

IMO Strategy on Reduction of GHG Emissions from Ships



November 1, 2019

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Active Shipbuilding Experts' Federation(ASEF)**

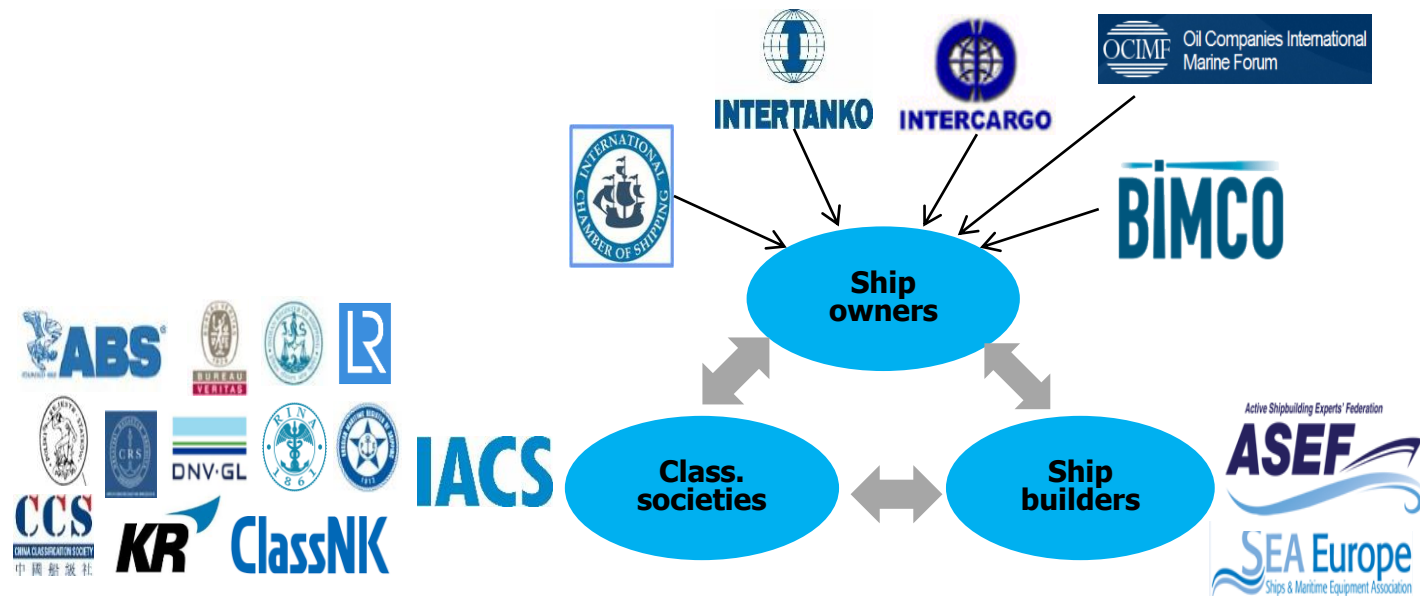


**Greta Thunberg,
Climate Action Summit 2019, UN
(2019-9-23)**



ASEF (Active Shipbuilding Experts' Federation)

- Started as 'Asian Shipbuilding Experts' Forum' in 2007
- Launched as an international organization representing shipbuilding industry in 2015
- Granted consultative status (NGO) with IMO in 2017



Tripartite in the Maritime Industry

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BACKGROUND

- **Stockholm Agreement (1972)**
 - UNEP (United Nations Environment Programme)
- **UNFCCC* (1992) / Tokyo Protocol(1997) / Paris Agreement(2015)**
 - IPCC** , COP***
- **UN Agenda 2030 for Sustainable Development / SDG 13:**

“Take urgent action to combat climate change and its impacts”
- **IMO Strategic Plan (2018-2023) / SD 3:**

“Respond to Climate Change”

* UNFCCC (UN Framework Convention on Climate Change)

