IMO 모의총회
The IMO Model Assembly

Proposals for Effective Black Carbon Regulations to save the Arctic

Presented by

Thousand Sunny

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MEPC 70 : Phase Out of Heavy Fuel Oil in the Arctic

24-28 October 2016

Photo in IMO

"By recognising the threats of ***black carbon*** *emissions from heavy fuel oil, the IMO today took a massive step towards the phase out of HFO from shipping in Arctic waters.", said Clean Arctic Alliance advisor Dr Sian Prior.*

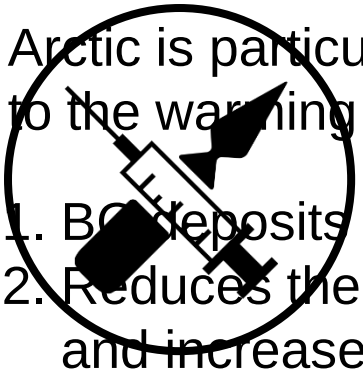
What is Black Carbon?

Black Carbon
strongly light absorbing carbonaceous material emitted as solid particulate matter created through incomplete combustion of carbon-based fuels.[1]

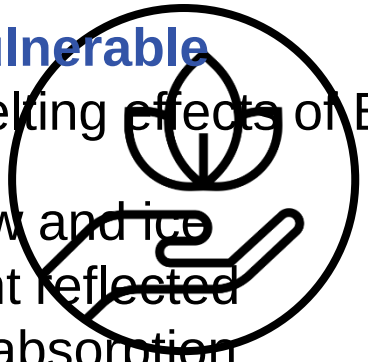
Climate

✖ Arctic is particularly **vulnerable** to the warming and melting effects of BC.

1. BC deposits on snow and ice
2. Reduces the sunlight reflected and increases heat absorption
3. Increases the rate of snow and ice melt



Human Health



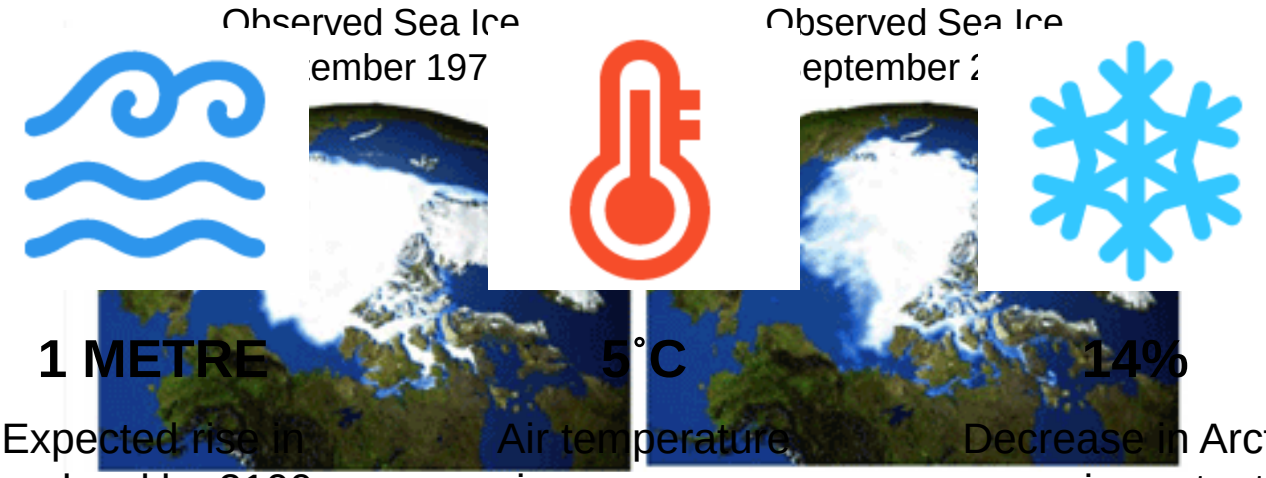
Environment

BC is a significant contributor to Arctic Warming

[1] The Institute of Marine Engineering, Science and Technology

Arctic Warming

The Arctic is warming faster than the rest of the world.



