PROPOSAL FOR the Alternative Fuel Vessel

Presented by SOx-Free, NOx-Free

INDEX

- Background
- Problem and Basis
- Proposal to IMO
- Conclusion

Particulate Matter less than 2.5 micrometres (PM2.5) emitted from dirty marine fuel oil causes poor air quality along shipping lanes. Emissions-Control Zones omit the ten largest container ports, which contribute an estimated 20% of worldwide port emissions of nitrogen oxides(Nox) and sulfur oxides(SOx)

Source : Nature (2016.02)

"THE DIRTY TEN"

Percentage of Vessel in Worldwide Emission

SOx

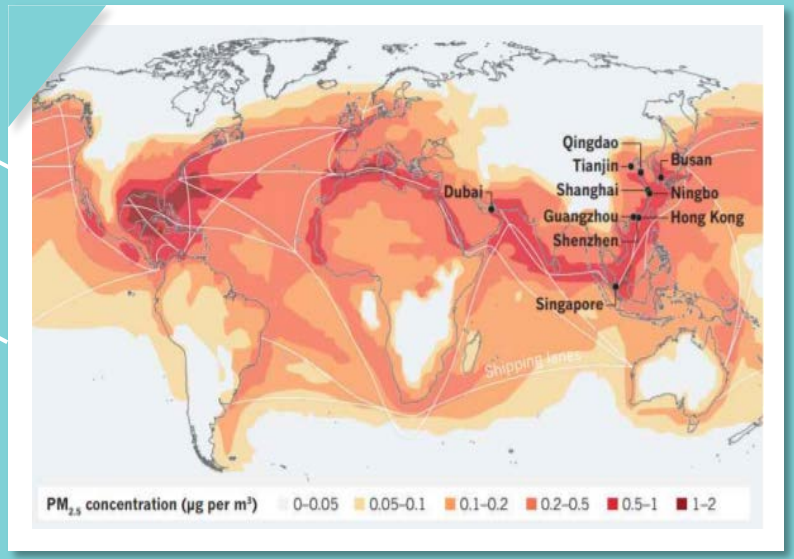
5~8%

NOx

15%

The concentration of ultrafine dust (PM2.5) is high around the world's major shipping routes.

Low-grade marine fuel oil contains 3,500 times more sulfur than road diesel.



Regulations must be made and strengthened Against the Emission of Vessels

The regulations for the Prevention of Emissions from Vessels

MARPOL 73/78 Annex VI

- SOx Regulation — Regulation 14.
- NOx Regulation — Regulation 13.
- ECA(Emission Control Area)

Tier	Ship construction date on or after	Total weighted cycle emission limit (g/kWh) n = engine's rated speed (rpm)		
		n < 130	n = 130 - 1999	n ≥ 2000
I	1 January 2000	17.0	$45 \cdot n^{(-0.2)}$ e.g., 720 rpm – 12.1	9.8
II	1 January 2011	14.4	$44 \cdot n^{(-0.23)}$ e.g., 720 rpm – 9.7	7.7
III	1 January 2016	3.4	$9 \cdot n^{(-0.2)}$ e.g., 720 rpm – 2.4	2.0

Outside an ECA established to limit SOx and particulate matter emissions	**Inside an ECA established to limit SOx and particulate matter emissions**
4.50% m/m prior to 1 January 2012	1.50% m/m prior to 1 July 2010
3.50% m/m on and after 1 January 2012	1.00% m/m on and after 1 July 2010
0.50% m/m on and after 1 January 2020*	0.10% m/m on and after 1 January 2015

"Implementation of the Global Sulphur limit!"

New Global Limit

0.5% m/m global limit of the sulfur content of fuel oil, which will come into effect from 1 January 2020.

How can ships meet lower Sulfur emission standards?

Method 1

Low Sulfur Fuel Oil

A method to refine the existing fuel containing a large amount of sulfur once more and make it less than 0.5%

Examples Maersk Line, etc

Method 2

Scrubbers

A method that uses the existing fuel and captures, removes SOx before they are released into atmosphere

Examples Hyundai Line, etc

Method 3

Alternative Fuel

Since alternative fuels essentially contain very little impurities, SOX, PM is rarely released

Examples No case

However, Only alternative fuels meet the Original Purpose of Regulation

Method 1.