** IPCC (International Panel on Climate Change)

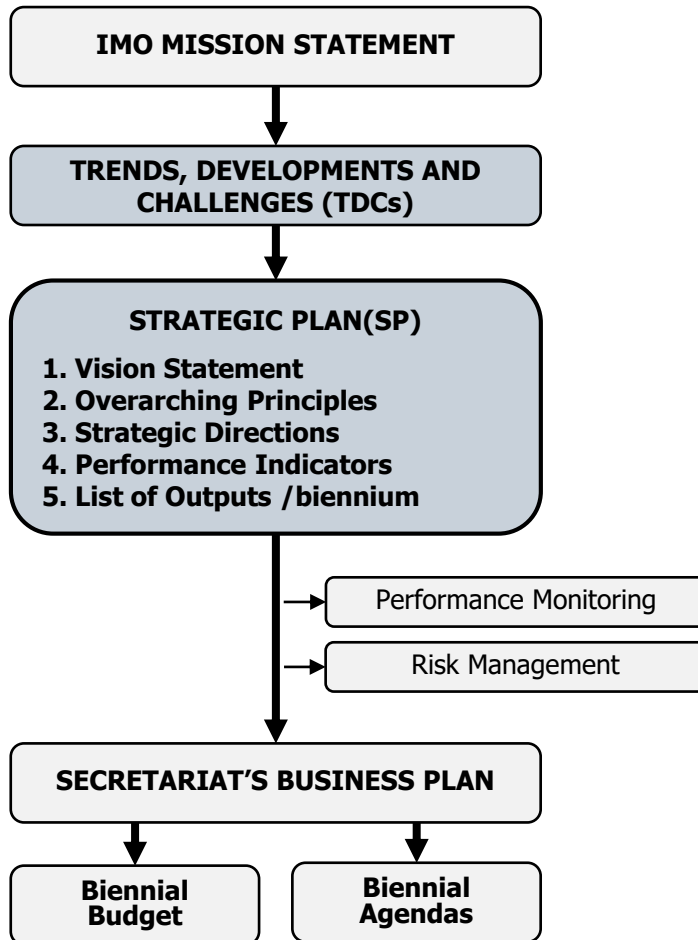
*** COP (Conference of Parties)

✳ UN AGENDA 2030: SDGs



❖ IMO Strategic Plan (2018-2023)

(IMO Resolution A.1110/A.1111(30))



- Mission Statements
- Vision Statements
- Overarching Principles
- Strategic Directions(SDs):
 - SD1 Improve implementation
 - SD2 Integrate new technologies in the regulatory framework
 - SD3 Respond to climate change
 - SD4 Engage in ocean governance
 - SD5 Enhance global facilitation of international trade
 - SD6 Ensure regulatory effectiveness
 - SD7 Ensure organizational effectiveness
- Performance Indicators
- List of Outputs (biennium)

Discussions at IMO

- **Assembly 23 (2003)**
 - Adoption of IMO policies and practices on GHG / A.963(23)
- **MEPC 62 (2011.7)**
 - Amendment of MARPOL Annex VI Ch.4(EEDI, SEEMP) / MEPC.203(62)
- **MEPC 70 (2016.10)**
 - Approval of Roadmap for GHG Strategy
- **MEPC 72 (2018.4)**
 - Adoption of IMO Initial strategy / MEPC.304(72)
- **MEPC 73 (2018.10)**
 - Program of Follow-up Actions
- **MEPC 74 (2019.5)**
- ...
 - ※ IMO GHG Studies (1-3, **4**)
 - ※ ISWG-GHG (1-4, **5, 6**)
 - ※ CG on EEDI Phase 4



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IMO GHG Initial Strategy

(Resolution MEPC.304(72))

- **Vision**
- **Levels of Ambition**
- **Guiding principles**
- **List of candidate measures with timelines:**
 - Short-term measures (2018 ~ 2023)
 - Mid-term measures (2023 ~ 2030)
 - Long-term measures (2030 ~)
- **Barriers and supportive measures**
- **Follow-up actions towards the development of the revised Strategy**
- ...

Vision

“IMO remains committed to reducing GHG emissions from international shipping and, as a matter of urgency, aims to phase them out as soon as possible in this century.”