1 METRE

Expected rise in sea level by 2100, due to ice melt

5˚C

Air temperature increase over the last 100 years

14%

Decrease in Arctic sea ice extent since the 1970s

Impacts of Warming Arctic [2]

In 2012, Arctic summer sea ice is expected to **disappear completely** [4]

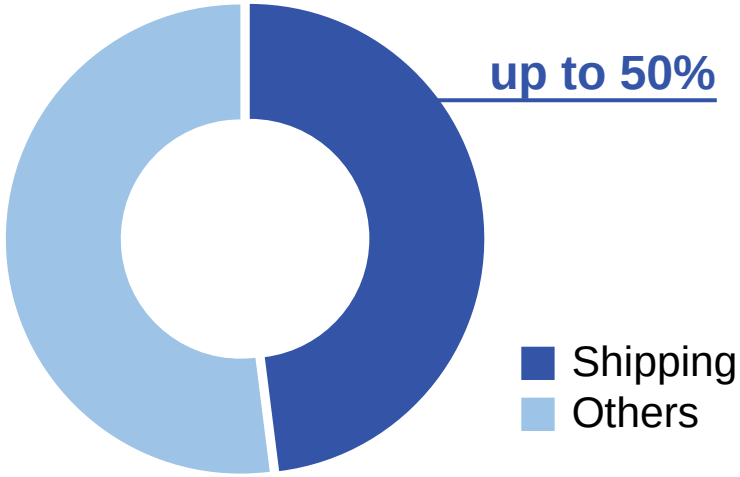
In 2080, Arctic summer sea ice is expected to **its lowest extent** in the satellite record since 1979. [3]

[2] Arctic Climate Impacts Assessment, 2004
[3] wwf.panda.org/what_we_do/where_we_work//arctic/what_we_do/climate/

Where is Black Carbon from?

- Shipping potentially contributes up to 50% of BC in some regions of the Arctic.[4]

[BC emissions in the Arctic]



Arctic shipping vessels shall be regulated

[4] Dalsøren, S. B., Samset, 2012, *Environmental impacts of shipping in 2030 with a particular focus on the Arctic region*, Atmos. Chem. Phys. Discuss.

Black Carbon and IMO

The Polar Code is expected to enter into force on 1 January 2017.

the International Code for Ships Operating in Polar Waters

- *Ships **are encouraged** not to use or carry heavy fuel oil in the Arctic.*
- *There is **no regulation** about Black Carbon on the Polar Code.*
- *Not only on the Polar Code but also on **MARPOL**, there are not many of regulations about Arctic.*

How to measure

MEPC 68/3/5
Page 2

2 It is vital for the Russian Federation to preserve the existing climate conditions in the Arctic. Considerable growth of ambient temperature will result both in serious changes in the environmental conditions of most part of the polar territories of the Russian Federation that make up about half of Russia, and resulting in huge economic losses caused by the destruction of the permanent frost. Loss of permanent frost will cause the destruction of towns and industrial facilities constructed in the Arctic on the permanent frost, also gas pipelines as well as other infrastructure including shipping infrastructure in the Arctic. With this in view, special research centres have performed a study of problems potentially affecting climate change including those of Black Carbon emissions from transport ships in the Russian Arctic, i.e. where world shipping in ice conditions is mostly performed. Based on the outcome of this research, measures to prevent the negative impact on climate change in the Arctic of various factors are to be prioritized and that priority assessed for the preventive measures taken by the Russian Federation both nationally and internationally.

Amount of Black Carbon emissions from ships in the Arctic

3 A number of documents submitted to MEPC and the PPR Sub-Committee have provided an assessment of Black Carbon emissions from shipping in the Arctic, and its impact on the rate of ice and snow melting and consequently climate change. Black Carbon emissions in the above assessments vary between 1,000 and 3,000 tonnes per year. It is noted that the most active shipping and the biggest Black Carbon emissions occur in the North-East Atlantic and the western Barents Sea, the areas with virtually no ice present. Ice navigation is mostly done by the Russian Federation from the ports of Archangelsk and Murmansk by the Northern Sea Route to the ports of Sabetta and Dudinka, in the estuaries of the Ob and Yenissei rivers, respectively. No information was provided, however, on Black Carbon emissions in this area.

