the six different scenarios, among which A1B had the biggest annual growth rate at 3.3%, while B2 had the lowest growth rate standing at 2.7%. In this paper, the annual growth rate of Chinese international seaborne trade is assumed to be synchronized with the development of world seaborne trade. It means that the growth rate under six different scenarios prescribed by IMO will be adopted as Chinese seaborne trade growth rate, which were described in Table 4.5.

Table 4.5 - Annual growth rate of Chinese international seaborne trade

		Annual average growth in world GDP for year 2000-2050					
		A1B	A1F	A1T	A2	B1	B2
	GDP	3.9%	4.0%	3.6%	2.4%	3.3%	2.7%
Total	Base	3.3%	3.3%	3.3%	2.6%	2.5%	2.1%

transport	High	5.3%	5.3%	5.4%	4.2%	4.1%	3.5%
demand	Low	1.5%	1.5%	1.5%	1.2%	1.1%	0.9%

Source: IMO GHG Study 2009

(2) Turnover prediction based on the annual growth rate of Chinese GDP

The second approach is based on the annual growth rate of Chinese GDP, as statistics clearly show that the international seaborne trade is highly related with the level of economic development. Formula 3 shows their relationship:

$$\mathrm{Q} = 0.000\,002 \times \mathrm{GDP}^{1.0781} \quad (3)$$

$R^2 = 0.932\,8$

Q: Chinese international seaborne trade, GDP: Chinese Gross Domestic Product

According to the prediction of Chinese GDP development in the future made by Tsinghua University in 2011, the average annual growth rate is estimated at 9% between 2010 and 2020, 6% between 2020 and 2035, and 3.8% for the period of year 2035-2050. Therefore, according to model (3), the average growth rate of Chinese international seaborne trade equals 7.83% between 2014 and 2019, 5.23% between 2020 and 2034, and 3.31% between 2035 and 2050.

4.2.1.2 Transport efficiency

"IMO GHG Study 2009" concluded that, under the baseline scenario, transport efficiency for ocean-going shipping could be improved by 12% and 39% respectively by year 2020 and 2050. The energy consumption per unit for Chinese ocean-going ships was 2.479 kg/ (kt.km) 2007 based on annual "Highway and waterway transportation industry Statistical Bulletin" issued by China's ministry of transportation. According to this benchmark, the average annual increase of transport efficiency of Chinese ocean-going ships between 2008 and 2020 will be 1.27%, and 1.21% between 2020 and 2050. Accordingly, the energy consumption per unit will be

2.181 kg/ (kt.km) in 2020 and 1.512 kg/ (kt.km) in 2050.

4.2.1.3 CO2 emission factor

Fuel-based CO_2 emission factors are conversion values that are used to calculate emission, based on consumed fuel. Default emission factors prepared by Lloyd's Register are used as recommended by IPCC. Because the ocean-going ships are mainly equipped with low and medium speed diesel engines for propulsion and generators, which burn HFO or DO, so, according to Lloyd's Register's database, emission factor for HFO is 3.190 kg/tonne of fuel, and 3.130 kg/tonne of fuel for DO. In the near future, marine fuel oil will still dominate the shipping market, in our work, we adopt marine fuel oil as the main fuel source for emission prediction.

4.2.2 Prediction of CO2 emission from Chinese international fleet

As being analyzed above, future CO_2 emission of Chinese international fleet is related to the future seaborne trade, transportation efficiency and CO_2 emission factor of fuel oil. CO_2 emissions of period 2010-2050 are predicted based on the formula 2 under different scenarios.

4.2.2.1 CO_2 emission with a basic transportation demand

Under this scenario, we assume that the Chinese international seaborne transportation increases with a basic speed same as world transportation demand. The statistic shows that inflection point of CO_2 emission of Chinese international seaborne trade will not be realized till 2050. Under scenario A1, CO_2 emission of year 2020 will increase by 15% compared with year 2010, and will ascend further to 111% in 2050. For scenarios A2, B1, and B2, figures witness a rather moderate increase. Table 4.6 exhibits the details.

Table 4.6 - CO_2 emission with a base speed Unit: million tonne

Year	A1B	A1F	A1T	A2	B1	B2
2010	3569	3569	3569	3569	3569	3569
2020	4346	4346	4346	4060	4021	3866
2050	7978	7978	7978	6079	5846	5000

Source: Compiled by author (2014)

4.2.2.2 CO2 emission with a high transportation demand

Due to high seaborne transportation demand, CO_2 emission will increase continuously. A1T scenario has soared, with an average annual increase rate 3.68% between 2010 and 2050.