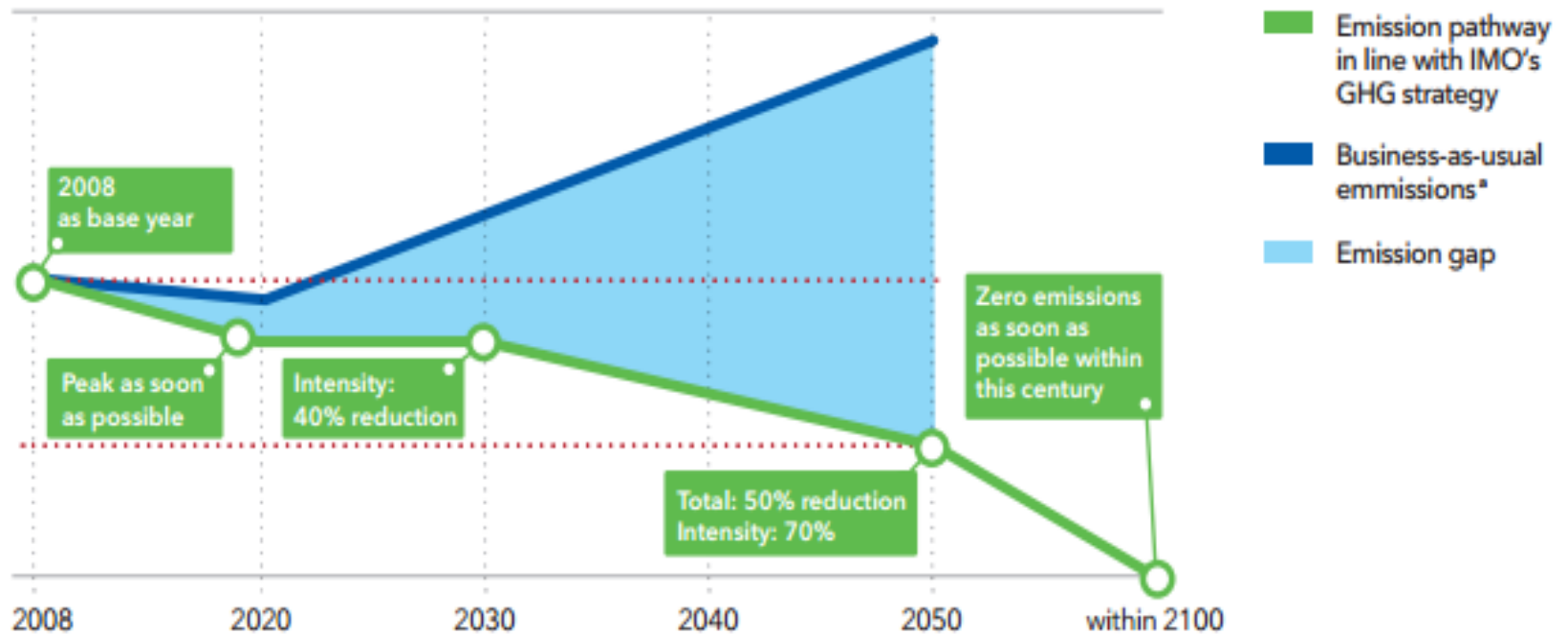


Levels of Ambition

- **Carbon intensity of the ship to decline through implementation of further phases of the energy efficiency design index (EEDI) for new ships**
to review with the aim to strengthen the energy efficiency design requirements for ships with the percentage improvement for each phase to be determined for each ship type, as appropriate;
- **Carbon intensity of international shipping to decline to reduce CO2 emissions per transport work**, as an average across international shipping, by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008; and
- **GHG emissions from international shipping to peak and decline**
to peak GHG emissions from international shipping as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out as called for in the Vision as a point on a pathway of CO2 emissions reduction consistent with the Paris Agreement temperature goals.

※ IMO GHG Strategy

Units: GHG emissions



Total: Refers to the absolute amount of GHG emissions from international shipping.

Intensity: Carbon dioxide (CO₂) emitted per tonne-mile.

^{a)}Note that the the bussiness-as-usual emissions are illustrative, and not consistent with the emissions baseline used in our modelling (Chapter 6).

Source: Energy Transition Outlook 2019 (DNV-GL)

List of Candidate Measures

Timeline	Short term (2018~2023)	Mid-term (2023~2030)	Long-term (2030 ~)
Candidate Measures	<ul style="list-style-type: none"> • <u>Improvement of the existing energy efficiency framework with a focus on EEDI and SEEMP</u> • <u>Development of technical and operational energy efficiency measures</u> • Establishment of an Existing Fleet Improvement Programme • Use of speed optimization and speed reduction • <u>Measures to address emissions of methane and Volatile Organic Compounds</u> • Development and update of NAPs • Measures to encourage port developments • <u>R&D activities addressing marine propulsion, alternative low-carbon and zero-carbon fuels, and innovative technologies</u> • Incentives for first movers to develop and take up new technologies • ... 	<ul style="list-style-type: none"> • <u>Implementation programme for the effective uptake of alternative low-carbon and zero-carbon fuels</u> • Operational energy efficiency measures for both new and existing ships including indicators in line with three-step approach • Further continue and enhance technical cooperation and capacity-building activities such as under the ITCP • Development of a feedback mechanism • ... 	<ul style="list-style-type: none"> • <u>pursue the development and provision of zero-carbon or fossil-free fuels</u> to enable the shipping sector to assess and consider decarbonization in the second half of the century • Encourage and facilitate the general adoption of other possible new/innovative emission reduction mechanism(s).

Program of Follow-up Actions

(MEPC 73/wp.5, Annex)

