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## Development of legislation for ship greenhouse gas emission reduction, and suggestion of enforcement for China MSA

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**WORLD MARITIME UNIVERSITY**

Dalian, China

**DEVELOPMENT OF LEGISLATION FOR SHIP  
GREENHOUSE GAS EMISSION REDUCTION,  
AND SUGGESTION OF ENFORCEMENT FOR  
CHINA MSA**

By

**LIU YONGFENG**

**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.

(Signature):           Liu Yongfeng

(Date):                 July 10, 2014

**Supervised by:** Wang Shumin

Professor

Dalian Maritime University

## **ACKNOWLEDGEMENTS**

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At last, I should appreciate my parents and my wife Li Lingling. Their understanding and support are logistics and spiritual safeguard to my study, so I can study and live comfortably in the school on day release.

## **ABSTRACT**

Title of Research Paper: **Development of the Legislation for Ship Greenhouse Gas Emission Reduction, and Suggestions of Enforcement for China MSA**

Degree: **Msc**

Abstract: The 2011 amendment of MARPOL, Annex VI, which came into force on January 1, 2013. It has great influences on shipping business, shipbuilding industry and other related industries. It also has technologically broke through “The principle of Common but Differentiated Responsibility”, and expedited action steps of global greenhouse gas emissions of the ship. Because there are many problems on quality of greenhouse gas law, legislative supervision and the connection between domestic law and international covenant in China, the basic way to solution is from the tend of international legislation of greenhouse gas emissions of ship, and identifying the nature of greenhouse gas law, to draw emission control area of ship and put carbon tax system into practice. And on this account, this paper put forward domestic shipping business step-by-step to transform industry. Finally, countermeasure proposal of enforcement was given by providing the new amendment of agreement references from the perspective of contracting states, port states and coast states.

**Keywords: Legislation GHG Suggestions Enforcement China MSA**

## TABLE OF CONTENTS

ACKNOWLEDGEMENTS .....	iii
ABSTRACT.....	v
TABLE OF CONTENTS .....	vi
LIST OF FIGURES .....	vii
LIST OF TABLES .....	viii
LIST OF ABBREVIATIONS .....	ix
Chapter 1 Introduction .....	1
Chapter 2 Ship GHG Emission Reduction Actualities .....	1
Chapter 3 The development and analysis of the international legislation for the reduction of ship greenhouse gas emissions .....	12
Chapter 4 Domestic legislation and the difference .....	18
Chapter 5 Reform suggestions for our country’s legality .....	22
Chapter 6 Suggestion of performance for China MSA .....	29
Chapter 7 Conclusion.....	35

## LIST OF FIGURES

Figure 2-1 – Seaborne trade 1970–2007 in billion tonne-miles	1
Figure 2-2 –proportion of ships in 2007 (Total fleet: 100 243)	2
Figure 2-3 – Emissions ofCO2 from shipping compared with global total emissions	3
Figure 2-4 – Typical ranges ofCO2 efficiencies of ships compared with rail and road transport	4
Figure 2-5-The average dead weight ton from 2001 to 2011 (10000tons)	8
Figure 5-1-The average dead weight ton from 2001 to 2011 (10000tons)	24

## LIST OF TABLES

Table 2-1 –Summary of GHG emissions from shipping* during 2007	2
Table 2-2 – Exhaust emissions (million tonnes) from international shipping, 1990–2007	5
Table 2-3 –Assessment of potential reductions ofCO2 emissions from shipping by using known technology and practices	6
Table 2-4 –Discharge amounts ofCO2 for international shipping of China in 2008	7
Table 2-5–Average dead weight ton of China's international navigation ships	8
Table 2-6–Top 20 states and regions of GHG emissions in the world (2010)	10

## LIST OF ABBREVIATIONS

CCS	Chinese Classification Society
CH <sub>4</sub>	Methane
CO	Carbon monoxide
CO <sub>2</sub>	Carbon dioxide
EEDI	Energy Efficiency Design Index
EU	European Union
GDP	Gross domestic product
GHG	Greenhouse gas
IMO	International Maritime Organization
MARPOL	The International Convention for the Prevention of Pollution From Ships
MSA	Maritime Safety Administration
MSC	Maritime Safety Committee
NO <sub>x</sub>	Nitrogen oxides
NMVOOC	Non-methane volatile organic compounds
PM	Particulate matter/material
PSC	Port State Control
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
U.S.A	United States of America
RO	recognized organizations
SEEMP	Ship energy efficiency management plan
SO <sub>x</sub>	Sulphur oxides

## **Chapter 1 Introduction**

### **1.1 Background of Research**

As the United Nations Framework Convention on Climate Change (UNFCCC) came into force in 1992, and in 1997, the Kyoto Protocol forced to approve of the UNFCCC implementing greenhouse gas emission reduction on developed countries. Limiting greenhouse gas emissions has become a new trend to legislate to protect global environment, and greenhouse gas emission reduction gradually came into people's field of vision. The data provided by International Maritime Organization show that watercrafts should be responsible for 2.7% carbon dioxide emissions in the world (Yuan, 2010). With the development of international trade and the increase of seaborne volume, watercrafts has become more and bigger day by day, expansion of navigating zone, density of sailing route and global GHG emissions of ships are increasing continuously.

On 15 July 2011, the 62th MEPC committee of IMO passed the amendment of MARPOL, Annex VI (International Convention for the prevention Pollution from Ships) on ship energy efficiency rules and determined two standards of ship energy efficiency rules including EEDI (The new ship design of energy efficiency index) and SEEMP (Ship energy efficiency management plan). It is the first and special mandatory legal document to international shipping greenhouse gas emission

reduction. The amendment would entry into force on 1 January 2013, but competent authority-in-charge can exempt the new ships until 1 January 2017. Meanwhile in convention, there is another rule that is one hundred percent off reduction coefficient in the first 2-year application stage, so the amendment should entry into force before 1 January 2019. IMO will request shipbuilding of countries to start new Carbon emission reduction system, or to meet requirements in any way. If the ships cannot meet the prescribed requirement of energy efficiency and emission, they will be punished such as arrest of ship, paying penalty. If the ships are continuous not up to the standards, they will be required to exit the international shipping market.

## **1.2 Purpose of Research**

### **1.2.1 Rationalization proposal for national legislation**

Although China won a short period for adaptation, it showed that shipping business facing challenges of environmental protection, energy conservation and emission reduction is imminent. The 2011 amendment of MARPOL, Annex VI has embodied “Common but Differentiated Responsibility”, and clearly pointed out that the amendment passed “ never prejudge ongoing negotiation in other international forum (for example UNFCCC) or never affect standpoint of countries involved in the negotiation”, but this is, after all, that global greenhouse gas emission reduction is mandatory precedent in all contracting states, “Common but Differentiated Responsibility” made fuzzy rules in transfer of technology, and will have an impact on negotiation position of countries in the UN Climate Conference. Furthermore, based on emission reduction mechanism of market, especially on emission trade mechanism, China is lack of experience. There are a lack of foundation to build greenhouse gas emission trade mechanism in jurisprudence, market environment and even social culture etc, thus will bring a great difficultly to China. So, we should

focus on the study of gap between domestic legislation and foreign legislation and put forward useful suggestion to development in China.