Table 4.7 - CO_2 emission with a high speed Unit: million tonne

Year	A1B	A1F	A1T	A2	B1	B2
2010	3569	3569	3569	3569	3569	3569
2020	5246	5246	5314	4740	4694	4431
2050	17 181	17 181	17 845	11 288	10 863	8 620

Source: Compiled by author (2014)

4.2.2.3 CO2 emission with a low transportation demand

With a low transportation demand, in the years 2010-2050, CO_2 emission grows quite marginally, with an average annual growth rate 0.1%. A2, B1 and B2 all witness a decline, as the transportation demand annual growth is countered by the improvement of transportation efficiency.

Table 4.8 - CO_2 emission with a low speed Unit: million tonne

Year	A1B	A1F	A1T	A2	B1	B2
2010	3569	3569	3569	3569	3569	3569
2020	3645	3645	3645	3539	3504	3435
2050	3950	3950	3950	3509	3372	3116

Source: Compiled by author (2014)

4.2.2.4 CO_2 emission with the Chinese GDP growth speed

Since the average growth rate of Chinese economy is higher than that of the world economy, and the seaborne transportation is highly related to the economic development, CO_2 emission was calculated under the Chinese growth speed. The results show a similar pattern as the scenario with a high growth rate. Table 4.9 illustrates the details.

Table 4.9 - CO_2 emission with the Chinese growth speed Unit: million tonne

Year	**A1B**(high transportation demand)	Chinese growth rate
2010	3569	3569
2020	5264	6529
2030	7809	9621
2040	11 583	12 693
2050	17 181	155 557

Source: Compiled by author (2014)

4.2.3 Conclusion

Statistics clearly demonstrate that if the seaborne transportation demand grows with high, base or Chinese speed, the CO_2 emission of Chinese international seaborne trade will arise between 2020 and 2050 without inflection point. While CO_2 emission will only decline if the transportation demand is weak and A2, B1 and B2 scenarios all will go through a decline.

We could identify that the future economic developing pattern has a huge impact on the shipping CO_2 emission. For China, the CO_2 emission will grow faster than the world seaborne trade. As indicated in scenario A1T, the CO_2 emission from Chinese international seaborne trade will increase 39.3% in 2020 and 355% in 2050 based on year 2007. While under the same scenario, CO_2 emission of world shipping will grow 21.6% in 2020 compared to 2007. Therefore, if MBMs are going to be implemented world widely for the shipping sector, Chinese shipping industry will suffer more than other counterparts.

Chapter 5 How to Meet the Challenge of MBM for Chinese International Fleet

5.1 Analysis of the context

5.1.1 International developing Trend

Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century.

(IPCC, 2013)

In response to the great challenge posed by climate change, the international communities have been forged together and made a great progress under UNFCCC. The latest Warsaw conference 2013 agreed on a time plan for countries to table their contributions to reducing or limiting GHG emissions under a new global climate agreement to be adopted in 2015. It also agreed upon ways to accelerate efforts to deepen emission cuts over the rest of this decade and set up a mechanism to address losses and damage caused by climate change in vulnerable developing countries (EC, 2013a).

Within IMO scope, during the latest MEPC 66 meeting, Air pollution and energy efficiency and reduction of GHG emissions from ships once again attracted wide attention. Many States and institutions put forward their proposals about the establishment of a data collection system for energy efficiency, commenting on the documents of MEPC 65/4/19 and MEPC 65/4/30[4]. Different attitudes were observed that developed countries were very aggressive about the implementation of a data collection and reporting mechanism, while developing countries were very prudent. India asked Members to focus on the existing technical and operational measures, and China expressed the view that the MRV data collection mechanism should be discussed in more details and requires further study of the methodologies. Although there is still some disagreement about which method and to what extent the mechanism would be, with the escalation of the concerns about the global warming and more often extreme weather phenomenon, we could well expect that this new requirement will soon be realized through amendment to MARPOL Annex VI or in some other form.

Besides, some regional actions also have a significant impact on the international shipping industry. In June 2013, European Commission issued a proposal for a regulation on the monitoring, reporting and verification of CO_2 emissions (MRV) from maritime transportation. It covers all ships regardless of their flags trading intra-EU voyage, voyages from the last non-EU port to the first EU port of call and voyages from an EU port to the next non-EU port of call. And France also issued a

[4] MEPC 65/4/19 (United States) proposed to enhance energy efficiency in international shipping through a phased approach, and the commenting document MEPC 65/4/30 (Belgium et al.) supporting the development of technical and operational measures to increase the energy efficiency of ships.

national legislation that ship operators are required as of 1 October 2013 to disclose the quantity of CO_2 emitted during transport services. The new CO_2 emission disclosure requirement applies to any public or private personnel, organizing or selling transport services for passengers, goods or moving purposes, carrying cargo using one or several means of transport, departing from or travelling to a location in France, with the exception of transport services organized by public or private persons for their own behalf.