Low Sulfur fuel oil

Method 2.

Scrubbers

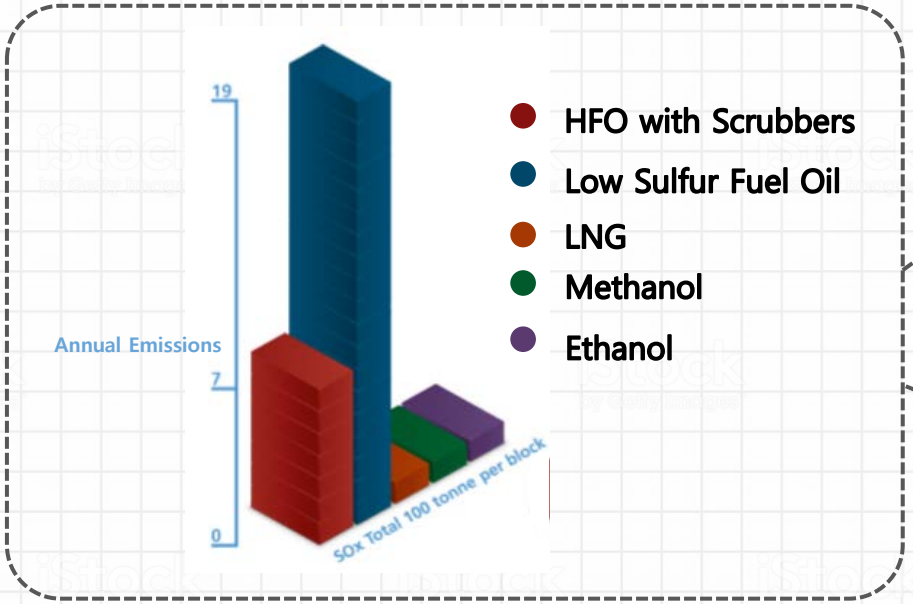
Alternative Fuel

The original purpose of the MARPOL 73/78 Annex VI is to make Vessel Emissions ZERO over the long term

Low Sulfur Fuel oil and Scrubber are only short-term alternatives to take action against the 2020 SOx regulation

For the original purpose, ' Alternative fuels ' should be used on Vessels

Why only alternative fuels meet the original purpose of Regulation



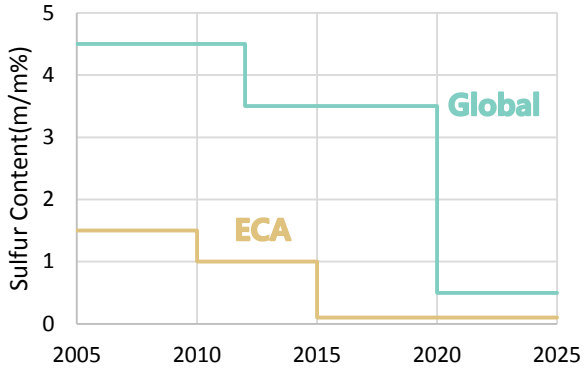
Compared to alternative fuels, scrubbers produce SOx 7 times and low sulfur fuel oil 19 times

Two methods of responding to the Regulation 14 can meet the conditions of 0.5 %, but SOx emissions are still significant.

- Scrubbers and Low Sulfur Fuel Oil consider only the 2020 regulation and these are short-term alternatives.

The two methods never fit original purpose of IMO

Increasingly strengthened Regulations



- MEPC 58, **revisions to progressively reduce pollutants.**
- Marine fuel sulfur content
- **Global: 4.5% → 3.5% → 0.5%**
  ECA: 1.5% → 1.0% → 0.1%