### **1.2.2 Maneuverable policy suggestion for implementation of maritime convention**

Due to the impact from economic, political, technical etc factors , there are still many weaknesses on legislation and supervision for controlling greenhouse gas emission from ships and the obligatory implementation of relevant convention on greenhouse gas emission reduction of ships in IMO. Adapting to new trend of international legislation on greenhouse gas emission reduction in subsequent era of Kyoto Protocol, it is essential to explore greenhouse gas emission reduction policy of ships suitable for China's national conditions., and be in keeping with trend in development of international legislation, provide policies for China's Maritime Department implementing international convention and achieving sustainable development of shipping.

## **1.3 Research Method**

### **1.3.1 Literature**

For further understanding history and the present situation of international legislation and national legislation on greenhouse gas emission reduction, obtaining comparative data from facts, understanding the thing's panorama. Chinese literatures and foreign literatures are read by the writer. Full-text database of CNKI, Westlaw database, Lloyds law reports database, Hein Online law database and BIMCO database in School Library are also visited.

### **1.3.2 Summary of Experience**

Based on Literature, I induce and summarize experience in legislation and law enforcement of countries (such as members of EU, and the U.S.A), including all sorts of punitive measures to destruction of blue carbon sink; use legal supervision of Australia's mineral and Petroleum Resources Committee to carbon capture and sequestration under the sea for reference and try. persisting in combining induction with deduction, Anglo-American Legal System versus continental legal system, I probe into the gap between domestic legislation on greenhouse gas emission of ships in China and international legislation, so then I brought forward reformatinal suggestions on domestic ship-greenhouse-gas-emission-reduction legislation.

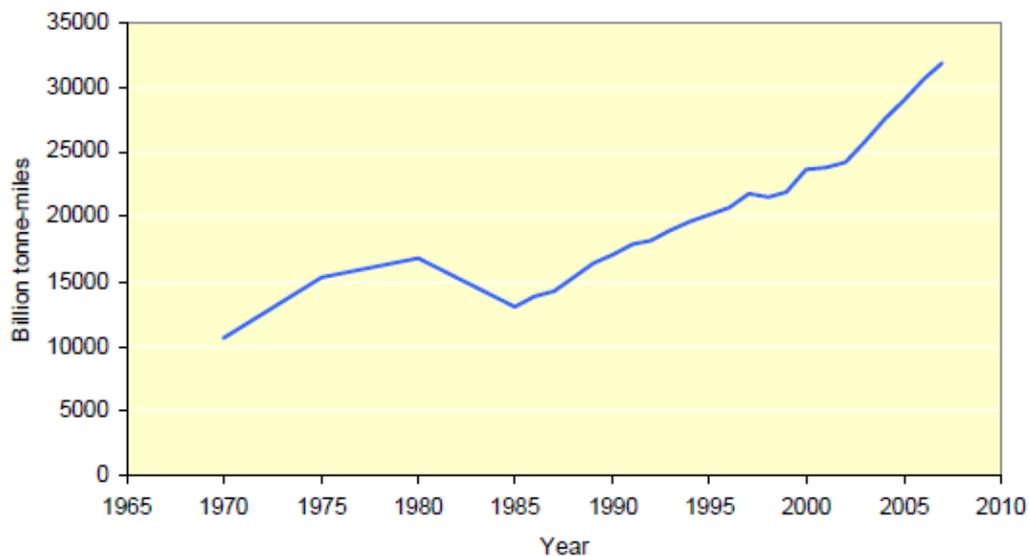
### **1.3.3 Case Study**

The Writer's Research Group exchange the latest intelligence and information through the way of investigating and providing symposium with all relevant departments, and study and compare scholars' different ideas. In April 2011 they went to National Ministry of Environment, State Oceanic Administration and Dalian Maritime Court etc for investigation and sent letter to Marine Fisheries Department of Liaoning Province , Liaoning Maritime Safety Administration and so on , sorted out and analyzed the cases of liability for maritime ecological damage, provided scientific and accurate suggestions for the amendment of China's laws and regulations on the Marine Environment Protection Law, and promoted theoretical research.

## Chapter 2 Ship GHG Emission Reduction Actualities

### 2.1 International emission actualities

About 82% of world trade by volume is carried by sea where demand for seaborne transport is closely linked to the development of the economy. While, total seaborne trade, expressed in billion tonne-miles, is shown in figure 2-1.

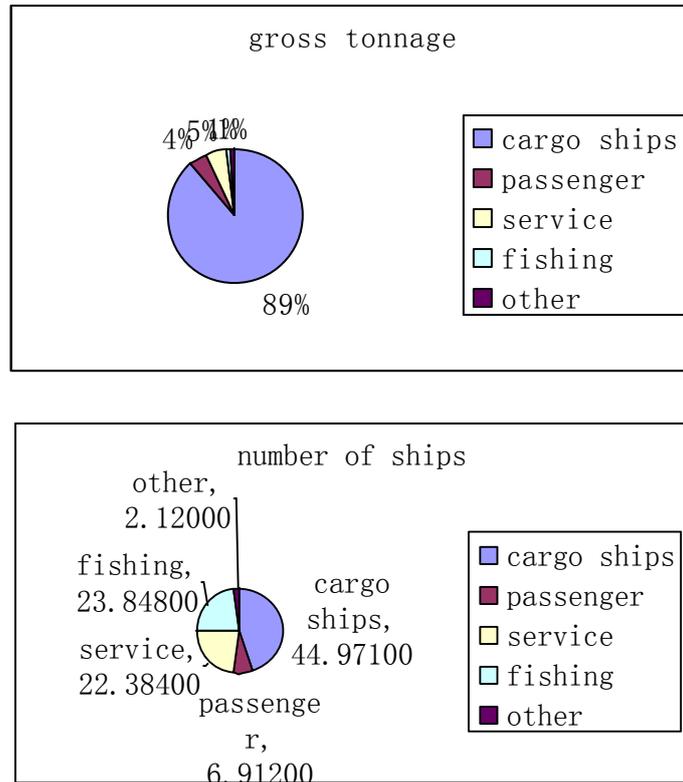


**Figure 2-1 – Seaborne trade 1970–2007 in billion tonne-miles**

**Source: Wang, Y. H. (2008). Baseline study of the amounts for GHG emissions.**

As shown in figure 2-2, the world fleet in 2007 comprises more than 100,000 ships

of more than 100 GT, of which just less than half are cargo ships. However, cargo ships account for 89% of total gross tonnage, clearly indicating the relatively large size of cargo ships.