4 The Russian Federation has carried out an assessment of the Black Carbon amount emitted from ships in the Arctic region where cargoes are transported in ice conditions. It was based on the actual data on the main and auxiliary diesel propulsion power, fuel consumption, duration of the voyage, stays in ports and the distance sailed. It was demonstrated that in 270 days of ice navigation, about 21 tonnes of Black Carbon are emitted from ships in total. This also includes emissions from ships in transit in the Arctic, as in some cases they navigate in high latitudes where ice is likely to be encountered. Ice conditions were meant to be those where ice concentration exceeds 10%, such conditions may be encountered during approximately 270 days a year. The open water period, mid-July to mid-October, is about 90 days long. The Black Carbon amount emitted from ships is not likely to change significantly over the next 10 years, as shipping intensity is not likely to grow more than twice in that period.

Black Carbon distribution in the Arctic and its impact on albedo and temperature change in the Arctic

5 In document MEPC 60/4/24, the impact of the Black Carbon emissions from ships on the rate of ice and snow melting in the North-East Atlantic and the western Barents Sea is estimated as 1% to 3%. Given that the emissions took place in ice free areas, the climate change impact can only be explained by the fact that the Black Carbon emissions were transferred by air over a distance of thousands of miles.

6 It says in the reports of the Arctic Council Task Force on Short-Lived Climate Forcers and the Arctic Council Task Force for Action on Black Carbon and Methane that the main Black Carbon sources are big forest fires, shore plants and waste incineration, etc. Shipping, in their opinion, is only making a small contribution to the Black Carbon emissions in the Arctic and therefore to climate change.

https://edocs.imo.org/Final Documents/English/MEPC 68-3-5 (E).docx

[5] MEPC 68/3/5, 2011

*"Black Carbon emissions in the above assessments **vary** between 1,000 and 3,000 tonnes per year."* [5]

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An integrated BC meas

Difficult to inter-compare results obtained with different instruments

Switching Fuel

HFO → **Low Sulphur Distillates**

a fuel used almost exclusively in the marine shipping sector

a fuel with a Sulphur content of below 0.5%

- would result in BC reductions between 30% and 80%.[6]