5.1.2 Domestic Context

China's soaring GHG emissions over the last decade have contributed to 65% of the world's emission growth. In 2010, its CO_2 emissions from burning fossil fuels accounted for about a quarter of global emissions. What is worse, with further economic development that heavily relies on the energy use, China's CO_2 emissions will keep rising at a fast pace. The IEA and EIA predict that China will continue to be the fastest-growing major emitter from 2010-2020, contributing to between 49% and 69% of the global CO_2 emissions increase (Yang et al, 2014a). Although China is not a Party to Annex I to the Kyoto Protocol, to tackle GHG emissions, China pledged to cut its CO_2 emissions per unit of GDP by 40% to 45% from the 2005 level by 2020 in Copenhagen Summit 2009.

With the high pace growth of Chinese economy and energy consumption, could the 2020 Copenhagen CO_2 emission commitment be met by 2020? The research paper from Tsinghua University indicated a pessimistic result, showing that China's carbon intensity (CO_2 emission/ GDP) is projected to decline by only 33%, and CO_2 emission will increase by about 4.31 to 5.32 billion metric tons from 2011 to 2020 (see figure 5.1) (Yang et al, 2014b).

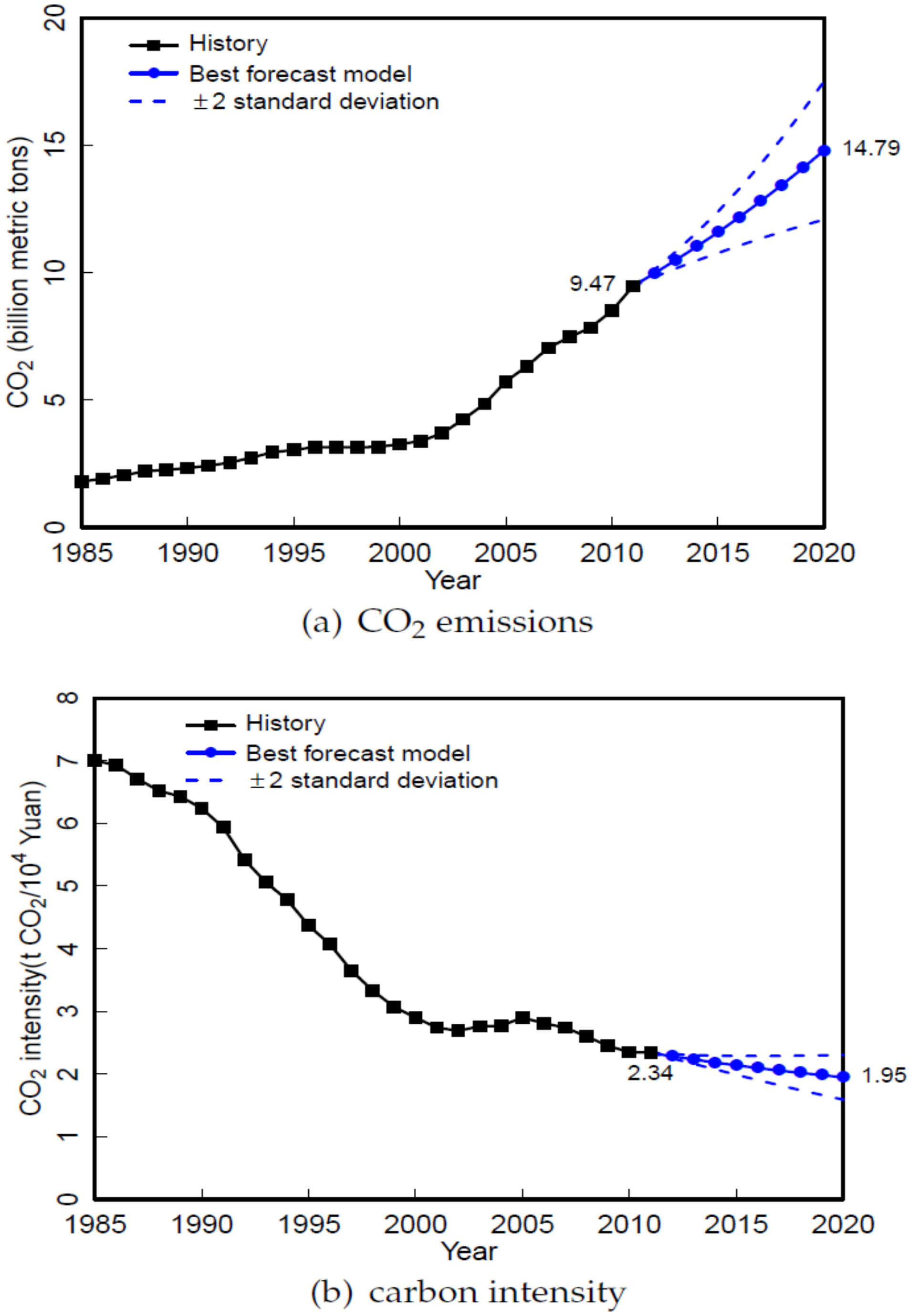

Figure 5.1 – Emission forecast up to 2020 using the best forecasting model

Source: Yang, Y. & Zhang, J.J. & Wang, C. (2014). *Is China on track to comply with its 2020 Copenhagen Carbon intensity commitment?* Retrieved April 26, 2014 from the World Wide Web: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2346516

In meeting the big challenges ahead, Chinese government has been taking actions and will continue to step up its efforts to tackle CO2 emission. Following the 12th Five-Year Plan, in which targets was clearly set about the carbon intensity, a series of specific working plans and regulations have been developed both from national and provincial levels such as “National Plan for Climate Change 2012-2020”, “12th Five-Year National Scheme for GHG Emission”, “National Strategy to adapt to the Climate Change ” etc. And since 2012, seven provinces and cities[5] have been granted the permits to develop the CO_2 emission allowances trading scheme. As for Shenzhen trading platform, the overall turnover of Carbon trading has exceeded 110,000 tons, valued 700 million Yuan since its operation from June 2013 (National Development and Reform Commission [NDRC], 2013).

5.2 Proposals for Chinese international trading ships

5.2.1 Data Collection

Today, the precise amount of CO_2 and other GHG emissions from seaborne transportation is not known due to the lack of monitoring and reporting of such emissions. EC identified that a robust system for MRV of GHG emissions from maritime transport is a prerequisite for any MBMs or efficiency standards. Furthermore, a robust MRV system should contribute to the removal of market barriers, especially those barriers related to the lack of information on ship efficiency (EC, 2013b). Since Member States in IMO are still debating and have not achieved the consensus of the finalized form of MBMs and the timetable of implementation, the introduction of MRV could gain more time for further discussion and consideration on the MBMs, efficiency standards, and etc.