**Figure 2-2 –proportion of ships in 2007 (Total fleet: 100 243)**

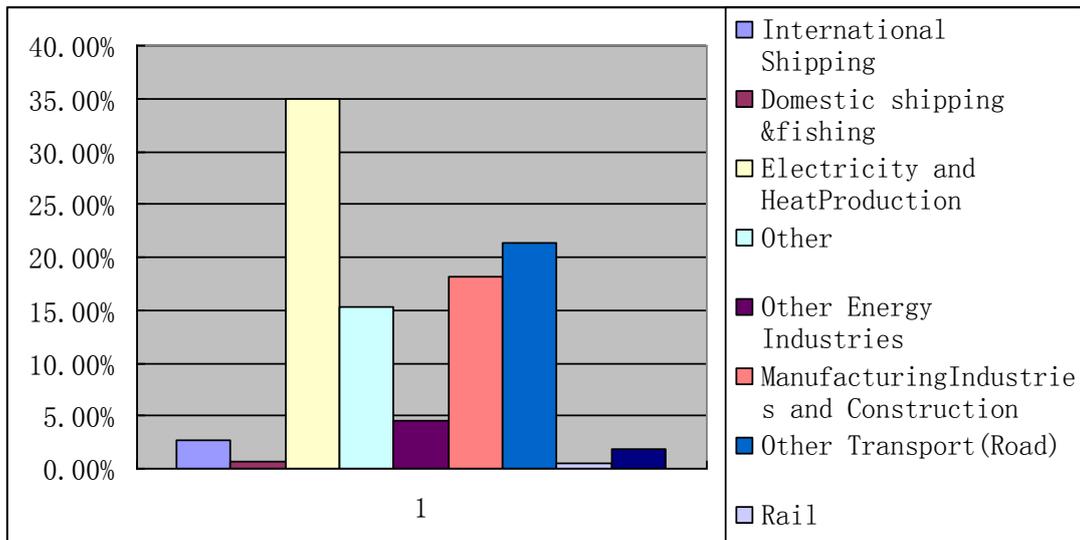
**Source: Li,Z.W. (2013). The new development of international legislation for GHG emission reduction and its enlightenment.**

According to the research report on the second GHG issued by IMO in 2009, the emission of CO<sub>2</sub> of the whole shipping industry was 10.4 million tons and was 3.3% of emission total amount of CO<sub>2</sub> in 2007; the emission of International shipping is 8.7 million tons and is 2.7% of global emission total amount in table 2-1 and figure 2-3.

**Table 2-1 –Summary of GHG emissions from shipping\* during 2007**

	International shipping	Total shipping	
	million tonnes	million tonnes	CO2 equivalent
CO2	870	1046	1046
CH4	Not determined*	0.24	6
N2O	0.02	0.03	9
HFC	Not determined*	0.0004	≤6

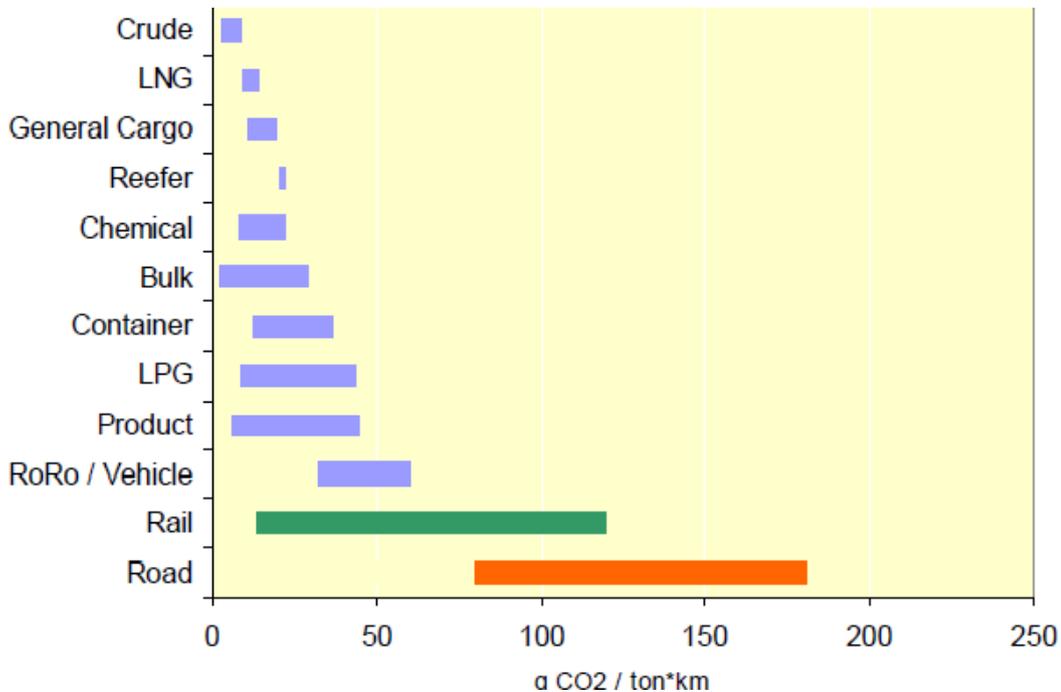
**Source: Li,Z.W. (2013). The new development of international legislation for GHG emission reduction and its enlightenment.**



**Figure 2-3 – Emissions of CO2 from shipping compared with global total emissions**

**Source: International Maritime Organization.(2009). Second IMO GHG Study 2009.**

The ranges of CO<sub>2</sub> efficiency of various forms of transport were estimated, using actual operating data, transport statistics and other information. The efficiency of ships is compared with that of other modes of transport in figure 2-4.



**Figure 2-4 – Typical ranges of CO<sub>2</sub> efficiencies of ships compared with rail and road transport**

**Source: Wang, Y. H. (2008). Baseline study of the amounts for GHG emissions.**

In general, ocean shipping is the highest-efficiency mode of transportation, but that doesn't mean that all the ships are better than other transportations. From figure 2-4 we can see, various ships' energy efficiency is higher than road transportation, but some ships' energy efficiency is little different from some railway transportations. For example, the efficiency of roll-on-roll-off ship is lower, and the emission of CO<sub>2</sub> is around 30~70gCO<sub>2</sub>/ton\*km; but the efficiency of some railway transportation can be up to around 20gCO<sub>2</sub>/ton\*km.

Results for shipping as a whole and for international shipping are shown in table 2-2.

These estimates are based on the consensus estimate for fuel consumption.

**Table 2-2 – Exhaust emissions (million tonnes) from international shipping, 1990–2007**

Year	NO <sub>x</sub>	SO <sub>x</sub>	PM	CO	NMVOC	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O
1990	14	7.9	1.0	1.3	0.4	562	0.05	0.01
1991	15	8.2	1.0	1.4	0.4	587	0.06	0.02
1992	15	8.4	1.0	1.4	0.5	598	0.06	0.02
1993	16	8.7	1.1	1.5	0.5	624	0.06	0.02
1994	16	9.0	1.1	1.5	0.5	644	0.06	0.02
1995	16	9.3	1.1	1.6	0.5	663	0.06	0.02
1996	17	9.5	1.2	1.6	0.5	679	0.07	0.02
1997	18	10	1.2	1.7	0.5	717	0.07	0.02
1998	18	10	1.2	1.7	0.5	709	0.07	0.02
1999	18	10	1.2	1.7	0.6	722	0.07	0.02
2000	19	11	1.3	1.8	0.6	778	0.07	0.02
2001	19	11	1.4	1.8	0.6	784	0.08	0.02
2002	19	11	1.4	1.9	0.6	794	0.08	0.02
2003	21	12	1.5	2.0	0.6	849	0.08	0.02
2004	22	13	1.6	2.1	0.7	907	0.09	0.02
2005	23	13	1.6	2.3	0.7	955	0.09	0.02
2006	24	14	1.7	2.4	0.8	1008	0.10	0.03
2007	25	15	1.8	2.5	0.8	1054	0.10	0.03

Uncertainty in all emissions due to fuel consumption estimate:  $\pm 20\%$

**Source: Wang, Y. H. (2008). Baseline study of the amounts for GHG emissions.**

The report predicted, with the increase of seaborne trade, if no any measures is taken,

the emission of CO<sub>2</sub> of Ship GHG in 2020 will increase by 30% than those in 2007, may be approximately up to 14.75 million tons. If taking measures to control effectively and improving the Ship Energy Efficiency, 25%~75% decrease of emission could be achieved.