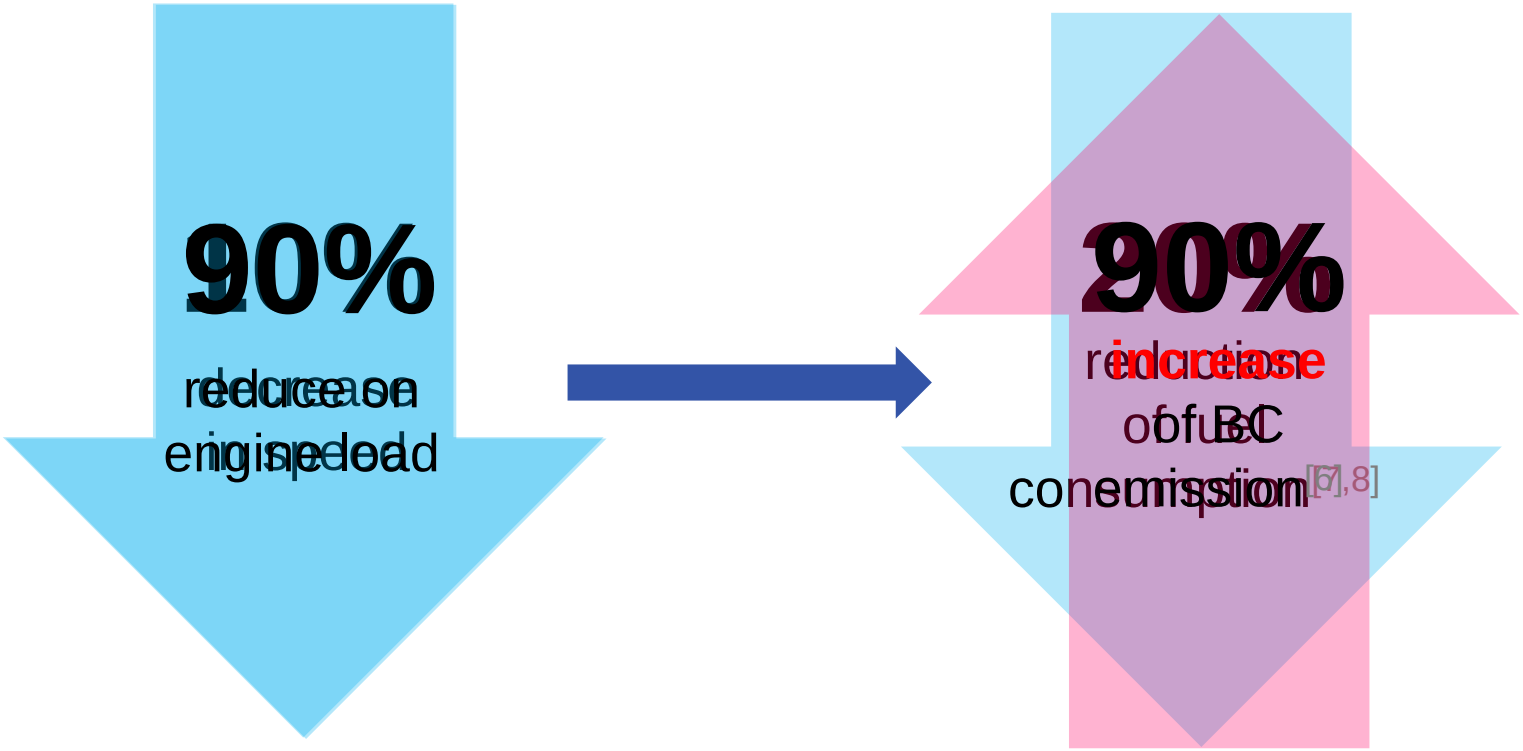
Ban on the use of Heavy Fuel Oil

[6] Lack, D. A. and Corbett, J. J., 2012, *Black Carbon from Ships: A Review of the Effects of Ship Speed, Fuel Quality and Exhaust Gas Scrubbing*

Slow Steaming

Slow Steaming

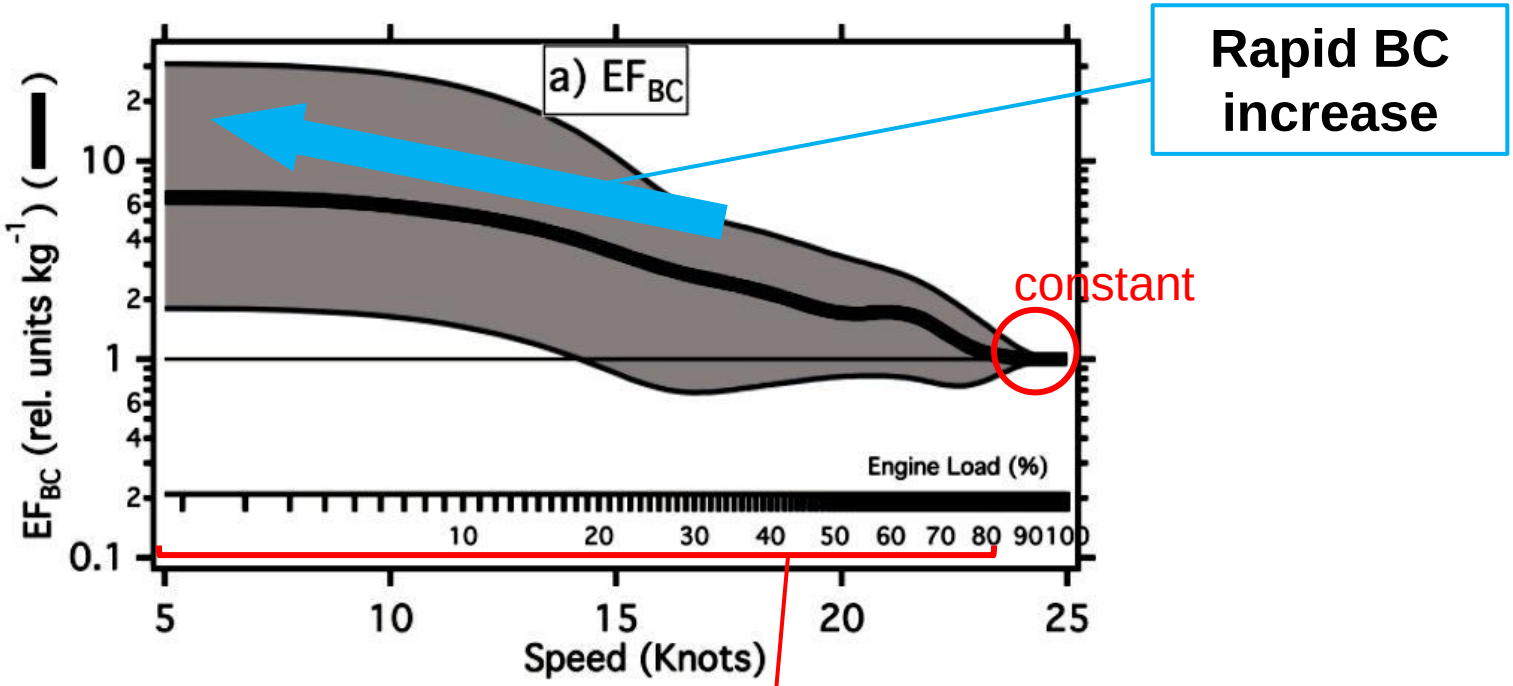
A reduction from full ship speed to a lower speed