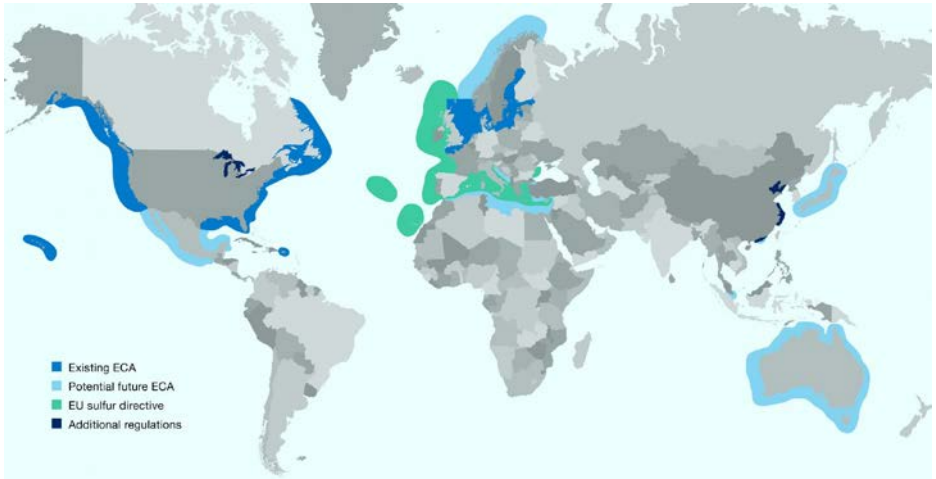
After 2020???

Expanding of ECA

2006 - the Baltic Sea area
2007 - the North Sea area
2014 - the North American area
the United States Caribbean Sea area
2019 - Circum-Bohai-Sea, Yangtze River Delta,
Pearl River Delta, China

Potential Future ECA

Australia, Japan, Korea, Mexico, and in the Mediterranean Sea.



Why only alternative fuels is the answer

Method 1.
Low Sulfur fuel

- The price of Low Sulfur Fuel (0.5 % sulfur) is 40 % to 60 % higher
- The Low Sulfur Fuel price will continuously rise along with regulations
- The use of Low Sulfur Fuel oil cause economic losses

Method 2.
Scrubbers

- Vessels have a very long life about 30 years
- The Sulfur regulation are revised twice during 13 years
- Scrubber cannot be a long-term solution

The two methods are not appropriate in the long term

Why only alternative fuels is the answer

Interview.

A1. The fundamental purpose of strengthening global SOx Cap regulation was to **gradually reduce the use of fossil fuels and encourage the use of alternative fuels** after 2020

A2. Scrubber and low-sulfur fuel have **limitations which meet only the Global SOx Cap regulations that begin in 2020.**

Reasons why the original purpose of regulation is not observed

→ Because the purpose is unclear

New Proposal — Add the 'Purpose of Legislation' on MARPOL Annex VI

ANNEX

REVISED MARPOL ANNEX VI

Regulations for the Prevention of Air Pollution from Ships

CHAPTER I

GENERAL

Regulation 1
Application

The provisions of this Annex shall apply to all ships, except where expressly provided otherwise in regulations 3, 5, 6, 13, 15, 16 and 18 of this Annex.

0. "In the long term, the vessel emission pollutants should be zero"

A detailed amendment is necessary to induce a New Direction

Regulation 10
Port State Control on Operational Requirements

1 A ship, when in a port or an offshore terminal under the jurisdiction of another Party, is subject to inspection by officers duly authorized by such Party concerning operational requirements under this Annex, where there are clear grounds for believing that the master or crew are not familiar with essential shipboard procedures relating to the prevention of air pollution from ships.

2 In the circumstances given in paragraph 1 of this regulation, the Party shall take such steps as to ensure that the ship shall not sail until the situation has been brought to order in accordance with the requirements of this Annex.

3 Procedures relating to the port State control prescribed in article 5 of the present Convention shall apply to this regulation.

4 Nothing in this regulation shall be construed to limit the rights and obligations of a Party carrying out control over operational requirements specifically provided for in the present Convention.

MEPC 58/23/Add.1
ANNEX 13
Page 13

New

+ in the ports where the number of LNG ships account for more than 10% of the total ships entering and leaving ports, it is mandatory to review and discuss the introduction of alternative fuel bunkering facilities.

+ By 2050, the portion of alternative fuel vessels should be over 50% of all vessels

The simultaneous regulation of Vessels and Ports → Can fulfill the original purpose of regulation

If there is a Clear Purpose of Regulation, it can make Win-Win relation between each other.

Regulator

- The regulator will be satisfied that the purpose of regulation can be correctly fulfilled

Win-Win

Regulated Subjects

- Do not come up the countermeasures in the short-term
- Know the future in advance and be able to act

The alternative fuel which is the most effective for reducing ship emission air pollutants

The Vessel Emission could be Zero

Thank You