**Table 2-3 –Assessment of potential reductions of CO<sub>2</sub> emissions from shipping by using known technology and practices**

<b>DESIGN (New ships)</b>	<b>Saving of CO<sub>2</sub>/tonne-mile</b>	<b>Combined</b>	<b>Combined</b>
Concept, speed & capability	2% to 50%+	10% to 50%+	25% to 75%+
Hull and superstructure	2% to 20%		
Power and propulsion systems	5% to 15%		
Low-carbon fuels	5% to 15%*		
Renewable energy	1% to 10%		
Exhaust gas CO <sub>2</sub> reduction	0%		
<b>OPERATION (All ships)</b>			
Fleet management, logistics & incentives	5% to 50%+	10% to 50%+	
Voyage optimization	1% to 10%		
Energy management	1% to 10%		

+ Reductions at this level would require reductions of operational speed.

\*CO<sub>2</sub> equivalent, based on the use of LNG.

**Source: Wang, Y. H. (2008). Baseline study of the amounts for GHG emissions.**

According to report and prediction of IMO on Ship CO<sub>2</sub> emission situation, Ship GHG emission of international shipping really cannot be ignored, IMO must promote

marine emission reduction through relevant legal measure, and make a positive contribution to climate change.

## 2.2 domestic emission actualities

On the one hand China's vessel fuels is used less efficiency. On the other hand ministry of environmental protection has not setted and subdivided standard values to Ship GHG, so using efficiency of crude fuel has not been required. On the contrary, consumption of crude fuel needs a big increase, pollution also correspondingly increases. In the overall scale of China's ship, China has rich resource of inland river shipping, the volume of ship is more than 0.8 million, the Ship oxy-nitride emission is 20% of traffic emission and particulate matter is 10% in Guangdong Province. The Ship oxy-nitride emission is around 50% of traffic emission in Shanghai. The following table indicates the amounts ofCO2 emissions for international shipping of China in 2008

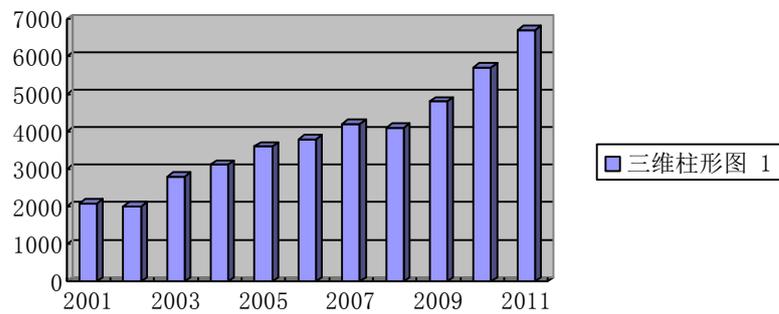
**Table 2-4 –Discharge amounts ofCO2 for international shipping of China in 2008**

method	classification	Discharge amounts (10000tons)
from top to bottom	Data based on the investigation of 10 Shipping companies	2873.1
	Data based on the investigation of national statistical agency	3997.8
from bottom to top	Scheme of IMO specialist	1970.1
	Scheme of MEPC 59 <sup>th</sup>	1976.7

	conference	
--	------------	--

**Source: Liaoning MSA (2008) , The data of Dalian research center.**

From the historical data available, during the period of 2001~2011, the fleet of China's international shipping payload has growth rate of 10% as shown in the table



**Figure 2-5-The average dead weight ton from 2001 to 2011 (10000tons)**

**Source: Liaoning MSA,(2010), The statistics report for 2011 of Liaoning MSA.**

According to the statistical data in China, in 2011 China International shipping is 42606t. Because of the situation, international shipping will keep growing by 1.06% every year. China's international navigation ships average load Weight ton is shown in Table 2-5.

**Table 2-5-Average dead weight ton of China's international navigation ships**

Time	2015	2020	2025	2030
Average dead weight ton	44442	46848	49384	52057
Time	2035	2040	2045	2050
Average dead	54876	57846	60978	64279

weight ton				
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**Source: Liaoning MSA,(2010), The statistics report for 2011 of Liaoning MSA.**

From the proportion of Ship emission than traffic emission in provinces, we can see, the latent capacity of ship pollution emission reduction is very large, especially the provinces with rich resource of shipping. Additionally, ocean ships are the main source of global oxy-nitride emission, but they are very impressive in coastal harbors.

Based on sufficient survey on computing method and prediction model of International ShipCO2 emission, Chinese scientists has built prediction model of China International ShippingCO2 emission, and combined with the data issued by Shipping Economics, logistics institute etc. International Shipping related institutes and the baseline scenario of Special Report on Emissions Scenarios from special climate change committee in governments, can predict International ShippingCO2 emission from 2010 to 2050. And they further analyzed the effect of suppositional market mechanism (carbon tax) from International Maritime Organization on China Import and Export Trade and International Shipping Operating Costs, and provided relevant political suggestions for International negotiation on China climate change, International shipping emission reduction negotiation and development of industry. The results show that in the future 20-30 years, China International ShippingCO2 emission will still rapidly increase. Under baseline scenario, in 2050 China International ShippingCO2 emission will reach to be 23370000-57900000 tons which will be 0.7-1.8 times of those in 2010. Top 20 states or regions are indicated in Table 2-6.

**Table 2-6-Top 20 states and regions of GHG emissions in the world (2010)**

Ranking	Country or area	Ranking	Country or area
1	America	11	Korea
2	China	12	France
3	Russia	13	Australia
4	Japan	14	California of USA
5	India	15	South Africa
6	Germany	16	Ukraine
7	Texas of USA	17	Mexico
8	Canada	18	Brazil
9	England	19	Spain
10	Italy	20	Poland

**Source: Wang, Y. H. (2008). Baseline study of the amounts for GHG emissions.**

Therefore China Ministry of Transportation made a goal for energy consumption reduction and emission reduction ----“the 12th five-year implementation scheme on promoting water transport energy-saving emission reduction overall”. Ministry of Transportation has a commitment:

*In 2015 thruput on comprehensive energy consumption of port production units will decrease by 8%, volume of the circular flow on energy consumption of ship operation units will decrease by more than 15%, thereinto energy consumption of ocean shipping will decrease by more than 16% , energy consumption of inland shipping will drop by 14% . Thruput onCO2 emission of port production units will decrease by more than 10%; volume of the circular flow onCO2 emission of ship operation units will drop by more than 16%, thereintoCO2 emission of ocean*

*shipping will decrease by more than 17% ,CO2 emission of inland shipping will drop by more than 15%.(Ministry of Transportation, 2011)*

## **Chapter 3 The development and analysis of the international legislation for the reduction of ship greenhouse gas emissions**

### **3.1 Development of the international legislation**

The international organizations have initiated legislation to limit greenhouse gas emissions, including the "United Nations Framework Convention on Climate Change" in 1992 and the "Kyoto Protocol" in 1997, before that the "Annex VI amendments of MARPOL 73/78 Convention" was adopted in the IMO. But the "United Nations Framework Convention on Climate Change" did not stipulate specific duties and implement individual parties, therefore, there is lack of legal execution. The "Kyoto Protocol" that came into force in 2005 is the subsidiary of the "United Nations Framework Convention on Climate Change", is the only international law document of universal legally binding which is formed in International climate negotiations by far. Due to those conventions above are all drafted based on nations and order developed countries who have approved conventions must bring discharging of greenhouse gases into law system. As the place of greenhouse gases discharged by vessels difficult to be judged, the gases can't be included into carbon emission reduction system. Therefore, "Kyoto Protocol" only required the developed nation which listed in attachment I to achieve

the goal of carbon emission reduction in related fields through IMO, and did not formulate the duty of the developing country.