[7] Faber, J., Nelissen, D., Hon, G., Wang, H. and Tsimplis, M., (2012)
[8] Maersk, 2010, *Slow Steaming Here to Stay*.

Slow Steaming

A reduction from full ship speed to a lower speed



BC mass changes per distance travelled as a function of vessel speed.[6]

Engine Load < 80%

[7] Faber, J., Nelissen, D., Hon, G., Wang, H. and Tsimplis, M., (2012)
[8] Maersk, 2010, *Slow Steaming Here to Stay*.

Slow Steaming + De-rating

- **Slow Steaming + De-rating / Re-Tuning**

  Re-tuning / De-rating of engines
  → provide ideal combustion at all loads

- This can counteract the significant increase in BC emissions caused by operation of engines at lower loads.[9]

- Slide valves as alternatives of de-rating/re-tuning

The technologies mentioned above for reducing BC emissions at low loads shall be onboard

[9] IMO, 2015, "Investigation of appropriate control measures(abatement technologies)to reduce Black Carbon emissions from international shipping"

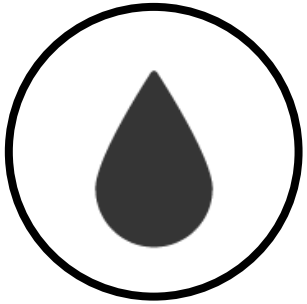
Additional Abatement Tech.

Diesel Particulate Filter (DPF)