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5 These seven trial trading places are Beijing, Tianjin, Shanghai, Chongqing, Shenzhen, Guangdong Province, and Hubei Province.

At the latest MEPC 66 meeting, a number of delegations expressed the view that the development of a data collection system of collecting accurate figures for CO_2 emissions and fuel consumption of international shipping is of top priority. As mentioned in section 5.1, in 2013, both EC and some individual countries have taken actions about the MRV of CO_2 emission from shipping, so as a major shipping country, what China should do to be better prepared for the coming MBMs?

First, efforts should be made to develop the appropriate method and procedure to collect CO_2 emission data and to figure out what is the actual CO_2 emission level of Chinese fleet. To be better and more effective of protecting Chinese shipping industry, we should get involved in the establishment of the mechanism of MRV of CO_2 emissions more actively by providing more reliable and first-hand data for IMO. In January 2013, amendments to Annex VI of MARPOL 73/78 entered into force (not based on the consensus), including the application of EEDI to new ships, and the mandatory use of SEEMP for the existing ships. Although China together with many other developing countries opposed the amendments, it was still adopted as we do not have enough solid evidences to challenge the average level of ship efficiency, technological formula for calculation of EEDI and other coefficients. Simply we are yet well prepared.

Second, how to collect the data? CO_2 emission is calculated by multiplying fuel consumption with emission factor. Emission factor is based on the latest IPCC values, while fuel consumption could be measured by several different methods:

(1) Bunker Fuel Delivery Note (BDN) and periodic stock takes of fuel tanks;

(2) Bunker fuel tank monitoring on board;

(3) Flow meters for applicable combustion processes;

(4) Direct emissions measurements.

Although methods (1) and (2) are not as accurate as (3) and (4), obviously, they are much cheaper as extra equipments are not needed to be installed onboard. Seeing the current economic environment, it is much easier for shipping companies or operators to accept them. So, I would like to recommend the first method, BDN and periodic stock takes of fuel tanks, to be adopted. It is not only easy to be implemented since ships are already required keeping BDNs onboard for at least three years for verification by MARPOL and documenting certain entries in the log books by SOLAS, but also it does not add any additional cost for shipping companies. Ships could be monitored and verified through the existing port state control and flag state control schemes.