In the early 21st Century, IMO (International Maritime Organization) started to work hard on the ship greenhouse gas emission reduction. “MARPOL 73/78 Convention” was taken effect on May 19th, 2005, and in its Annex VI “Regulations for Prevention of Air Pollution from Ships”, it provides the ship emission standard and technical reduction methods of the ozone layer consumption matter, nitrogen oxides, and sulfur oxides, etc. It also allows the establishment of the emission control area to limit the toxic and harmful ship gas emissions. The sixty-second session of the MEPC in July 5th, 2011 adopted the amendment to annex VI of “MARPOL 73/78 Convention”, it not only revised the existing provisions, but also added the 4th section “Rules of ship efficiency”. In this section, it mainly aimed at the numeral quantization for the carbon emission standards at the ship design and construction stage, and it required that provided since Jan. 1st 2013, all the new ships loading 400 tons or more must meet the new Energy Efficiency Design Index (EEDI), which will lead to decrease of 10% carbon emissions, and reduce 10% or more from 2020 to 2024. Hopefully it will finally reach the target decrease 30% emissions. In addition, the used vessels should also comply with the listed rules in Ship Energy Efficiency Management Plan (SEEMP). The sixty-third session of the MEPC in 2012 adopted the guide on the implementations of a series of compulsory measures for improving international shipping energy efficiency and reducing the greenhouse gas emission (Liu, 2012); but the guide hasn’t got the legal sanction. It only provides support and guidance for the provisions in “the Annex VI of ‘MARPOL 73/78 Convention’” implemented by the member state s uniformly.

### **3.2 Analysis of the Legislation**

### **3.2.1 The background of the times**

It is not a surprise for the approval for “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’ ”, and it has the profound background of the times. IMO started the legislation of ship greenhouse gas emission reduction under the authority of “United Nations Framework Convention on Climate Change” and "Kyoto Protocol", and some western countries had previously approved the legislation to control greenhouse gas emissions before "Kyoto Protocol" took into effect. For example, in the early 90s of twentieth Century, Denmark, Britain and Germany began to levy a carbon tax; in 1990, USA revised "Clean Air Act" to implement the trading mechanism for the SO<sub>2</sub> and nitride emissions. In 2006, the Global Warming Solutions Act of California authorized the Air Resources Board in the State to take compulsory measures for the ships and port greenhouse gas emissions( Liu,2011). In 2008 the EU approved the "European environmental air quality and cleaner air instructions" which aimed at limiting nitrogen oxides, carbon dioxide and other greenhouse gas emissions, and was to bring a voyage carbon tax into the EU greenhouse gas emissions trading system. Therefore, the approval for “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’ ” is not only the practice of the authorizing for the “United Nations Framework Convention on climate change”, but also a legislative response to the international community requiring to carry out the ship greenhouse gas emission reduction.

### **3.3.2 The effect to the legislation for other counties**

The approval for “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’” indicates that the international community expand the legislation supervision of the ship gas emission from ozone depleting substances, sulfur oxides,

etc. to the non-traditional pollutants such as greenhouse gas; and the emission reduction scope and species are gradually expanding. At the same time, “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’” has certain effect to the legislation for the ship greenhouse gas emission reduction of the countries: 1) urged the IMO member states to implement the greenhouse gas emission reduction and fulfill their national obligations under the convention by legislation. For instance, in July 28th, 2011, Germany revised the “Greenhouse Gas Emission Transaction Act” aiming to establish the trading system for greenhouse gas emissions to reduce the emissions; and combine the trading system with the ship greenhouse gas emission reduction mechanism in the “amendment to Annex VI of ‘MARPOL73 / 78 Convention’”, which brought the greenhouse gas emission trading of the ship enterprises into the applicative scope of the act (Wang, 2010). It required the IMO member states to implement the feasible measures to reduce greenhouse gas emissions. In the frame of the “United Nations Framework Convention on Climate Change”, the developing countries needn’t take the obligations of the greenhouse gas emission reduction. Therefore, most of the developing countries always indicated their attitudes towards the greenhouse gas emission reduction by the non-compulsory emission reduction mechanisms such as promising a macroscopic national emission reduction, a comprehensive framework agreement, etc.; they needn’t adopt the emission reduction measures with legal sanction for the special area.

“The amendment to Annex VI of ‘MARPOL73 / 78 Convention’” specialized, quantized and forced the greenhouse gas emission reduction. It requires the member states limit the ship emission of carbon dioxide at the stage of design and establishment. Its 22nd section provides the EEDI and ship operation and safety management with bundled style. This indicates that the non-compulsory macro commitment couldn’t meet the requirements of the IMO maritime legislation. It’s the

only way for the nations' emission reduction legislation to refine the standard for the greenhouse gas emission reduction within the ship operation process and the reduction requirements of related industry by the domestic legislation.

### **3.3.3 Function and pressure to other countries**

“The amendment to Annex VI of ‘MARPOL73 / 78 Convention’” means that in the late “Kyoto Protocol” era, the developing countries will gradually take some certain obligations under the international emission reduction law. From the point of the international convention negotiation on climate change, strictly limiting the ship greenhouse gas emission reduction has become the main trend of the times development and the international legislation. “The amendment to Annex VI of ‘MARPOL73 / 78 Convention’” replaces the previous way for determining the applicative scope in the national convention with “country” as its basic unit with the “technical standard”; and replaced the “principle of common but with different responsibilities” with the “non-preferential treatment principle”; it tries to solve the sensitive political problems such as “Environmental right” and “Developing right” between the developing countries and developed countries from the level of the responsibility commitment for ship greenhouse gas emission reduction. Although numerous developing countries including China are against this amendment, the low carbon operation becoming the irreversible developing direction of global shipping industry is deniable. To the developing countries in the industrialization, modernization and urbanization process, the mandatory application of EEDI will affect not only the legislation for the ship energy efficiency design standard, the resulted “Butterfly Effect” will also affect the various related shipping industry area such as ship operation management, ship energy structure and so on. This means, our nation and the other developing countries will have to face the economic, political

and technical pressure from the comprehensive limitation of ship greenhouse gas emission reduction by the domestic legislation within the late “Kyoto Protocol” era.

## **Chapter 4 Domestic legislation and the difference**

As to the international convention, the conventions concerning ship greenhouse gas emission which China is involved in includes the “United Nations Framework Convention on climate change” signed in 1992 and taken to effect in 1994; the “Kyoto Protocol” approved in 1997 and taken to effect in 2005; and the “MARPOL73 / 78 Convention” taken to effect in 1983. The countries must abide by the rules according to the international convention. Generally, once the norms of the international law are accepted by the contracting countries and taken into effect, this international law will become the origin of the domestic law. Although the “constitution of the People’s Republic of China” and “the People’s Republic of China legislation law” don’t have the provisions about the position of the international convention in domestic law and the implementation of the convention; according to most of the domestic legislations and judicial precedent promulgated by the Supreme People's Courts, in the situation that there is legislation blank in the domestic law or there exists the conflicts between the domestic law and the international conventions China involved, the international conventions are always in the prior status. Therefore, the above three effective conventions will be undoubtedly belong to part of our domestic legislation of the ship greenhouse gas emissions. The shortcomings are as follows.