traps the PM prior to exhaust emission by using filters

Scrubber

scrubs the exhaust to remove gas and particle pollutants

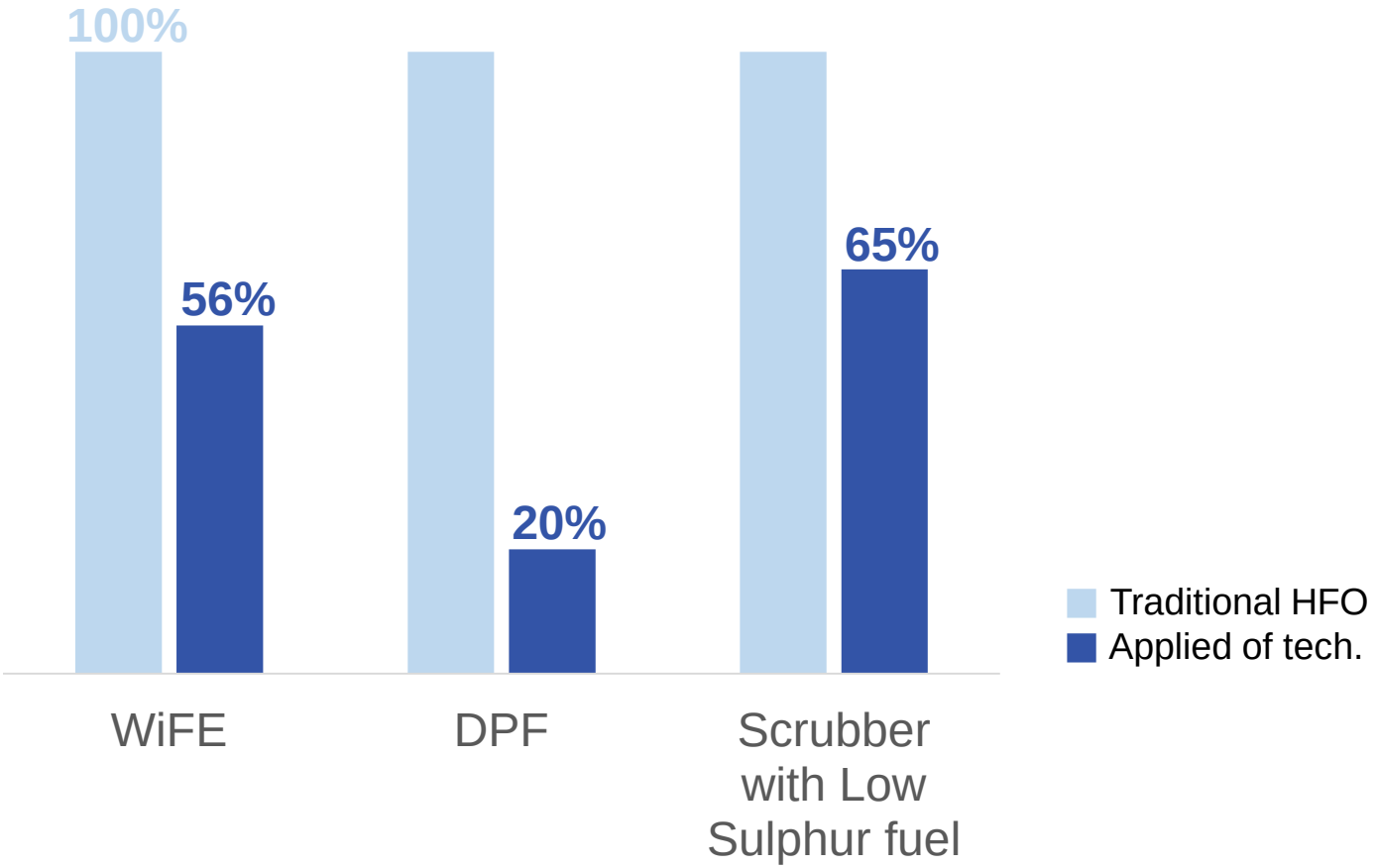


Water-in-Fuel Emulsion (WiFE)