Streams of activity	2018	2019	2020		2021	2022		2023
	MEPC 73	MEPC 74	MEPC 75	MEPC 76	MEPC 77	MEPC 78	MEPC 79	MEPC 80
<i>Candidate short-term measures (Group A) that can be considered and addressed under existing IMO instruments²</i>	Invite concrete proposals	Consideration of proposals	Consideration and decisions on candidate short-term measures that can be considered and addressed under existing IMO instruments e.g. further improvement of the existing energy efficiency framework with a focus on EEDI and SEEMP, ITCP ³					
<i>Candidate short-term measures (Group B) that are not work in progress and are subject to data analysis</i>	Invite concrete proposals	Consideration of proposals	Consideration and decisions on candidate short-term measures that are not work in progress and are subject to data analysis, consistent with the Roadmap ³					
<i>Candidate short-term measures (Group C) that are not work in progress and are not subject to data analysis</i>	Invite concrete proposals	Consideration of proposals	Consideration and decisions on candidate short-term measures that are not work in progress and are not subject to data analysis e.g. National Action Plans guidelines, lifecycle GHG/carbon intensity guidelines for fuels, research and development ³					
<i>Candidate mid-/long-term measures and action to address the identified barriers</i>	Invite concrete proposals	Consideration of proposals including identification of barriers and action to address	Progress made and timelines agreed on the development of mid- and long-term measures					
<i>Impacts on States⁴</i>	Invite concrete proposals	Finalization of procedure	Measure-specific impact assessment, as appropriate, consistent with the Initial Strategy, in particular paragraphs 4.10 to 4.13					
<i>Fourth IMO GHG Study</i>	Scope	Initiation of the Study	Progress report	Final report				
<i>Capacity-building, technical cooperation, research and development</i>		Development and implementation of actions including support for assessment of impacts and support for implementation of measures						
<i>Follow-up actions towards the development of the revised Strategy</i>		Ship fuel oil consumption data collection pursuant to regulation 21.A of MARPOL Annex VI (DCS)	Initiation of revision of the Initial Strategy taking into account IMO DCS data and other relevant information			Adoption of revised Strategy		

² Includes ongoing work pursuant to regulation 21.6 of MARPOL Annex VI.

³ "In aiming for early action, the timeline for short-term measures should prioritize potential early measures that the Organization could develop, while recognizing those already adopted, including MARPOL Annex VI requirements relevant for climate change, with a view to achieve further reduction of GHG emissions from international shipping before 2023" (paragraph 4.2 of the Initial Strategy).

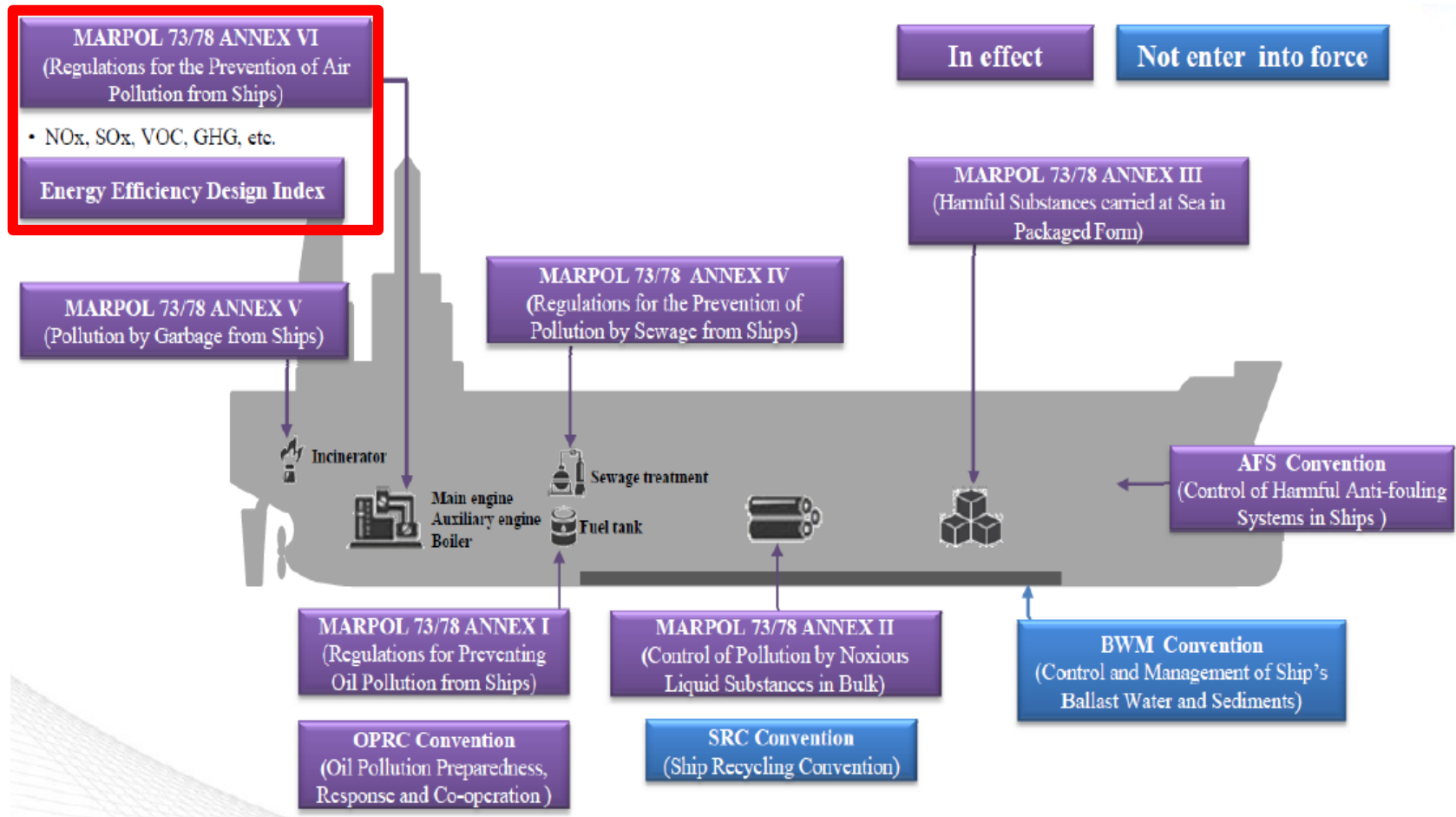
⁴ Assessment of impacts on States to be undertaken in accordance with the procedure to be developed by the Organization.