#### **4.1 The existed blank in the legislation for the ship greenhouse gas emission**

At present, the legislation for the supervision of ship pollution in our country centralizes in supervising the aspects such as the toxic and harmful substances, marine oil pollution, and the solid waste, etc. There aren't any provisions for the controlling of greenhouse gas emission or the greenhouse gas emission in "environmental protect law", "marine environmental protection law", "prevention of pollution from ships marine environmental management regulations" and "prevention of pollution from ships in inland waters environmental management Regulations". In the legislation standard of the ship greenhouse gas emission reduction, although the 32nd section of the "air pollution prevention law" requires that the emission of the air atmospheric pollutants from the motor vessels must not exceed the emission standard. There isn't any standard for the ship atmospheric pollutants' emission by now. Currently, the domestic law almost takes the IMO related detailed technical standards completely and applies them in domestic directly (Wang, 2010). The related standards in the convention are mainly set for the ocean vessels, the ships in the inland or coastal waters under the jurisdiction of China are not included in the convention, and as a result, the application of the international convention taken directly doesn't solve the legislation vacancy problem for the ship greenhouse gas emissions in the domestic law. Although our nation is working on the legislation to promote the trading system in carbon emission market, but the released "clean development mechanism project operation and management measures" doesn't get the ship industry involved in the trading system in carbon emission market explicitly. And for the "Chinese voluntary greenhouse gas emissions trading activities management approach" with great concerning, whether it will extend the subject of greenhouse gas emission trading into the "sea" is still unsure due to the unreleased situation of the draft.

#### **4.2 The legal nature of the greenhouse gas is not clear.**

At present, in domestic, there are serious disagreements in the understanding of legal nature on greenhouse gas. Whether the gas is a kind of pollutant or not; whether it's necessary to take the greenhouse gas such as carbon dioxide, etc. into the legal controlled scope; there are the questions need to be clarified. On the one hand, there is no provision about the controlling of the greenhouse gas emission in domestic law; on the other hand, the meaning and the scope of the pollutants or atmospheric pollutants are not defined in "environmental protection law", "air pollution prevention law" and other relevant laws. Therefore, there isn't a definite answer for whether the greenhouse gas belongs to pollutants under the provisions of the domestic laws, and whether its emission should be restricted by the current legislations. Meanwhile, other countries such as Australia, Canada, etc. have treated carbon dioxide as the atmospheric pollutant under the law. In 2005, according to the "air pollution control act", the environmental protection bureau of New Jersey in USA takes carbon dioxide as the air pollutant into the legal supervision range. The emission of Carbon dioxide is supervised by the government (New Jersey, 2014). According to the "Clean Air Act" 202 (a), on Dec. 7th, 2009, American environmental protection bureau defines carbon dioxide, methane, nitrogen dioxide, carbon monoxide and nitrous oxide, sulfur hexafluoride all these six kinds of greenhouse gases as "hazardous pollutants" under federal law; and this provision got the support from the American Federal Supreme Court precedent.

#### **4.3 There is deficiency about the cohesion and application aspects of the domestic legislation and greenhouse gas emission.**

China is a member state of IMO. According to the provision from Article 5 and Article 19(5) in “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’“, the competent authority of the contacting countries could decide to postpone the implementation of 4 years the ship energy efficiency standards by themselves after the amendment takes effect; besides, the provision about zero “discount rate” during the first 2 years application stage (from Jan. 1st, 2013 to Dec. 31st, 2014) in Article 21(2) of this amendment, the competent authority could postpone at most 6 years after the amendment take effect, which means the China the deadline for China starting to implement the new ship energy efficiency standards from the international convention is Jan. 1st of 2019. However, so far in our country, the work about ship greenhouse gas emission reduction still stays in the policy level and technical index required level; the cohesion with the international convention is improper in the legal system aspect. As a developing country, China needn’t takes the obligation of the mandatory greenhouse gas emission reduction from the international laws; but as the effective date for “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’“ in our nation is approaching, our numerous ocean going vessels will be subject to this amendment then. However, the reality is that our domestic legislation for the ship greenhouse gas emission reduction lags behind the international convention, and our country lacks the legislation and measures for further ship greenhouse gas emission reduction. All the preparatory work for the implementation of “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’” hasn’t got sufficient attentions from all the parties; all the above put us in a negative situation, which is not good for the future development of the shipping industry.

## **Chapter 5 Reform suggestions for our country's legality**

The developed countries' rejection of taking the obligations about the greenhouse gas emission reduction according to the "United Nations Framework Convention on climate change" and "Kyoto Protocol" is gradually restricted by the IMO maritime legislation. "The amendment to Annex VI of 'MARPOL73 / 78 Convention'" will mandatorily require more countries to take the obligations about the greenhouse gas emission reduction by adjusting the application range and standard. For China, there are three points in detail:

### **5.1 Define the legal nature of the greenhouse gas**

The nature of the greenhouse gas will decide what kind of adjusting method of its emissions is taken. According to the current economic development reality in China, the author thinks that it's improper to take the greenhouse gas as the pollutant within the domestic legislation during this period. If the government brings the greenhouse gas as the pollutant into the legislation control category, this means the units or individuals with the pollutants emission will undertake the corresponding legal obligations and even legal responsibilities, and many of the current international environmental conventions will inflict more international legal obligations, which is not in line with Chinese national benefit. Due to the current situation that China has no international legal obligations on cutting the greenhouse gas such as carbon

dioxide etc., reducing the carbon dioxide emission sharply is not good for the development of the industry. In fact, the greenhouse gas differs from the traditional pollutants in the physical, chemical properties and the impact on human life, and it is not pollutant purely. The increasing of the greenhouse gases including carbon dioxide in the atmosphere can not only prompt the growth of the crops, but also reduce the water consumption, even weaken the influence of drought (Li,2009). Therefore, viewing from the legislation point, it has limitations to define it as pollutant totally. The wise way is that its emission should be controlled in a certain range instead of being eliminated completely under the legislation. Although the greenhouse gases such as carbon dioxide shouldn't belong to the pollutant, they are the main substances causing greenhouse effect, and they are the substances impacting atmospheric environment. In the future, if people revise the "environmental protection law, the idea of "atmospheric environmental impact substances" may be considered to define such substances not fully eliminated but getting controlled in their emissions; and the ship greenhouse gas emission should belong to this category. Defining ship greenhouse gases as the "atmospheric environmental impact substances" in the legislations can not only avoid the chain effect from the legislation aspects such as the administrative supervision and the emitters' legal obligations due to defining the greenhouse gases as pollutants; but also legally supervise the emission of ship greenhouse gases to commitment voluntary promises and the international convention obligations in the world.

## **5.2 Legislate to delimit the emission control area**

According to the "the amendment to Annex VI of 'MARPOL73 / 78 Convention'", two sulfur oxides emission control areas in the Baltic Sea and the North Sea area, and the Northern American nitrogen oxide and sulfur oxides emission control areas

set by IMO has taken effect (Schroder,2013). In 2011, the 62nd session of MEPC approved the “the amendment to Annex VI of ‘MARPOL73 / 78 Convention’“ setting the specific waters adjacent to Puerto Rico and the US Virgin islands for the nitrogen oxides, sulfur oxides and other specific substances emissions control areas.