Third, time also plays a very important role in the data-collecting. At MEPC 66, we identified, most likely, that a ship energy efficiency data collection system would come into force in the near future. By then, most of ocean-going ships would have been forced to implement the policy, including Chinese fleet. Consequently, action is badly needed. Table 5.1 shows the proposed timetable for domestic reporting scheme.

Table 5.1 – Timetable for domestic reporting scheme

Time	Action	Stakeholder	Remark
By Dec. 2014	• Publish the regulations and establish the proper data collection system based on the existing BDN, Oil Record Book, SEEMP and national ship inspection data system. • Feedbacks and advices from ships and companies.	Government Authority Ship & Company	The system prefer to base on the existing instruments and does not impose too much new costs on government and ships.
Jan.2015-Dec. 2015	• Pilot operation to full	Government	Data reporting and

	implementation. • Ship and Company report the data to Maritime Safety Administration periodically following the proper format.	Authority Ship Company	collecting could be integrated into the existing "Ship permit to sail" system.
Jan. 2016-	• Adjust the system to synchronize with IMO policy if needed. • Analyze the data and calculate the ship energy efficacy of Chinese international and domestic fleet respectively. • Forward reports and proposals to IMO if possible to express our achievements and interests.	Government Authority Government Authority & Academy Institutions Government	If IMO adopt any policy, we could adjust our system to correspond to the IMO's. Sound data and report earn merits for our fleets on the establishment of efficiency baseline in IMO.

Source: Compiled by author (2014).

Lastly, China along with many other countries have great concerns about the safety of information. The disclosure of data could put the developing nations in a disadvantageous position in the international market. One probable solution, I believe, is that the Member States collect the data from the domestic owners and operators, and report it to IMO annually. IMO has the responsibility to keep the data safe and not to be used for any commercial purpose. IMO could publish an annual report about the fuel consumption and CO_2 emissions from international shipping in a general approach, without mentioning any particular nation or ship owner. This approach could protect the less energy efficient owners and countries from being exposed.

Abundant and reliable data provides a good foundation for any further development of measures to enhance ship energy efficiency by facilitating the establishment of ship efficiency baselines. It helps the industry to track the ship energy efficiency and find the potential of possible GHG emissions cutting. The international community, especially big shipping countries like China, needs a robust data collecting system to identify the Carbon foot print of seaborne transportation.

I believe that with reliable data, the optimal level of tax and CO_2 emission allowances would be identified, and MBMs would be implemented in the maritime sector, just like the shore-based power plant and air industries.

5.2.2 Comparison of Tax and Trade

Until MEPC 66, IMO has received a bunch of proposals of MBMs to tackle GHG emissions from international shipping, including GHG Fund, METS, SECT, LIS, RM and etc (see chapter 2). Basically, they could be grouped into three main categories, emission charge, emission trading scheme and mechanism based on ship energy efficiency. Since the third group is not a pure market-based mechanism, I will analyze emission charge and emission trading scheme in this chapter primarily.

Although emission charge and emission trading scheme is alike in one important way, representing a decentralized and cost-effective approach to GHG emissions, we could still identify many differences between them. Table 5.2 exhibits a horizontal comparison between these two mechanisms in a qualitative way based purely on the author's personal opinion.

Table 5.2 – Comparison of Emission charge and ETS

	Main Criterion	Emission Charge	Emission Permits Trade	Remarks
1	Environment effectiveness (GHG reduction certainty)	Less certainty than ETS. It is through tax lever to influence the ship emission level. Fuel price, technology innovation, economic environment etc. could have a big influence.	Higher certainty of CO_2 reduction, but the arbitrary cap is rather difficult to set. Too much permits could let to price collapse as EU-ETS, and give a ship an incentive to pollute.	The optimal level of tax or total emission permits is very important to determine the success of the schemes.
2	Cost effectiveness	Yes	Yes	
3	Administrative burden	Relative high. Need to monitor all pollution sources and enforce the emission charge.	Low, the market will allocate the permits automatically through price instrument.	In reality, it may cost government authority a big fortune to establish ETS market, to monitor pollution, to prevent leakage, etc.
4	Certainty of cost for the industry	High, the tax level is fixed, the investment and expenditure could be well estimated.	Low, the price of permit fluctuates dramatically as been proven by the existing markets.	
5	Incentive for new technology	Reasonable, discussed in above section.	High, discussed in above section.	
6	Practical feasibility	Reasonable, referring to IOPC fund.	Low, works properly in individual country, like US using ETS to tackle SO_2 emission successfully, but a big question mark if implement it globally.	ETS would most likely be less effective due to high enforcement and monitoring costs of a pollution problem with a global dimension.

