

MARPOL Annex VI

Chapter 4 – Energy Efficiency Regulations



National Workshop (virtual) on Ratification and Effective Implementation of
MARPOL Annex VI for Egypt
25 November 2020

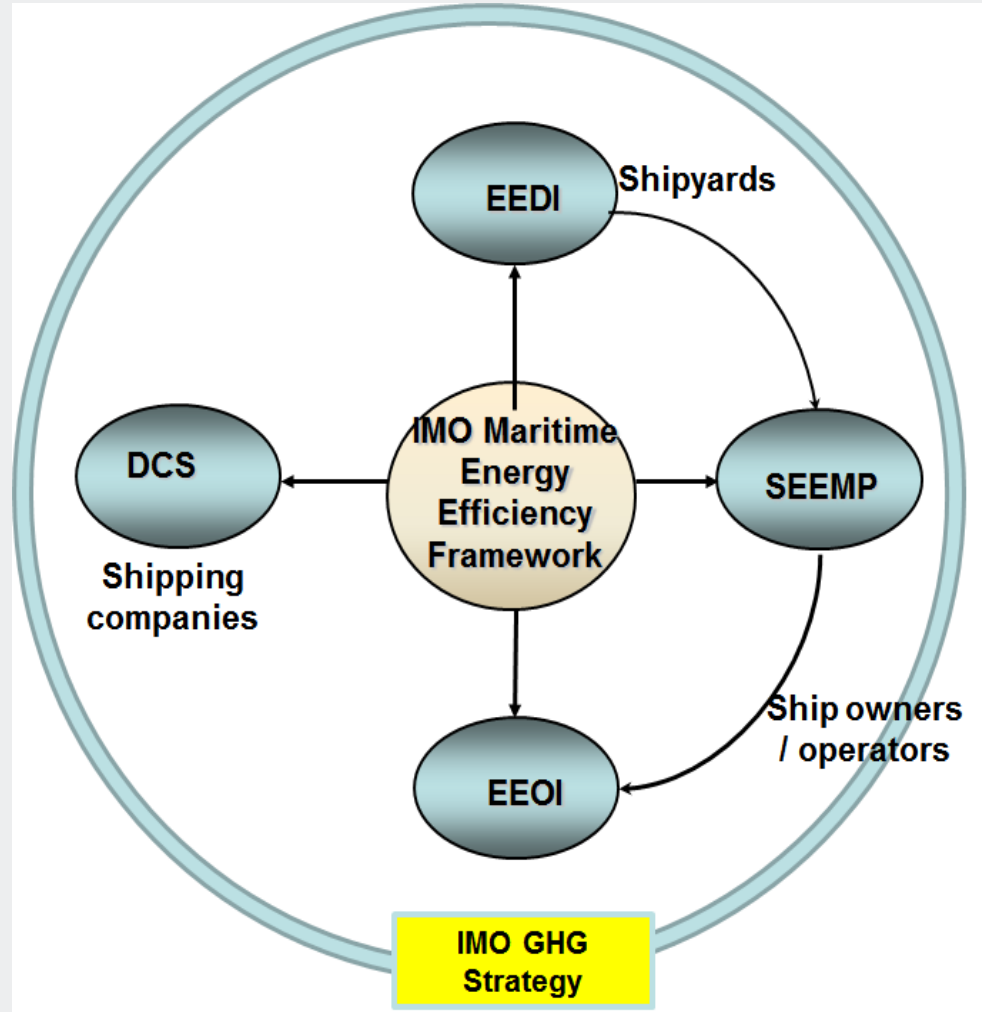
Dr Zabi Bazari
REMPEC Consultant

Content

- Overview
- EEDI
- SEEMP (and EEOI)
- DCS
- Initial IMO GHG Strategy

IMO shipping energy efficiency regulatory framework

- **EEDI and SEEMP:** Mandatory from 2013
- **DCS:** Mandatory from 2019
- **EEOI:** Voluntary
- **Initial IMO GHG Strategy:** Agreed in 2018 and under intense discussion



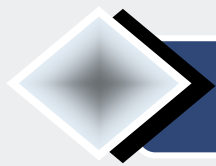
Res.MEPC.203(62) vs Res.MEPC.176(58)

Resolution MEPC.176(58)	Resolution MEPC.203(62)
<p>Chapter III</p> <ul style="list-style-type: none">Reg. 12 Ozone Depleting SubstancesReg. 13 Nitrogen Oxides(NOx)Reg. 14 Sulphur Oxides(SOx) and Particular MatterReg. 15 Volatile Organic Compounds (VOCs)Reg. 16 Shipboard IncinerationReg. 17 Reception FacilitiesReg. 18 Fuel Oil Availability and Quality	<p>Chapter III</p> <ul style="list-style-type: none">Reg. 12 Ozone Depleting SubstancesReg. 13 Nitrogen Oxides(NOx)Reg. 14 Sulphur Oxides(SOx) and Particular MatterReg. 15 Volatile Organic Compounds(VOCs)Reg. 16 Shipboard IncinerationReg. 17 Reception FacilitiesReg. 18 Fuel Oil Availability and Quality
	<p>Chapter IV</p> <ul style="list-style-type: none">Reg. 19 ApplicationReg. 20 Attained EEDIReg. 21 Required EEDIReg. 22 SEEMPReg.22A Data Collection System (DCS)Reg. 23 Promotion of technical co-operation and transfer of technology
Appendix I~VI	Appendix I~VI Appendix VIII Form of International Energy Efficiency(IEE) Certificate