**Figure 5-1-**The average dead weight ton from 2001 to 2011 (10000tons)

Source: Baidu (2013).

[http://baike.baidu.com/picture/5956905/6025064/0/c2bce203ba3e46d7d53f7c7f?fr=l  
emma&ct=single#aid=0&pic=c2bce203ba3e46d7d53f7c7f](http://baike.baidu.com/picture/5956905/6025064/0/c2bce203ba3e46d7d53f7c7f?fr=l<br/>emma&ct=single#aid=0&pic=c2bce203ba3e46d7d53f7c7f)

The eighteenth of “Air pollution prevention law” regulates that the competent administrative department of environmental protection under the State Council in conjunction with the relevant departments under the State Council shall, according to the weather, terrain, soil and other natural conditions, designate the area which may

produce acid rain or other area with serious SO<sub>2</sub> pollution as the control area of acid rain and sulfur dioxide pollution control district after approval by the State Council. From the environmental protection point of view, combustion pollutants and greenhouse gases is mainly from fossil fuel. They both have certain homology and their control methods also have a certain consistency. Research of the Ministry of Environmental Protection associating with some foreign researches institutions shows that pollutant emission reduction mainly in sulfur dioxide has obvious synergistic effect on the reduction of greenhouse gas emissions. In the harbor, channel and some sea area with concentrated airline and large flow of ships, air pollution has become a major source of pollution in the region. Navigable increasing density resulted in the increasingly deterioration of the environment, the impact of greenhouse gas emissions on regional atmospheric environment is also bigger and bigger. China's Bohai region, Yangtze River Delta, Pearl River Delta Coast is where shipping enterprises is highly concentrated and more polluted area. According to "study of the air quality in the Pearl River Delta", shipping has occupied the second in traffic pollution of the Pearl River Delta region. In view of this, when IMO designate serious polluted coastal area in China as emission control area, modeling on standard of the control area of acid rain and sulfur dioxide pollution controlled areas and every area per unit of GDP the carbon dioxide emissions decline index ranking among " 'Twelfth Five Year 'work plan for controlling greenhouse gas emissions", considering the Bohai rim region, the Yangtze River Delta, Pearl River Delta port city as the basic unit, according to assessment of environmental air quality index, our country classify the city whose annual average is showed as "heavily polluted" as shipping controlling greenhouse gas emissions. Limit total emissions of greenhouse gases of the regional shipping industry, shipbuilding and other industries, and put forward specific requirements for fuel sulfur content, loading gas catalysis and conversion device of the oil tankers entering to the region, container ships and

cruise ships and other large vessels in order to reduce and control the pollution from ships.

### **5.3 Construction of the ship carbon tax system**

A carbon tax is a kind of environmental tax (Baidu, 2013). Countries use carbon tax, one economic means, to curb greenhouse gas emissions, and regulate protection and utilization of environmental resources. Some people think that in the current situation of shipping market downturn and international trade "green barriers" restrictions, the domestic legislation of the marine carbon tax will increase operating costs. Especially in the background that the European Union and other countries will impose aviation carbon tax and navigation carbon tax, if the domestic legislation to impose the carbon tax, domestic shipping enterprises will face double taxation burden. The author thinks that the construction of the ship carbon tax system in China does not necessarily mean more shipping costs, the reason mainly includes: firstly, the state can suppress certain economic demand, on the other hand through tax revenue, can also encourage the development of some industry through tax revenue. The shipping industry and shipbuilding industry are currently the business tax and VAT taxpayers. The design of a carbon tax system, can, in the way of tax substituted for tax or tax rebate way, conditionally reduce carbon tax of shipping enterprises and shipbuilding industries etc. Secondly, domestic legislation imposing a carbon tax is an effective way to deal with the western "carbon barrier". At present, the EU imposing a carbon tax, aviation carbon tax has been imperative. Relying solely on political resistance can not effectively solve the problem of "barriers" (Zhang,2009). Through domestic legislation to establish a carbon tax system against Carbon tax act of the European Union countries etc. and developed countries is more operational. Last but not least, through the establishment of a domestic carbon tax

system occupies the moral high ground. For a long time, the United States, Japan and the European Union etc. The developed countries and the area on the greenhouse gas emissions importune China. Establishing a carbon tax system in China, not only can resist some developed countries and regions' unreasonable accusations and requirements to China in the aspects of greenhouse gas emission reduction, but also gain time and space for the development of domestic industry.

In the design of marine carbon tax system, tax should play a leverage role in the regulation of the ship greenhouse gas emissions. On one hand, we should consider the ship tonnage, hook ship emissions of greenhouse gases and carbon tax. That is to say, the more the ship greenhouse gas is released, the more the tax is; On the other hand, while establishing the basic collection system, implement policies which has the function of motivation such as tax cuts, tax exemptions and subsidies etc. (Lin,2009). For tax, value added tax, shipping tax taxpayer and small owners of Chinese shipping industry, shipbuilding etc., by reducing ship carbon tax, and by the way of other tax taking the place of ship carbon tax, reduce some or all of the taxpayer(Lin, 2009). For the ship which has equipment modification and mounts catalytic conversion device for the purpose of reducing emissions ship equipment, and the new ship in accordance with IMO on technical standards for greenhouse gas emission reduction, at present, some countries adopt the "rebate", "subsidies" and "tax" to encourage owners to take the initiative to implement greenhouse gas emission reduction.

For example, Sweden exercises taxes to ships whose NO<sub>x</sub> emissions is within 12—2g / kWh. They should pay decline according to the proportion; within 5 years before 2000, to the new ship is equipped with catalytic converter or modified ship for reducing nitrogen oxide emissions, the government can give the owner or user 40%

equipment purchase, installation fee rebate or subsidy (Huang& Xie,2005). Our country, in the design of the carbon tax, can learn from the Swedish approach, use tax leverage to adjust ship greenhouse gas emissions.

## **Chapter 6 Suggestion of performance for China MSA**

In 2009, IMO twenty-sixth session of the General Assembly decides to make state audit scheme members forced, and in 2015 plans to implement mandatory audits of Member States. After amendment becomes effective, it will be incorporated into the "IM O mandatory file implementation rules" regulated compulsory audit file list. For this situation, several suggestions are proposed in this chapter.

### **6.1 Performance the flag State duties**

#### **6.1.1 Speed up the domestic legislation, promote the implement of regulations**

In accordance with requirements of “Rules for the implementation of IMO mandatory document”, maritime Administration should complete the domestic legislation of the amendment as soon as possible, and promote the implementation of laws and regulations. Domestic legislative process can be divided into three steps. The specific measures are as follows:

First step, the flag State duties revise “the international navigation ships statutory inspection technology rules” booklet 3 article 5 of the “the structure and equipment to prevent pollution caused by ships” are join the relevant contents about the ship energy efficiency rules . The new adding contents should be in exact accordance with MARPOL convention bylaw amendment VI2011 years or higher than the prescribed

technical standards. Effective time should not be later than the requirements of the amendment.

The second step, the flag State duties revise the fifth article of chapter 7 “the domestic sailing ships statutory inspection technology rules” in prevention of air pollution regulations. Bylaws revision content references MARPOL convention VI2011 amendment, but technical standards can be discretionary reduced on the basis of the comprehensive and objective statistical data, according to the actual situation of domestic related industries. It can also appropriately delay effective time, but, in the process of legislation, policy guidance of energy saving and emission reduction should be reflected.