※ Identified Approaches to Candidate Measures

No	Approaches	Remarks
1	Improvement of the energy efficiency of existing ships on EEDI framework	<i>EEXI</i>
2	Further development of the EEDI framework for new ships* - for non-conventional propulsion - <u>further EEDI phases and rates</u>	<i>EEDI</i>
3	Improvement of the energy efficiency of existing ships building on SEEMP framework	<i>SEEMP</i>
4	Identification of appropriate operational energy efficiency indicators	<i>EEOI</i>
5	Development of a speed optimization and speed reduction mechanism	
6	Development of regulatory measures to reduce methane slip*	
7	Development of regulatory measures to reduce emissions of Volatile Organic Compounds (VOCs) *	
8	Encourage the development of National Action Plans (NAPs)	
9	Encourage port developments and activities to facilitate reduction of GHG emissions from shipping	
10	Initiate and support research and development activities*	
11	Encourage incentive schemes for first movers	
12	Development of lifecycle GHG/carbon intensity guidelines for all types of fuels	
13	Implementation programme for the effective uptake of alternative low-carbon and zero-carbon fuels*	
14	New/innovative emission reduction mechanism	

(based on Documents submitted to ISWG-GHG 5 and MEPC 74: Ref. MEPC 74/WP.6 Annex 5)

❖ IMO Instruments for Environment Protection



※ Steps/time frame for short-term measures

(development of an amendment to MARPOL Annex VI expected to enter into force on 1 January 2023 at the latest)

Time frame	Example 1	Example 2	Associated work	Impacts on States
Autumn 2019	ISWG-GHG 6 initiates development of draft amendment	ISWG-GHG 6 initiates development of draft amendment	Update or development of guidelines, as appropriate	Assessment of impacts on States
Spring 2020	MEPC 75 further develops draft amendment	MEPC 75 approves amendment		
Autumn 2020	MEPC 76 approves amendment	MEPC 76 adopts amendment		
Spring 2021 (at least six months later)	MEPC 77 adopts amendment			
Autumn 2021		Acceptance		
Beginning 2022 (at least 10 months later)	Acceptance			
Mid 2022		Entry into force		
End of 2022 (six months later)	Entry into force			



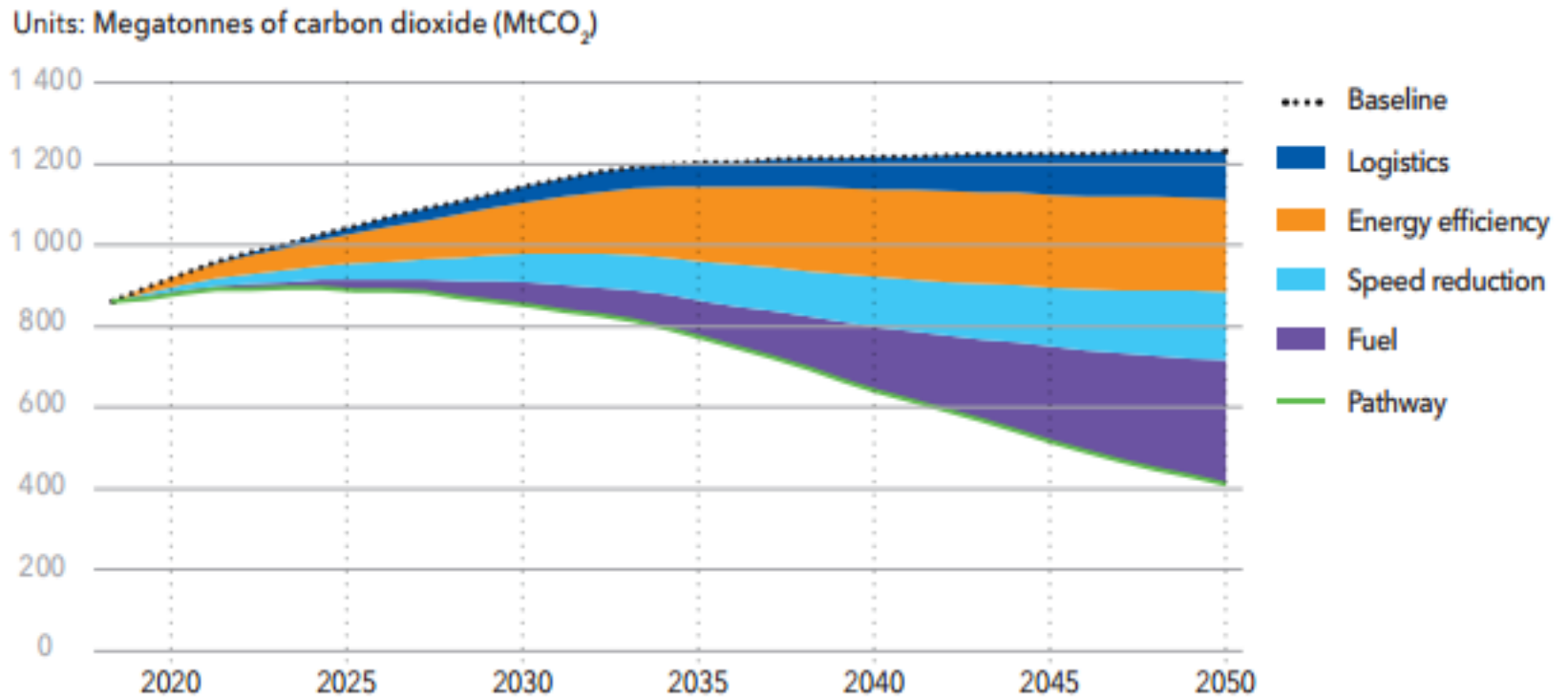
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Approaches to GHG Reduction