Regulation 19 - Applications

- This chapter **shall apply** to all ships of 400 gross tonnage and above.
- The provisions of this chapter **shall not apply** to ships solely operating in Flag's national waters.
- Regulation 20 and regulation 21 **shall not apply** to ships with **non-conventional propulsion** with the exception of cruise passenger ship with electric propulsion, and LNG carriers



Regulation 20 – Attained EEDI

Actual EEDI of a ship

Regulation 20 – Attained EEDI

- The attained EEDI shall be calculated for:
 - each **new ship**;
 - each **new ship** which has undergone a **major conversion**; and
 - each **new or existing ship** which has undergone a major conversion, regarded by the Administration as a **newly constructed ship**
- The above are applicable to ships defined in Regulations 2.25 to 2.35.
- The attained EEDI shall be specific to each ship and be accompanied by the **EEDI Technical File**
- The attained EEDI **shall be calculated** taking into account the **IMO guidelines**.
- The attained EEDI **shall be verified**, taking into account the **IMO guidelines**

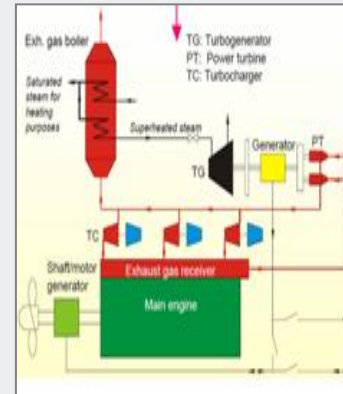
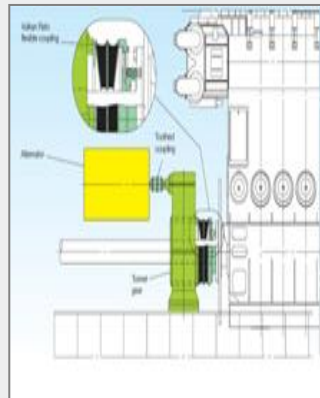
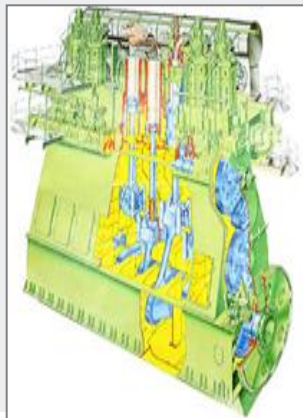
Attained EEDI: Calculation formula

Main Engine	Aux Engine (s)	Innovative Energy Eff. Power Gen. Technologies	Innovative Energy Eff. Prop.
-------------	----------------	--	------------------------------