improves combustion by mixing water into fuel

BC Reduction by technologies

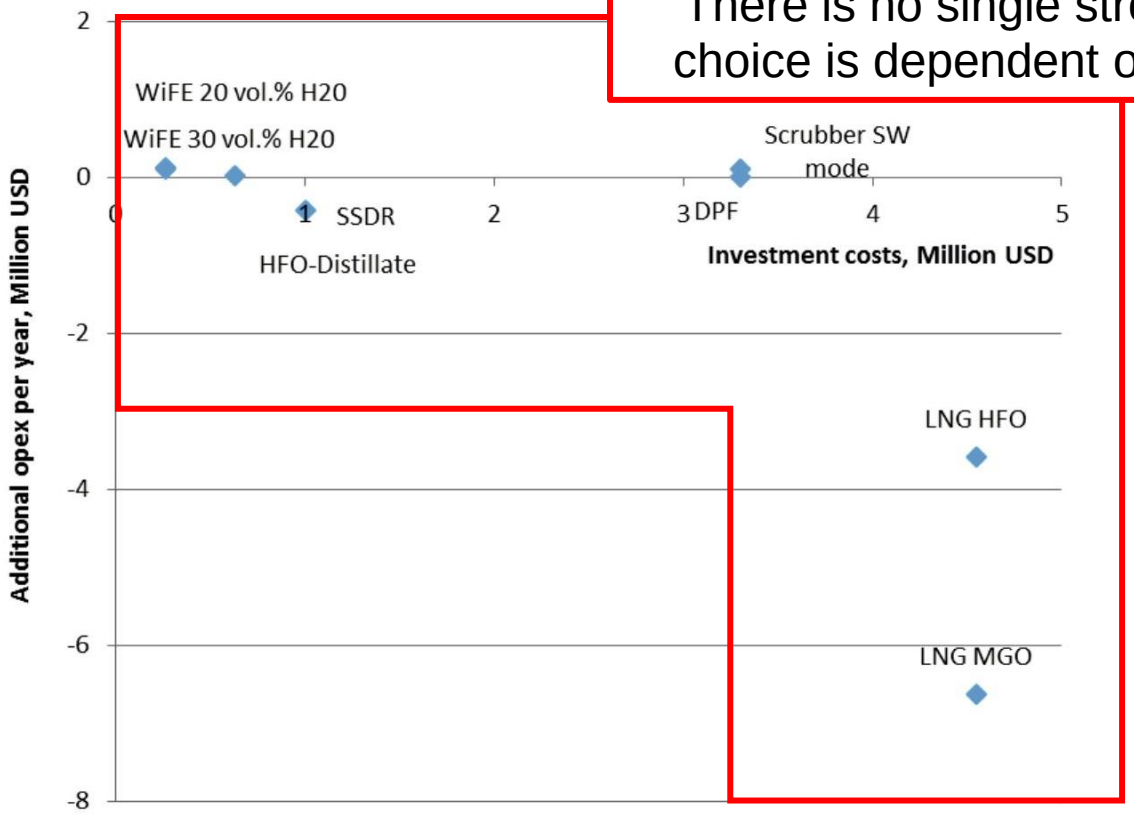
[BC Reduction][9]



[9] IMO, 2015, "Investigation of appropriate control measures(abatement technologies)to reduce Black Carbon emissions from international shipping"

Cost-Effectiveness

There is no single strong technology, choice is dependent on **operators** [9]



At least one of the technologies mentioned above is highly recommended

[9] IMO, 2015, "Investigation of appropriate control measures(abatement technologies)to reduce Black Carbon emissions from international shipping"

Our Proposals to IMO

03

Ban on the use of HFO

Mandatory Regulation on BC emissions

Strongly recommend applying equipment
or technologies which can reduce BC emissions

Set a limit on engine loads
while ships operating in Arctic area

Amendments to MARPOL ANNEX I

03

AMEDMENTS TO MARPOL ANNEX I TO ADD CHAPTER 10 – SPECIAL REQUIREMENTS FOR THE USE OF OILS IN ARCTIC AREA

A new chapter 10 is added as follows:

"CHAPTER 10 – SPECIAL REQUIREMENTS FOR THE USE OF OILS IN THE ARCTIC AREA"

Regulation 43
Special requirements for the use of oils in the Arctic area

1 With the exception of vessels engaged in securing the safety of ships or in a search and rescue operation, the use as fuel of the following:

.1 crude oils having a density at 15˚C higher than 900 kg/m^3,
.2 oils, other than crude oils, having a density at 15˚C higher than 900 kg/m^3 or a kinematic viscosity at 50˚C higher than 190 mm^2/s; or
.3 bitumen, tar and their emulsions,

shall be prohibited in the Arctic area, as defined in Annex I, regulation 46.2.

2 When prior operations have included the carriage or use of oils listed in paragraphs 1.1 to 1.3 of this regulation, the cleaning or flushing of tanks or pipelines is not required.

- Call for Arctic HFO ban at MEPC 71

Amendments to MARPOL ANNEX VI

03

AMEDMENTS TO MARPOL Annex VI TO ADD
Regulation 20 – BLACK CARBON

A new regulation is added as follows:

"Regulation 20 – BLACK CARBON"

Regulation 20

Black Carbon (BC)

Requirements for control Black Carbon emissions from ships

(1). The Black Carbon emissions from ships operating in Arctic Area shall be monitored taking into account guidelines to be developed by the Organisation.