Approach	Type of Measure	Main Measures	Remarks
Technical approach	Improving energy efficiency	<ul style="list-style-type: none"> • Light materials • Slender design • Propulsion improvement devices • Less friction (air lubrication/hull surface) • Waste heat recovery, ... 	EEDI
	Alternative/ New fuels	<ul style="list-style-type: none"> • Sustainable bio fuels • LNG • Hydrogen • Amonia • Fuel cell • Electricity • Solar • Wind • Nuclear, ... 	EEDI (?)
Operational approach	Improving operational practices	<ul style="list-style-type: none"> • Speed optimization • Ship size • Ship-port interface • Onshore power, ... 	SEEMP
Market based approach		<ul style="list-style-type: none"> • ETS (Emission Trading Scheme) • EIS(Efficiency Incentive Scheme) • GHG Fund, ... 	MBM

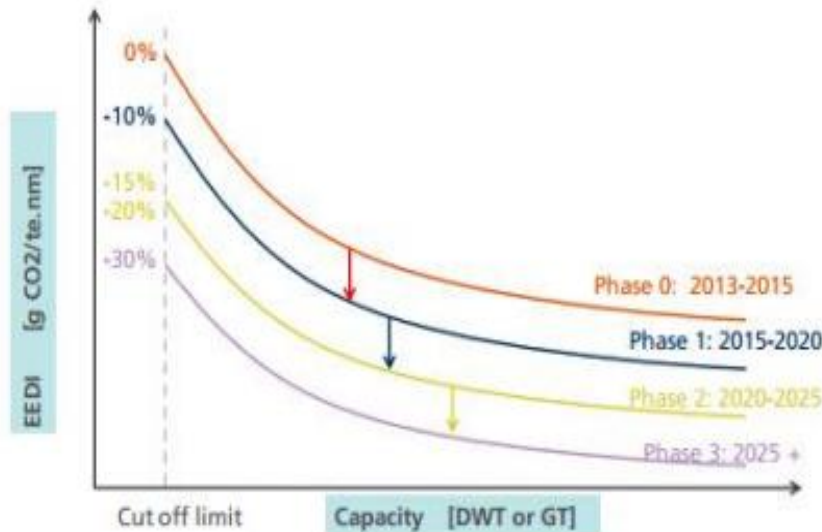
※ Emissions reduction by measure



Source: MEPC ISWG-GHG 6/7 (Norway)

EEDI (Energy Efficiency Design Index)

● MARPOL Annex VI Ch.4/MEPC.203(62)



$$\left(\prod_{i=1}^M f_i \right) \left(\sum_{i=1}^{M+1} P_{ME(i)} \cdot C_{ME(i)} \cdot SFC_{ME(i)} \right) + (P_{AE} \cdot C_{AE} \cdot SFC_{AE}^*) + \left(\left(\prod_{i=1}^M f_i \cdot \sum_{j=1}^{M+1} P_{PT(j)} \right) \sum_{i=1}^{M+1} f_{PT(i)} \cdot P_{AEff(i)} \right) C_{AE} \cdot SFC_{AE} - \left(\sum_{i=1}^{M+1} f_{PT(i)} \cdot P_{AEff(i)} \cdot C_{AE} \cdot SFC_{AE}^* \right)$$

(C) Emission reduction through the auxiliary power reduction by generating electricity for normal maximum sea load (P_{AEff})

(B) Emission reduction through the propulsion power reduction (P_{eff})

(A) The combination of P_p and V_{ref} as reflected in the power curve (knot-kW curve)

● EEDI Phase 4?