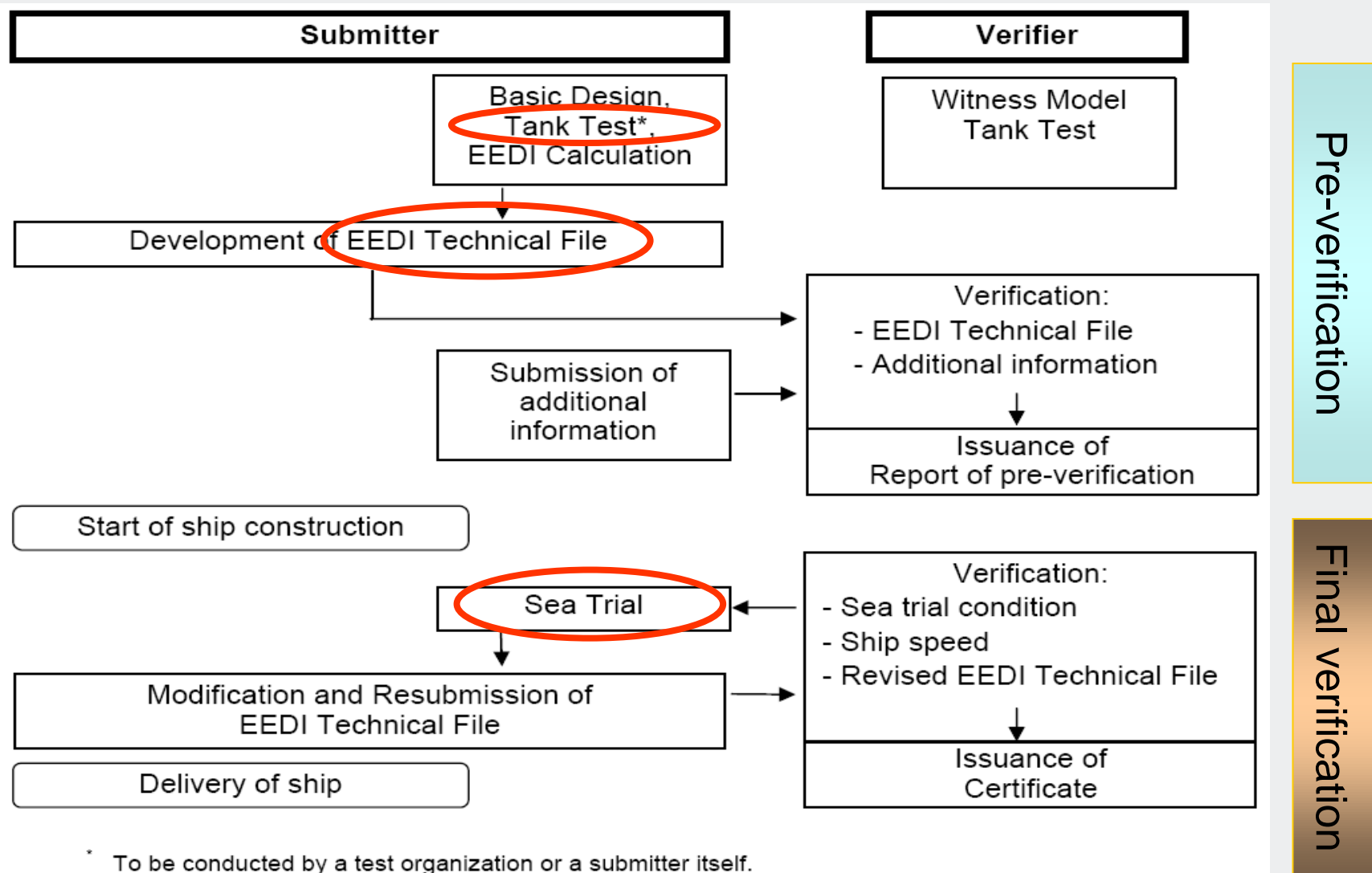
EEDI =

$$\frac{\left(\prod_{j=1}^M f_j \right) \left(\sum_{i=1}^{nME} P_{ME(i)} \cdot C_{FME(i)} \cdot SFC_{ME(i)} \right) + (P_{AE} \cdot C_{FAE} \cdot SFC_{AE}^*) + \left(\prod_{j=1}^M f_j \cdot \sum_{i=1}^{nPTI} P_{PTI(i)} - \sum_{i=1}^{neff} f_{eff(i)} \cdot P_{AE_{eff}(i)} \right) C_{FAE} \cdot SFC_{AE}}{f_c \cdot f_i \cdot Capacity \cdot V_{ref} \cdot f_w} - \left(\sum_{i=1}^{neff} f_{eff(i)} \cdot P_{eff(i)} \cdot C_{FME} \cdot SFC_{ME} \right)$$

[gCO₂/((tonne.nm))]



EEDI Verification process





Regulation 21 – Required EEDI

Regulatory limit of EEDI for a ship

Regulation 21.1 – Required EEDI

- Similar to Attained EEDI, it is calculated for New Ships, or cases with major conversion.
- For ships defined in Regulation 2.25 to 2.31
- The Required EEDI shall be calculated as follows:

$$\text{Required EEDI} = (1 - X/100)^* (\text{Reference EEDI})$$

- Where
 - X is the reduction factor
 - Reference EEDI is the EEDI from reference line

Regulation 21.3 – Reference line (value)

- Reference line = $a * b^{-c}$

Table 2. Parameters for determination of reference values for the different ship types

Ship type defined in regulation 2	a	b	c
2.25 Bulk carrier	961.79	DWT of the ship	0.477
2.26 Gas carrier	1120.00	DWT of the ship	0.456
2.27 Tanker	1218.80	DWT of the ship	0.488
2.28 Container ship	174.22	DWT of the ship	0.201
2.29 General cargo ship	107.48	DWT of the ship	0.216
2.30 Refrigerated cargo carrier	227.01	DWT of the ship	0.244
2.31 Combination carrier	1219.00	DWT of the ship	0.488