7	Revenue generated	Yes, the revenue could be used to compensate developing countries, research & development of new technology, cover administrative costs and etc.	Yes, if permits are distributed through auction, then revenues are raised.	
8	Risk of leakage	Average, depends on the methods of collecting charge. Less if collected through bunker suppliers or refineries.	High, as already documented in EU-ETS case.	
9	Impact on developing countries	Neutral	Distortion may be caused. Ships would most likely divert their routes to those countries, exempted from ETS scheme.	As most of new technologies are mastered by developed countries, without transfer of these technologies freely, implementation of MBM could put the developing countries in a less competitive position.

Source: Compiled by author (2014).

From Table 5.2, we could find that both mechanisms have advantages and disadvantages. If we have to choose, the best form in line with our interests, emission charge seems to be the best choice.

Firstly, it is relatively easy to be implemented and administered. From the perspective of practical feasibility, the emission charge is more reasonable than the trading mechanism. Under the current legislative framework, systems have been established and working smoothly that all ships entering and leaving ports need to report to the maritime safety administration and are subject to port fees. If the emission charge mechanism is adopted, we could consider adding the charge to the existing system to save costs. To prevent the carbon leakage, the tax could be collected from the bunker suppliers or even refineries with a diminishing number of direct participants.

Secondly, we well understand that nowadays most of new technologies tackling GHG emissions are mastered by developed countries like EU Members. Their ships are relatively more energy efficient than those of developing countries. If a trading scheme is adopted, as one could imagine, less energy efficient shipping companies will turn to more efficient shipping companies for permits. It means that actually developing countries will pay money to developed countries for the permits. Some countries may argue that exemptions could be given to the less developed countries to counter the adverse impacts on them. Shipping is truly an international business, in which ships could easily change its registry into another country, man it with seafarers from different countries and trade internationally, so the carbon leakage will apparently unavoidable in this case which could lead to the breakdown of the whole system.

Thirdly, charter party makes the trading scheme too complex to be adopted. When a ship is under a bareboat or time charter party, charterer actually is the acting ship owner. He decides where the ship goes, and which way or at what speed, the ship should be operated. This is recognized in the charter party that the fuel expense is put under the charterer's account. If the emission trading scheme is adopted, the owner will be required to be responsible for all the emissions from his ships, even though sometimes the ship is not under his direct control. This would put the owner in the untenable position of being responsible for emissions from bunkers which aren't his, and permit expenses over which he has no control, and which in many cases aren't known until well after the charter party is complete. The choice is either a legal fiasco or an administrative mess. An emission charge scheme could avoid these problems, since it care less who purchases the fuel or how it changes hands on-board (Devanney, 2011)

Lastly, the emission charge generates revenues while controlling GHG emission. The tax imposed universally on all ships could not only prevent carbon leakage, but also could generate revenues, which in return could be used to compensate and help developing countries to advance their technologies. It justifies both IMO non-discriminatory and UNFCCC's CBDR principle to the best. Money flowing into new technology mastering countries is no new phenomenon. As for designing the emission charge or fund mechanism, we need to pay special attention to the fund distribution mechanism and technology transfer matters.

5.2.3 Establishment of Fund in China

UNFCCC established a Green Climate Fund in 2011 during Durban conference (COP17). The Green Climate Fund aims to generate up to 100 billion dollars per year by 2020 in order to help mitigate and adaptat projects in developing nations. Although aviation and shipping industry have not been clarified as potential candidates for the fund at moment, there is a high potential that shipping would eventually appear on the list of contributors through the linkage with potential market-based mechanisms. Compared with the tradable emission permits scheme, an emission charge scheme is more straight forward and feasible for the shipping for the time being. Therefor, if IMO chooses to establish a similar green climate fund, the establishment of fund in China would be strongly recommended.

First of all, whether the fund is going to be collected from carriers or sea transportation consumers, with a strong performance of Chinese economy, China will, undoubtedly, become a major contributor to the fund if the levy is applied to all ships universally irrespective of their flags. Taking containerized cargo for example, table 5.3 illustrates the top 10 countries with the biggest container handling turnover. In the year 2012, China loaded and uploaded 155,017 TEUs, surpassing the second largest container handler –USA by almost three times which accounted for 25.8% of world total number. From the perspective of development, Figure 5.1 shows that, from 2003 to 2012, with some fluctuation between 2008 and 2009 due to world economic crisis, China presented a very strong increasing trend.