The third step, the flag State duties timely revise “the legal inspection technology inland river ships rules”. Due to complexity of the inland river ships in the aspects of ship type definition, tonnage limit etc, they should make research project aimed to inland ship energy efficiency management. Based on the project results, offer suggestions for inland river ships in the revision of the energy efficiency management and promote.

### **6.1.2 Guide the industry development, and facilitate the implementation of laws and regulations**

Maritime administration should be combined with relevant departments to actively research on domestic ship data, shipping greenhouse gas emissions situation, and strive to master the most comprehensive, timely information in the shortest possible time, in order to determine our existing problem in marine greenhouse gas emission reduction and have the advantage to develop scientific and industry standards. In

order to effectively fulfill the flag state obligations, maritime evaluates preparations of the recognized organizations (RO) which is Chinese Classification Society (CCS) for the new rules. Confirm and recognize organization has sufficient resources in the aspects of management and technology, and can complete the assigned task in accordance with the "the lowest standard of authorized organization on behalf of it to exercise the functions" of the relevant IMO resolutions. It is reported that CCS has developed a "ship energy efficiency management certification standard" "green ship specification" (Draft) etc.. In cooperation with the Dalian Ocean Shipping CO and cope with the implementation of the new rules such as EEDI, SEEM P etc., CCS Conducts a comprehensive investigation on technical reserves of the shipbuilding industry, and understand the situation, the shipbuilding industry difficulties etc.. CCS investigates shipping management, crew training level. By guiding to establish industry alliance, combining with the relevant departments to provide technical support, personnel training, which will help the shipbuilding industry to adapt to the new rules as soon as possible, answer the new development of Greenhouse gas emission reduction from the source, synchronized with the international development trend, and even be ahead of international level of development. We should raise awareness of the crisis, put away the strategic vision, and put the response as an opportunity. China's ship design, shipbuilding, ship inspection departments shall actively carry out technical innovation, develop new type, new energy, improve energy saving and environmental protection level of ship supporting mechanical and electrical products, and strive to adapt to the new rules shipping greenhouse gas emission reduction in the shortest time.

### **6.1.3 Strengthen personnel training, regular review**

The government should develop the maritime administration of industry management

functions, in the shipyards, shipping companies, crew training institutions, the vessel inspection agency and other relevant departments, strengthen the new rule of publicizing and training of personnel, and improve the awareness of related industry. In order to ensure that flag States supervision and inspection, comprehensive, accurately grasp the rules, Maritime Safety Authorities should strengthen internal training. At the same time, the competent authority shall organize regular supervision, audit, review circumstances of performing rules by the related industries, handle and put forward rectification opinions for the non-conformity and monitor keeping an agreement of the industry in an all-round way.

#### **6.1.4 strengthen international exchanges, strive for technical cooperation**

Twenty-third amendment of MARPOL annex VI2011 increases the relevant provisions " to promote and strengthen technical cooperation and exchange of ship energy efficiency", requests the competent authorities and the International Maritime Organization and other relevant international organizations to cooperate, and promotes the direct or indirect cooperation and transfer of technology, especially for the developing countries who have urgent need for technical assistance. This is the first description of "developing countries" in the Convention on the international maritime organization, and is an important achievement of the developing countries including China who long fight for it. Maritime authorities should strengthen and promote domestic guidance, actively promote relevant industry of our country and the developed countries in dealing with the ship energy efficiency rules technology exchanges and cooperation, and actively seek technical and financial support from developed countries. When necessary, the maritime authorities can get appropriate technical assistance through IMO, help the relevant industry of our country to eliminate technical barriers, difficulties, and explore coping mode suitable for the

situation of our country as soon as possible.

## **6.2 Fulfill the coastal state and port state obligations**

In accordance with the requirements of "rules for the implementation of IMO mandatory documentation", the government will have to perform Chinese coastal state and port state obligations.

In view of the amendment, Maritime authorities should: (1) Revise relevant laws and regulations of coastal states, port state and add the amendment to the relevant mandatory file. (2) Make update knowledge training of the PSC inspection officer, make sure that the PSC inspection officers have a comprehensive and accurate understanding of the MARPOL annex VI 2011 amendment and are able to accurately perform in PSC. (3) Take "no preferential treatment" to non contracting states of ships in the port state supervision and inspection, and promote the smooth implementation of the new rules in the global scope. For the defects found in the inspection, information should be promptly given to the ship flag state. (4) Clearly divide responsibilities within, cooperate with the flag and / or port state, make conformity with the situation survey, and earnestly fulfill the coastal state obligations.

## **6.3 Actively carry out technical research and development, enhanced IMO negotiation discourse**

Further actions also need to be taken. For example, actively participate in various research proposed by IMO technology, operation and emission reduction measures based on market, especially measures mandatory reduction possible; assess its impact

on the business. The team should Feedback the problems which facing to the Chinese research mechanism team dealing with greenhouse gas emission reduction timely, prepare relevant proposals to China government delegation who will attend the International Maritime Organization Conference. They should study the new ship design index of mandatoryCO2 details, assess requirements for the new ship performance, buy the ship for future investment, and prepare technology. Actively carry out the existing ship greenhouse gas emission reduction pilot work, collect relevant data for future energy, accumulate experience for dealing with the reduction.

#### **6.4 Develop the ship fuel consumption limit standard and the establish the access and exit mechanism**

In accordance with the law, the department of transportation is responsible for organizing the formulation of the operation of the ship fuel consumption limit standards and relevant supporting measures and implementation scheme. This standard must fully consider IMO requirements for ship emissions index etc.. Through carrying out the operation of the ship fuel consumption entry and exit pilot in typical water, the department should set up the operation ship fuel consumption detection system, establish economic compensation mechanism, promote the shipyard to strengthen energy-saving technological progress and innovation, strengthen the source of control of high energy consuming operation of the ship into the transportation market. In the future, ships which do not meet the criteria should be withdrawn from the market or shall not be used for operation.

## **Chapter 7 Conclusion**

China is the contracting state of MARPOL, Annex VI and also a big country of shipbuilding and shipping in the world. The entry into the force of the amendment will bring huge and far reaching effects on shipbuilding, shipping and related industries in China. Accelerating the perform process is the guidance and promotion to related industries and objective requirement to energy conservation and emission reduction. “‘The 12th five-year implementation plan’ on promoting energy-saving emission reduction (draft)” of China's maritime authority has treated the implementation of MARPOL, Annex VI as important contents.

At present, the greenhouse gas emissions behavior, whether from the supervision of domestic legislation or from the convergence of domestic law, international convention, and gas emissions legislation of international shipping greenhouse, still exists the gap. So, focus on future development, now China should reform the legal system for the greenhouse gas emission reduction with the developing concept “green shipping industry”; standardize and guide the ship greenhouse gas emission reduction by establishing and improving the legal system for the greenhouse gas emission reduction, prompt the transformation of the shipping industry by the legislation reformation.

Chinese Maritime safety administration as regulators of maritime safety and environmental pollution, should play its standardized management functions,

strengthen the guidance and promotion, make our country shipbuilding industry, shipping industry and related industries adapt to the new rules as soon as possible, and prepare for the mandatory compliance audit as I proposed in the paper.

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