Regulation 21: Reduction factor (X) for calculation of Required EEDI

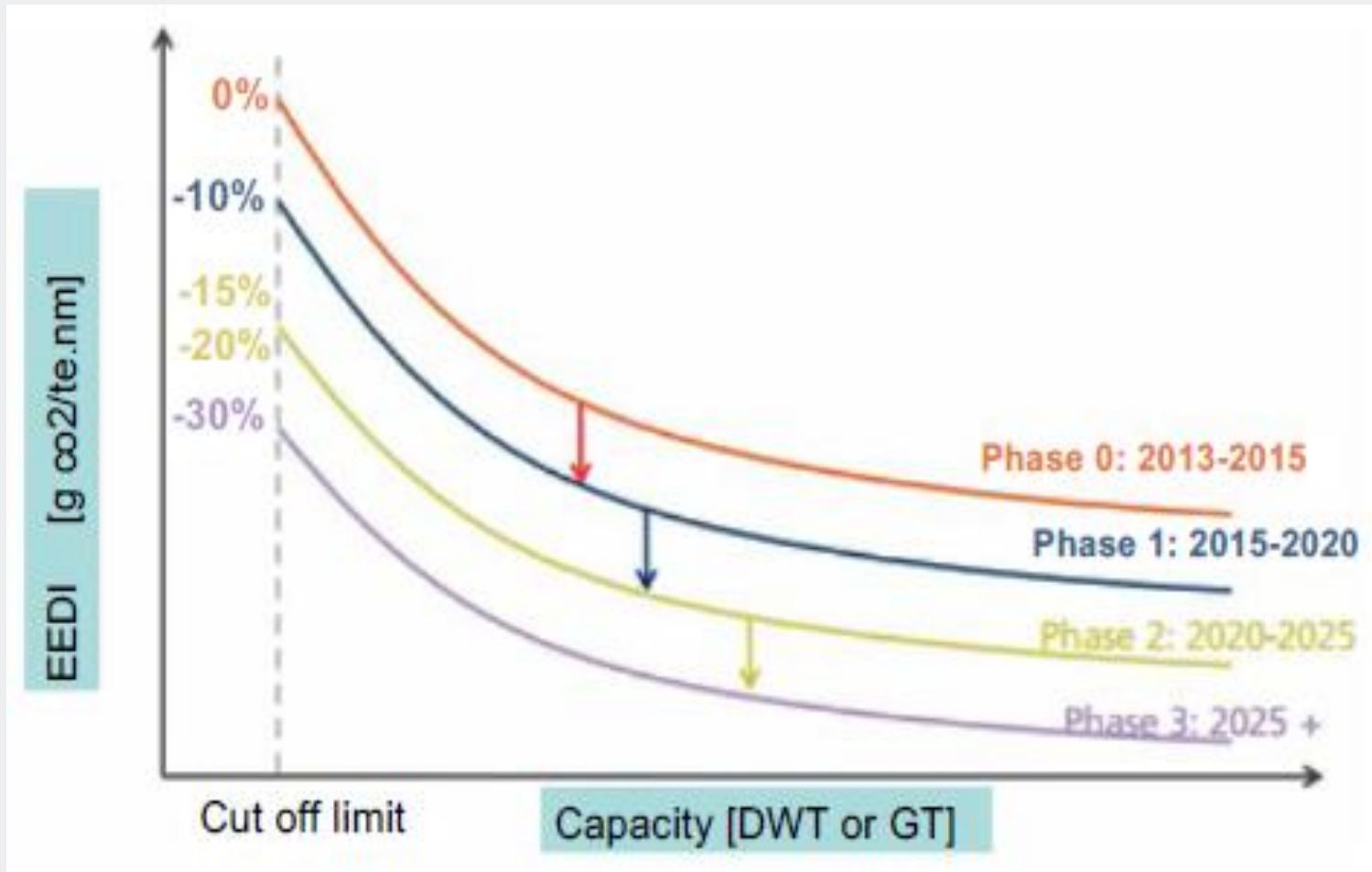
Reduction factors (in percentage) for the EEDI relative to the reference line for each ship type.

	Size	Phase 0 1 Jan 2013 – 31 Dec 2014	Phase 1 1 Jan 2015 – 31 Dec 2019	Phase 2 1 Jan 2020 – 31 Dec 2024	Phase 3 1 Jan 2025 onwards
Bulk Carriers	>20,000 Dwt	0%	10%	20%	30%
	10-20,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Gas tankers	>10,000 Dwt	0%	10%	20%	30%
	2-10,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Tanker and combination carriers	>20,000 Dwt	0%	10%	20%	30%
	4-20,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
Container ships	>15,000 Dwt	0%	10%	20%	30%
	10-15,000 Dwt	n/a	0-10%*	0-20%*	0-30%*
General Cargo ships	>15,000 Dwt	0%	10%	15%	30%
	3-15,000 Dwt	n/a	0-10%*	0-15%*	0-30%*
Refrigerated cargo carriers	>5,000 Dwt	0%	10%	15%	30%
	3-5,000 Dwt	n/a	0-10%*	0-15%*	0-30%*

* The reduction factor is to be linearly interpolated between the two values depending on the vessel size. The lower value of the reduction factor is to be applied to the smaller ship size.