Innovative Energy Efficiency Technologies				
Reduction of Main Engine Power			Reduction of Auxiliary Power	
Category A	Category B-1	Category B-2	Category C-1	Category C-2
Cannot be separated from overall performance of the vessel	Can be treated separately from the overall performance of the vessel		Effective at all time	Depending on ambient environment
	$f_{eff} = 1$	$f_{eff} < 1$	$f_{eff} = 1$	$f_{eff} < 1$
<ul style="list-style-type: none"> - low friction coating - bare optimization - rudder resistance - propeller design 	<ul style="list-style-type: none"> - hull air lubrication system (air cavity via air injection to reduce ship resistance) (can be switched off) 	<ul style="list-style-type: none"> - wind assistance (sails, Flettner-Rotors, kites) 	<ul style="list-style-type: none"> - waste heat recovery system (exhaust gas heat recovery and conversion to electric power) 	<ul style="list-style-type: none"> - photovoltaic cells

Category of innovative technology (MEPC.1/Circ.815)

INDUSTRY'S VIEW



E

MARINE ENVIRONMENT PROTECTION
COMMITTEE
74th session
Agenda item 5

MEPC 74/5/6
8 February 2019
Original: ENGLISH

AIR POLLUTION AND ENERGY EFFICIENCY

EEDI Reduction beyond phase 2 – Consideration of technical issues affecting future evolution of the EEDI regulation and decarbonising shipping

Submitted by ICS, ITF and ASEF

SUMMARY

Executive summary: The co-sponsors call the attention of the Committee to a range of technical issues and challenges which will need to be considered in order to properly evaluate further evolution of the EEDI regulation and facilitate informed decision making. The co-sponsors also provide proposals to improve the processes of the Organization when considering EEDI reduction rates.

Strategic direction, if applicable: 3

Output: 3.5

Action to be taken: Paragraph 48

Related documents: MEPC 73/19, MEPC 73/WP.7, MEPC 73/5/1, MEPC 73/5/9, MEPC.308(73), MEPC.304(72) and MEPC.203(62), and MEPC.1/Circ.850/Rev.2

General Views on the Initial Strategy

- Fully supportive to the development of IMO initial strategy and it's objectives
- Strengthening the EEDI is one of the most effective short-term measures to lowering GHG emissions from ships, as part of the initial strategy
- Implementing the strategy will need new technologies, accompanying high risks and huge investment
- In decision-making, a range of technical matters and the challenges facing the industry to be considered
- ...

Technical Issues (being considered)

- **Improving efficiency and reducing propulsion power**
- **Switching to lower carbon fuels**
 - LNG, Bio-fuels, ...
- **Carbon free alternative fuels**
 - Hydrogen, Ammonia, ...
- **Life Cycle Analysis**
- **Carbon capture onboard**
- **Alternative energy carriers and energy conversion**
 - Pure battery power, fuel cell, wind power, solar energy, nuclear energy

Industry's Views on EEDI

- The EEDI beyond phase 2 requires the adoption of new fuels, energy carriers and technologies.
- Many of these technologies change the risk profile of on board systems and operating practices.
- These changes will alter the industry as new technologies are increasingly adopted.
- This process needs to be evidence based and determined by scientific and technical analysis.
- The regulatory framework must be 'fit for purpose' both in terms of managing risk, and properly reflecting the efficiency improving and/or GHG reduction benefits of technologies in the EEDI calculation.

Proposals to IMO

- Finalization of minimum power requirements for tankers and bulk carriers before initiating the process of further reducing the EEDI values
- Review of the 2018 guidelines on the method of calculation of the EEDI reflects the benefits of new and innovative technologies
- Development of guidelines for qualifying and demonstrating the effectiveness of new technologies to ensure transparency
- Development of guidelines for fuel life cycle analysis reflecting in fuel C_f values
- Development of process for further EEDI reduction rates and implementation dates considering :
 - readiness of technology;
 - supply of fuels; and
 - ensuring safety matters.