Table 5.3 – Country League Top 10/ 2006-2012 (1000TEU)

	Country or territory	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**Growth Rate (2012/2006)**
1	China	84,811	103,823	114,959	108,799	130,290	143,896	155,017	183%
2	USA	40,897	41,646	39,319	37,353	42,337	42,999	43,664	107%
3	Singapore	24,792	27,936	29,918	26,592	29,178	30,727	32,421	131%
4	China (HKG)	23,539	23,998	24,494	21,040	23,699	24,384	23,100	98%
5	Korea	15,113	17,405	17,748	15,699	18,542	20,833	21,453	138%
6	Japan	18,470	19,028	18,944	16,285	18,098	19,417	21,232	115%
7	Malaysia	13,419	14,829	16,030	15,922	18,267	20,139	20,866	155%
8	Germany	15,010	16,644	17,178	13,296	14,821	17,218	17,579	117%
9	UAE	10,967	11,009	14,756	14,425	15,176	16,780	17,211	157%
10	China (Taiwan)	13,102	13,720	12,971	11,352	12,736	13,473	13,977	107%
Sub. Total		260,521	290,038	306,317	280,763	323,144	349,866	366,520	141%
Share of Top 10		60%	60%	60%	59%	60%	60%	61%	
World Total		433,253	484,361	509,441	472,273	540,816	580,022	601,772	139%

Source: International association of ports and harbors (IAPH). (2013).

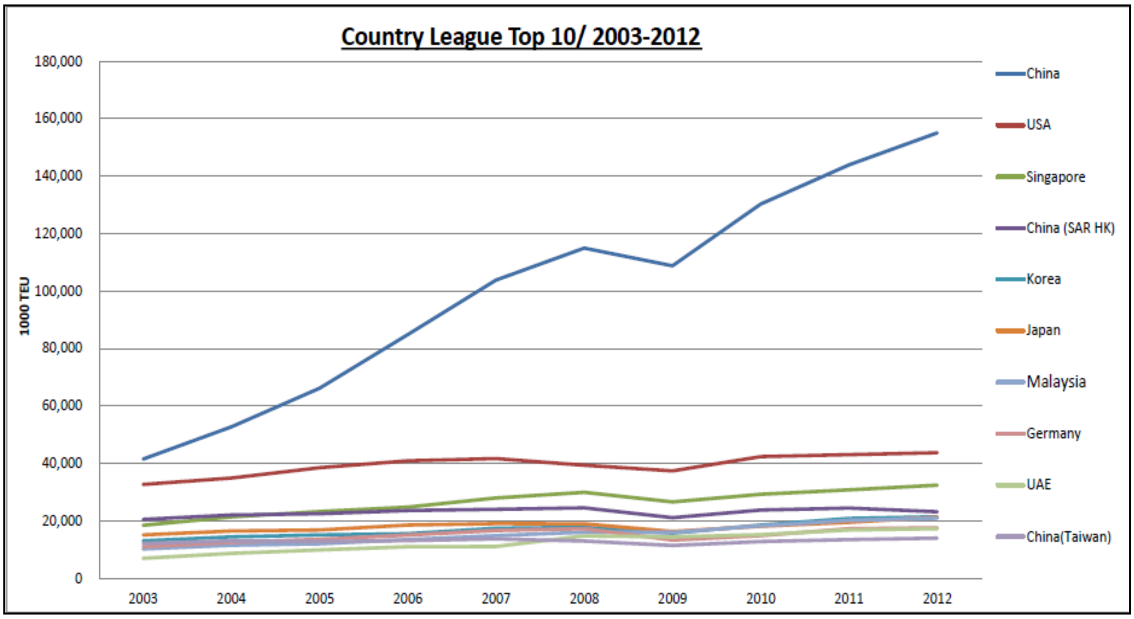

Figure 5.2 – Country League Top 10/ 2003-2012
Source: International association of ports and harbors (IAPH). (2013).

Statistics on bulk cargo show a similar trend that China is the country with the largest portion of overall seaborne bulk trade in 2013, with a 13 percent share of the total. China's imports (a massive 1.8 billion tonnes) represented 23 percent of global imports, including nearly 800mt of iron ore, 286mt of crude and products and 308mt of coal (Clarkson Research, 2014). So, if China has to donate a large portion of the fund, we could well ask the international community to establish the fund in China.