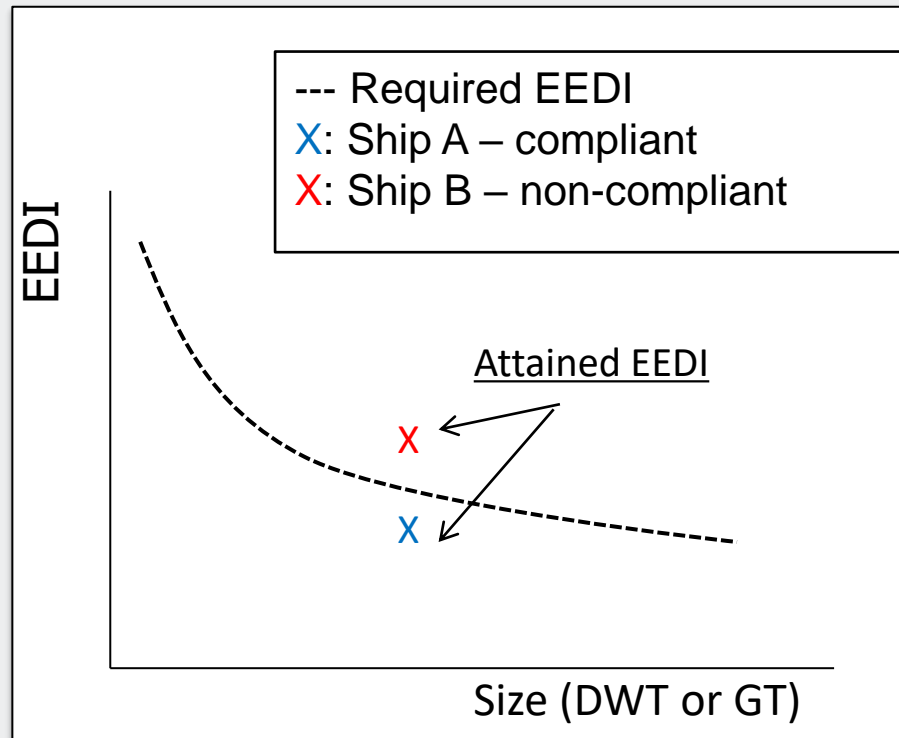


Required EEDI for different phases as a function of ship size



Regulation 21.1 – Regulatory requirement

Attained EEDI \leq Required EEDI



MEPC 74 decisions on EEDI for Phase 3

- MEPC 74 approved, for adoption at MEPC 75, amendments to Regulation 21.2:
- **Phase 3 (30% reduction rate) entry into effect is brought forward to 2022** (from 2025), for the following ship types:
 - Gas carrier of 15,000 DWT and above
 - Containership
 - General cargo ship
 - LNG carrier
 - Cruise passenger ship having non conventional propulsion
- The **EEDI reduction rates for containerships** are enhanced:
 - 50% for containership of 200,000 DWT and above
 - 45% for containerships > 120,000 DWT and < 200,000 DWT
 - 40% for containerships > 80,000 DWT and < 120,000 DWT
 - 35% for containerships > 40,000 DWT and < 80,000 DWT



Regulation 22 - SEEMP

Regulation 22 - SEEMP

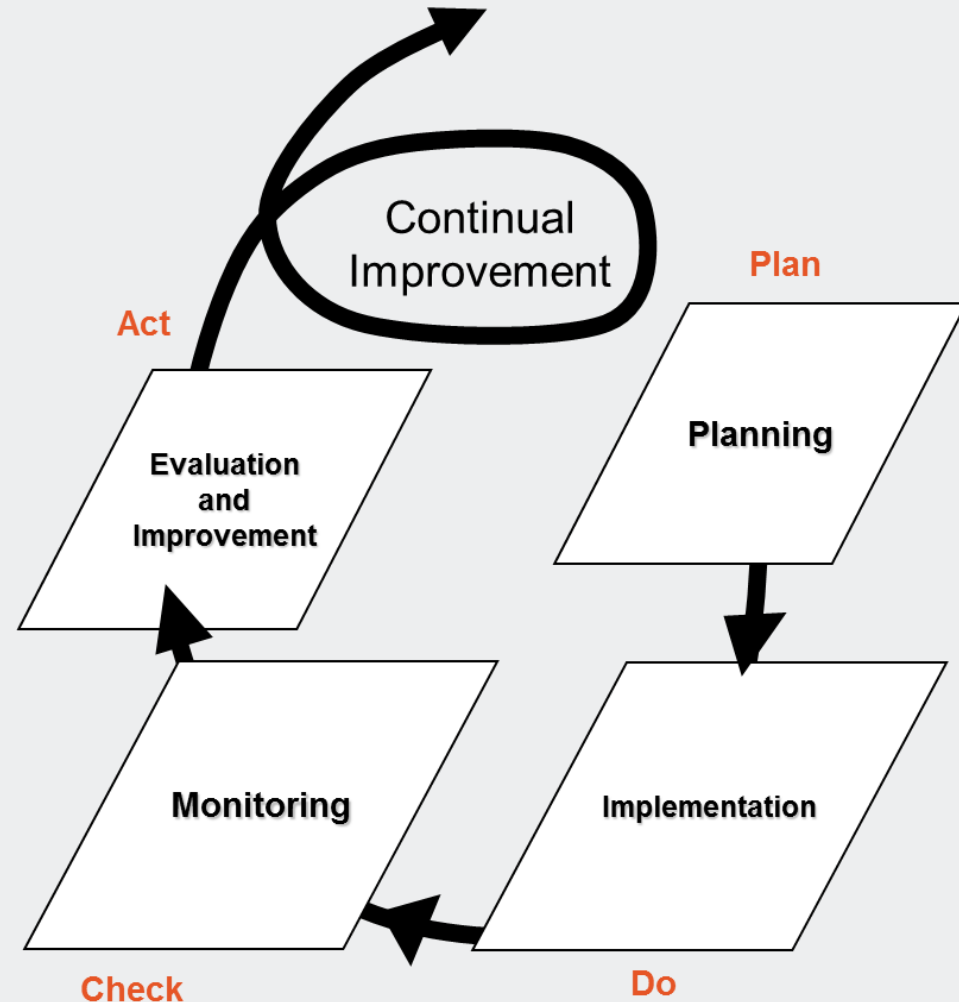
Regulation 22

Ship Energy Efficiency Management Plan (SEEMP)

- 1 Each ship shall keep on board a ship specific Ship Energy Efficiency Management Plan (SEEMP). This may form part of the ship's Safety Management System (SMS).
- 2 The SEEMP shall be developed taking into account guidelines adopted by the Organization.