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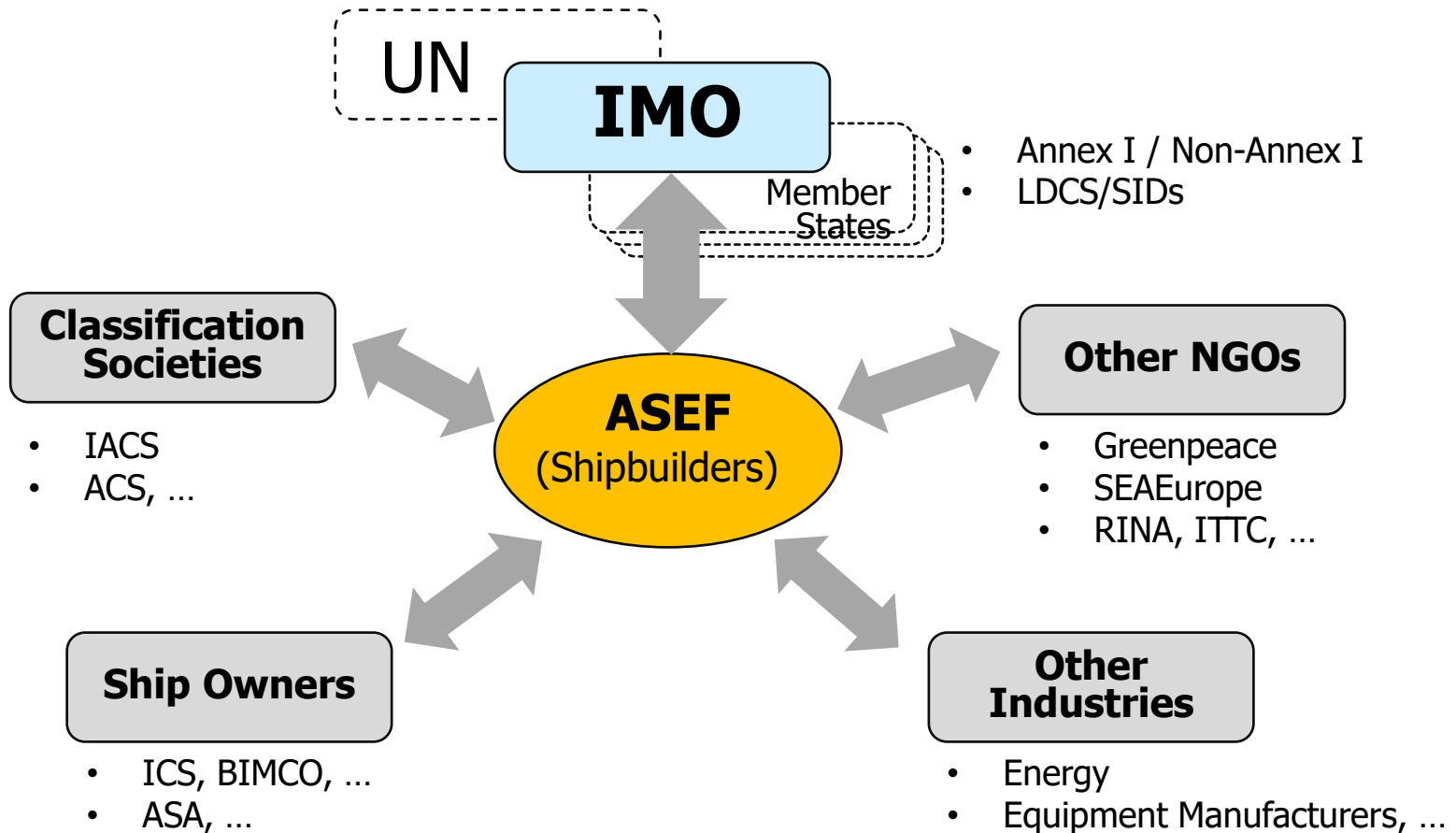
SUMMARY/SUGGESTIONS

- **IMO GHG Strategy:**
 - No compromise!
 - Paradigm change in the maritime industry
- **Strengthening EEDI Scheme:**
 - One of the most effective short-term measures
 - Big challenges facing the industry
- **Evidence-based/Holistic/Goal-based approach**
- **New R&D scheme**
 - ☞ IMRB / TG in IMO*
- **Technical cooperation / Capacity-building under ITCP****

* International Maritime Research Board / Technical Group

** International Technical Cooperation Programme

※ Stakeholders on GHG Issues



REFERENCES

- IMO MEPC 67-INF.3 - Third **IMO GHG Study** 2014 - Final Report
- IMO Resolution MEPC.304(72), **Initial IMO Strategy** on Reduction of GHG Emissions from Ships, 2018
- **IMO Resolution MEPC.308(73)** - Guidelines on the method of calculation of the EEDI reflects the benefits of new and innovative technologies
- **MEPC.1/Circ.815** - 2013 Guidance on treatment of innovative energy efficiency technologies for calculation and verification of the attained EEDI.
- E. A. Bouman et al, **State-of-the-art technologies**, measures, and potential for reducing GHG emissions from shipping – A review, Transportation Research Part D, 2017
- DNV·GL, **Maritime Forecast to 2050** – Energy Transition Outlook 2019
- ...

Thank you for your attention!



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