Secondly, as a national strategy, in 2009, the State Council issued *Opinions on Promoting the Development of Shanghai's Modern Service Industry and Advanced Manufacturing Industry, and Promoting the Construction of Shanghai International financial Centre and International Maritime Centre (IMC).* The opinions said the goal is basically to build Shanghai into an IMC by 2020 with concentrated shipping resources, maritime services, and efficient logistics service. The establishment of China (Shanghai) Pilot Free Trade Zone in September 2013 further opened up the economic, shipping and trading market and provided more favorable conditions to promote the development of Shanghai as an IMC.

During the process of discussion of MBMs in IMO, we could negotiate with other Member States more actively and creatively. For example, since China would have contributed a large portion of money to the fund, plus the national strategy of promoting shipping industry, we could provide IMO with very good resources and conditions and try to attract the fund to be established in Shanghai. The nature of the fund decides that the majority of the fund should be returned to the society to mitigate the climate change, especially to help developing countries accumulate knowledge and master technology to tackle GHG emissions from shipping sector. If the fund is established in China, the biggest developing country in the world, it could demonstrate the truly intention and determination of the international community to help developing countries to achieve the goal. In addition, with the support from China and more developing Members in IMO, I strongly believe that the MBMs would be developed more smoothly and fast.

Chapter 6 Conclusions

Transportation method for energy, materials, foods and products, maritime transport is central to sustainable development. And the maritime transportation system itself must, therefore, ensure that its development is also sustainable. Energy-efficiency measures are, therefore, part of this concept, as they also address the reduction of CO_2 emissions from international shipping; a key factor in ensuring international shipping contributes to efforts to mitigate climate change.

(Sekimizu, 2014)

Corresponding to the deeper concerns over the environment than ever before by public, IMO has been working very hard and adopted more regulations on the environmental protection than other sectors recently. This dissertation attempts to make an analysis of the MBMs to tackle GHG emissions. Due to the unavoidable implementaion of MBMs and significant influence on the Chinese shipping industry, several proposals are put forward to the authority.

It is recognized that the MBMs have more merits than the traditional regulatory measures. It is cost effective. Through the MBMs, the allocation of the resources will be the most cost effective way as the MCCs for all ships would be adjusted to the same level. The MBMs also promote the innovation and implementation of new technologies. It rewards the more energy efficient ships and eliminates the old fleets out of the market. It requires less administrative intervention and consequently save administrative expenditure. Most importantly, it generates revenues, which could be used into further research and development of new technologies.

The main problems associated with MBMs are also evaluated in this paper. What the role is IMO going to play? How to design the MBMs to meet the both IMO and UNFCCC's principles? How to avoid the potential carbon leakage and market distortion? These important questions also remind us that there are many unsolved issues in the process of the establishment of MBMs. I believe that the core question is the coordination of interests between developing and developed countries. We need to think about the historical responsibilities of developed countries and consider the requirement of the development of the developing world. Only by the universal application of MBMs could the carbon leakage be prevented, and the anticipated GHG emissions mitigation be achieved.

Whether from the perspective of the volume of seaborne trade transportation or the controlled number of ships, China, undoubtedly, would be a big player and be influenced by the MBMs significantly. The CO_2 emissions under different scenarios are calculated based on the international standards. It illustrated a very challenging result indeed. Although it may take some time before the adoption of the MBMs, but through the documents of the latest MEPC meeting, we could see that the consensus generally have been achieved that a mandatory reporting of CO_2 emissions and fuel consumption of international shipping is necessary and in sore need. Therefore, as a Council Member of category "A" in IMO, China needs to be prepared and contribute our best efforts to the development of MBMs.

Last but not least, IMO has made great efforts on the protection of environment. In January 2013, the new chapter 4 to MARPOL Annex VI on Regulations on energy efficiency for ships made the shipping industry to be the first international industrial sector to be bounded by an international treaty law. The IMO GHG Study 2009 predicted that the amendments could improve ship energy efficiency considerably in the coming decade. Figuring out the rising tide of new environmental rules and regulations in shipping in the current situation may prove to be detrimental to the industry, especially when the high fuel price has already push the ship operators to improve energy efficiency and cut CO_2 emissions, we should work even harder to promote the full and effective implementation of the existing measures internationally. China Maritime Authority has to be in the same line with other central government agencies. We cannot ratify any treaty under IMO before any sound conclusion in UNFCCC is reached.

International shipping is truly a complex industry, an international industry, a multi-player industry. It is vital for all governments to understand that in the absence of a global framework agreed by IMO, there is a serious risk of regional or unilateral measures regulating CO_2 emissions from shipping. This would bring a seriously distorting effect on international shipping markets. Most importantly, without coordinated efforts, it would be much less effective in delivering meaningful reductions in CO_2 emissions by global shipping sector as a whole.

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