SEEMP framework (see details in the relevant Guidelines)

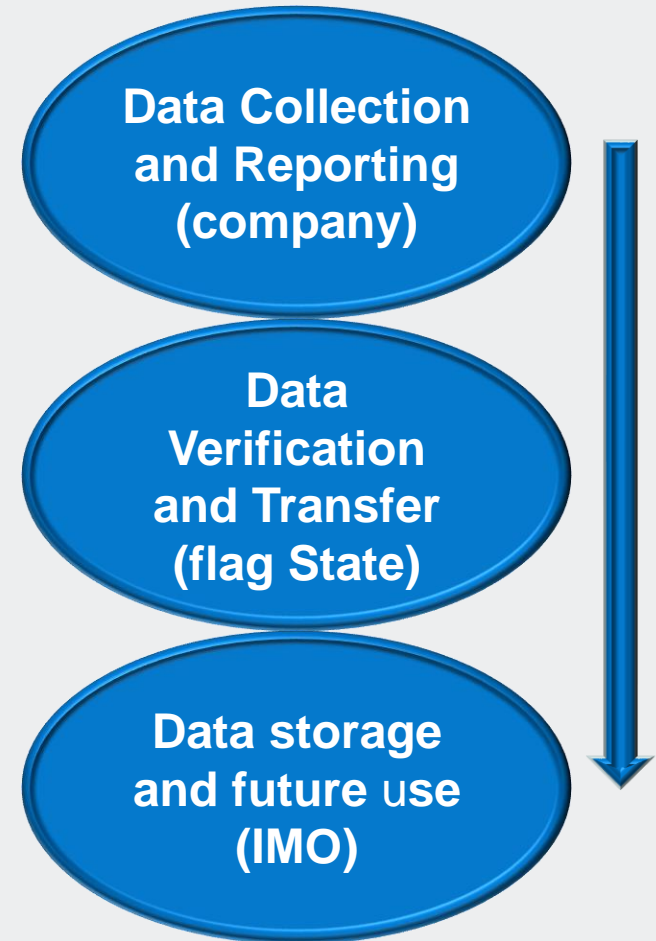
- SEEMP works through four steps:
 - Planning,
 - Implementation
 - Monitoring, and
 - Self-evaluation
- Continuous improvement cycle for improving ship energy management.
- Within the SEEMP, a number of Energy Efficiency Measures are documented for implementation.



Regulation 22A – Fuel Consumption Data Collection system for ships

IMO Data collection and reporting framework

- Regulations for mandatory measurement and reporting of the ship's annual fuel consumption.
- The system have three main elements:
 1. Data collection and reporting by ships (company)
 2. Data verification by Flag State and delivery to IMO
 3. Data storage in a centralised database at the IMO.



IMO ship fuel DCS: Main features

- Applicable to ships greater than **5000 GT**.
- **Annual reporting** with no need for voyage data.
- IMO number for ship identification
- **Company** responsible for submission of data.
- **Flag** Administration responsible for **data verification**.
- Compliance through having a **Statement of Compliance (SOC)** issued annually.
- Aggregated data to be submitted and stored in an **IMO database**

IMO ship fuel consumption DCS : Types of data to be reported

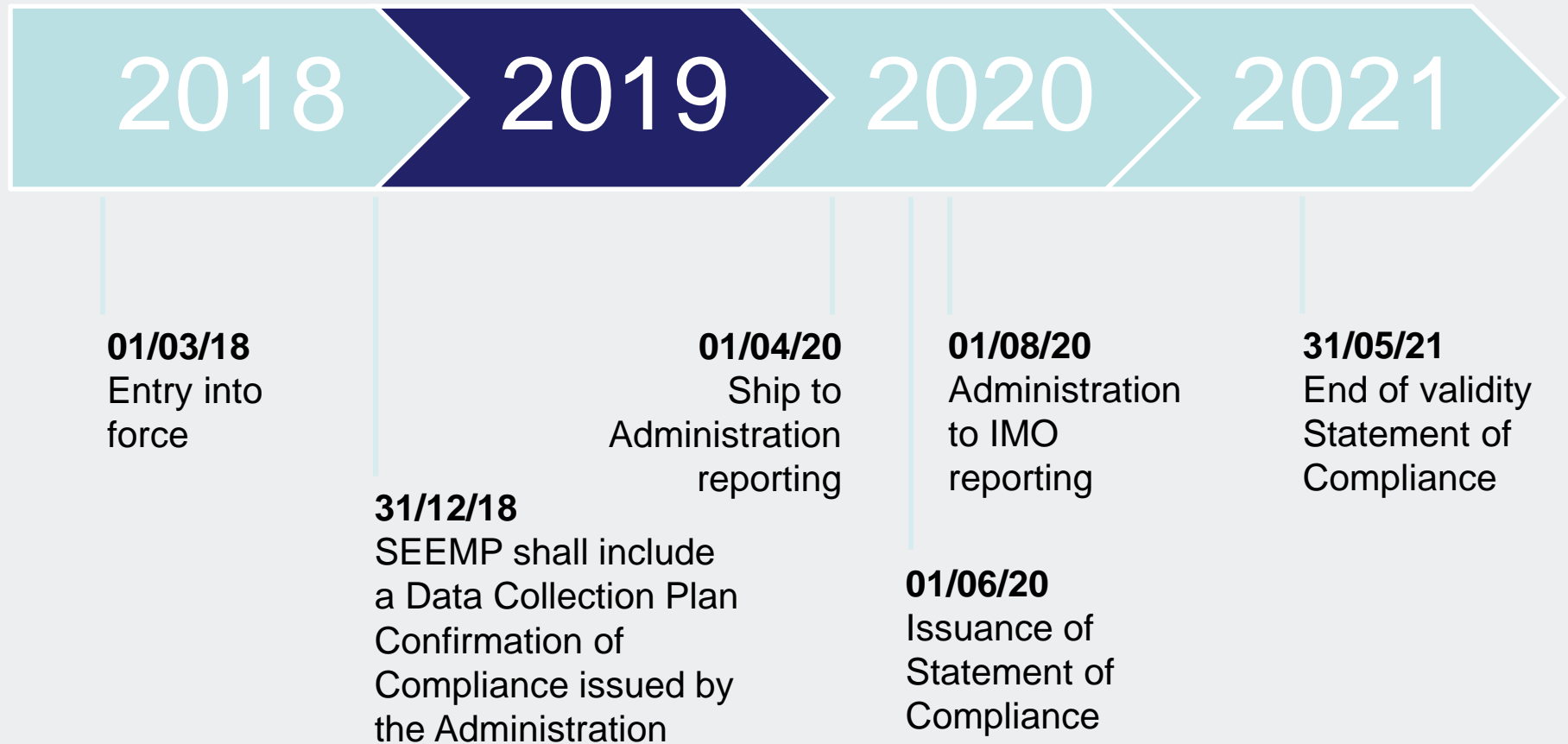
The following data to be reported annually:

- Ship IMO number
- Technical characteristics of the ship:
 - Ship type
 - Gross Tonnage
 - Net tonnage
 - Deadweight at summer load line
 - Main and auxiliary engine MCR (Maximum Continuous Rating)
 - EEDI, if applicable
 - Ice class, if applicable
- Total annual fuel consumption by fuel type
- Distance travelled
- Hours underway

IMO ship fuel consumption DCS: Ship fuel oil consumption measurement

- Three main methods to be used:
 - **Use of BDN** plus additional ship-board fuel stock check at the start and end of reporting period.
 - **Use of regular ship-board fuel stock check** and calculation of fuel consumption for the reporting period
 - **Use of fuel flow meters.**
- The methodology to be specified in SEEMP in the form of a **Data Collection Plan**. SEEMP Part II.
- All the relevant data and calculations to be retained by ship for a set period.

IMO ship fuel DCS: Regulatory timetable



Verification aspects – Statement of Compliance

- Verification is the responsibility of Flag Administration
- What will be verified:
 - The **data collection method** and process (to be included in SEEMP)
 - The **actual data** submitted and their compliance with the agreed process
- A **Statement of Compliance (SOC)** will be issued for each calendar year by Administration.
- The SOC and disaggregated data should be retained on-board the ship for a set period (for at least the period of its validity).

"Appendix X
Form of Statement of Compliance – Fuel Consumption Reporting
STATEMENT OF COMPLIANCE – FUEL CONSUMPTION REPORTING

Issued under the provisions of the Protocol of 1997, as amended by resolution MEPC.XXX(X), to amend the International Convention for the Prevention of Pollution by Ships, 1973, as modified by the Protocol of 1978 related thereto (hereinafter referred to as "the Convention") under the authority of the Government of:

.....
(full designation of the Party)

by

(full designation of the competent person or organization authorized under the provisions of the Convention)

Particulars of ship[†]

Name of ship

Distinctive number or letters

IMO Number[§]

Port of registry

Gross tonnage

THIS IS TO CERTIFY:

IMO ship fuel DCS: Reporting and IMO database

- It is the responsibility of the Flag Administration to transfer the relevant data to the IMO database.
- IMO will set up a “Fuel Oil Consumption Data Base”.
- IMO will store the data in the above data base.
- Access to database by MARPOL Annex VI Parties will be possible but ships will remain anonymous.

**Aggregated Annual
Data (by Flag)**



**IMO Ship Fuel Oil
Consumption
Database**

The IMO Fuel Oil Consumption database is now part of the GESIS and Administrations will have access to it.

Amendments to survey, certification and port state control regulations for Chapter 4

- Regs with **RED** also changed to include requirements of Chapter 4

Resolution MEPC.176(58)	Resolution MEPC.203(62)
Chapter I Reg. 1 Application Reg. 2 Definitions Reg. 3 Exceptions and Exemptions Reg. 4 Equivalents	Chapter I Reg. 1 Application Reg. 2 Definitions Reg. 3 Exceptions and Exemptions Reg. 4 Equivalents
Chapter II Reg. 5 Surveys Reg. 6 Issue or endorsement of a Certificate Reg. 7 Issue of a Certificate by another Party Reg. 8 Form of Certificate Reg. 9 Duration and Validity of Certificate Reg. 10 Port State Control on Operational Requirements Reg. 11 Detection of Violations and Enforcements	Chapter II Reg. 5 Surveys Reg. 6 Issue or endorsement of a Certificate Reg. 7 Issue of a Certificate by another Party Reg. 8 Form of Certificate Reg. 9 Duration and Validity of Certificate Reg. 10 Port State Control on Operational Requirements Reg. 11 Detection of Violations and Enforcements

Surveys and certification (Reg. 5.4)

- Ships to which chapter 4 applies shall also be subject to the surveys specified below:
 - An initial survey before a new **ship is put in service** and before the International Energy Efficiency Certificate (IEEC) is issued. ...
 - A general or partial survey, after a major conversion of a ship
.....
 -
.....