(2). The Black Carbon emissions from ships shall be reduced to [redacted].

(3). With the exception of vessels engaged in ice breaking, securing the safety of ships or in a search and rescue operation, the engine loads of ships operating in Arctic Area shall be upper than [redacted].

(4). For the purpose of this regulation, BC Emission Control Area shall include:

(a). the Arctic area as defined in Annex I, regulation 46.2; and

(b). [redacted]

- Set a deadline and decide how much BC emissions shall be reduced
- Set a lower limit on engine load
- BC Emission Control Areas

Amendments to MARPOL ANNEX VI

(5). While ships are in Arctic Area, the following condition shall be fulfilled:

(a). the BC emissions does not exceed [ ];

(6). While ships are in Arctic Area, at least one of the following conditions is recommendatory to be fulfilled:

(a). a Water-in-Fuel Emulsion system, approved by the Administration taking into account guidelines to be developed by the Organisation, is applied to reduce the total emissions of BC from ships.

(b). a scrubber system, approved by the Administration taking into account guidelines to be developed by the Organisation, is applied to reduce the total emissions of BC from ships.

(c). a Diesel Particulate Filter, approved by the Administration taking into account guidelines to be developed by the Organisation, is applied to reduce the total emissions of BC from ships.

(d). Any residues from the use of such equipment described in sub-paragraph (6)(a), (6)(b) and (6)(c) shall not be discharged into enclosed ports, harbours and estuaries unless it can be thoroughly documented by the ship that such waste streams have no adverse impact on the ecosystems of such enclosed ports, harbours and estuaries, based upon criteria communicated by the authorities of the port State to the Organization. The Organization shall circulate the criteria to all Parties to the Convention; or

(e). any other technological method that is verifiable and enforceable to limit BC emissions to a level equivalent to that described in subparagraph (a), (b), or (c) is applied. These methods shall be approved by the Administration taking into account guidelines to be developed by the Organisation.

- Set an integrated measurement and the standard to limit BC emissions

Amendments to MARPOL ANNEX VI

(7). While ships are operating at engine load below [ ] in Arctic area, at least one of the following conditions shall be fulfilled:

A

(a). ships shall be re-tuning or de-rating engines, approved by the Administration taking into account guidelines to be developed by the Organisation, for the purpose of providing ideal combustion at all loads and reducing the total amount of BC from ships.

(b). a slide valve, approved by the Administration taking into account guidelines to be developed by the Organisation, is applied to ships that re-tuning or de-rating is not available, to provide ideal combustion at all loads and reduce the total amount of BC from ships.

(c). any other technological method that is verifiable and enforceable to limit BC emissions to a level equivalent to that described in subparagraph (a), or (b) is applied. These methods shall be approved by the Administration taking into account guidelines to be developed by the Organisation.

A B

(7.1). While ships are operating at engine load between [ ] and [ ] in Arctic area, at least one of the following conditions is recommendatory to be fulfilled:

- Set limits on engine load in Arctic area

- Make one of the technologies compulsory if the engine load goes below A
- One of the technologies is recommendatory if the engine load goes between A and B

Conclusion

References

[1] The Institute of Marine Engineering, Science and Technology

[2] Dalsøren, S. B., Samset, 2012, Environmental impacts of shipping in 2030 with a particular focus on the Arctic region, Atmos. Chem. Phys. Discuss

[3] Arctic Climate Impacts Assessment, 2004

[4] wwf.panda.org/what_we_do/where_we_work//arctic/what_we_do/climate/

[5] MEPC 68/3/5, 2011

[6] Lack, D. A. and Corbett, J. J., 2012, Black Carbon from Ships: A Review of the Effects of Ship Speed, Fuel Quality and Exhaust Gas Scrubbing

[7] Faber, J., Nelissen, D., Hon, G., Wang, H. and Tsimplis, M., 2012, Regulated Slow Steaming in Maritime Transport: An Assessment of Options, Costs and Benefits.

[8] Maersk, 2010, Slow Steaming Here to Stay.

[9] IMO, 2015, “Investigation of appropriate control measures(abatement technologies)to reduce Black Carbon emissions from international shipping”

Thank you!