IEE (International Energy Efficiency) Certificate

Regulation 6 changed to reflect:

- An IEE Certificate shall be issued to any ship of 400 gross tonnage engaged in international waters.
- The Certificate shall be issued or endorsed either by the Administration or their ROs.

Regulation 9 changed to reflect:

- The IEE Certificate shall be valid throughout the life of the ship unless:
 - Ship is withdrawn from service or
 - Major conversion of the ship (require new certificate) or
 - Transfer to another flag

Summary of regulatory documents needed for compliance to Chapter 4

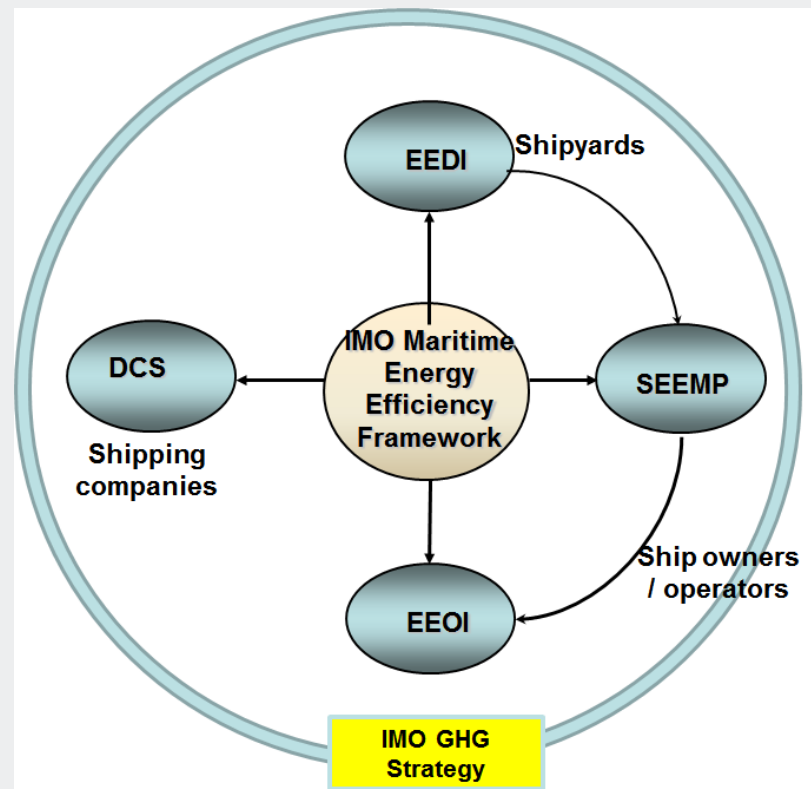
- IEE Certificate
- Record of construction for ship energy efficiency (supplement to IEE)
- SEEMP
- SEEMP Part II for DCS (Data Collection Plan)
- Statement of Compliance for DCS
- EEDI Technical File

For all of the above, specific **templates** are given in Chapter 4 or in its related guidelines

Initial IMO GHG Strategy

Initial IMO GHG Study

- IMO GHG Strategy:
 - Specifies **targets** for future shipping GHG emissions
 - Identifies some specific **actions** (energy efficiency measures)
 - Core of target setting has been to drive:
 - **Technological innovations.**
 - Future **low-carbon or zero-carbon fuels**



Initial IMO GHG Strategy: Main targets

- **Total GHG emissions from international shipping**
 - To peak as early as possible..
 - Reduce the **total annual emissions by at least 50% by 2050** as compared to 2008.
- **Ship operational energy efficiency**
 - Energy efficiency of shipping (tonne CO₂/tonne.mile cargo) to **reduce by an average of at least 40% by 2030, with main aim of reaching 70% by 2050**, as compared to 2008.

How to do it: By identifying and regulating new Energy Efficiency Measures

- Initial IMO GHG Strategy advocates the energy efficiency activities as below:
 - **Short term measures:** Are those that can be defined and finalised between 2018 and 2023.
 - **Mid-term measures** are those that will be those beyond short term and for discussion by the IMO between 2023 and 2030.
 - **Long-term measures** are those measures that are going to be finalized, regulated and agreed by the IMO beyond 2030.

IMO GHG Strategy status

- Agreed in 2018
- Being debated mainly in two areas:
 - **Measures** to be developed and regulated
 - **Impact assessment** on countries
- Revised IMO GHG Strategy will be ready by 2023.
- MEPC has already debated some short term measures and the following has moved forward:
 - **EEXI**: A similar scheme as EEDI but for existing ships.
 - **CII (Carbon Intensity Index)**: An operational efficiency indicator for measurement of energy efficiency of ships.
 - **EEDI**: Further increase in Reduction Factors (X) and bringing forward dates for Phase 3.
- There are requests for IMO to include debate on MBM on the agenda..

Self Assessment: True or False?

- EEDI is applicable to New Ships only?
- Attained EEDI is the EEDI regulatory limit for a ship?
- Required EEDI is the actual EEDI for a ship?
- The unit of EEDI is gCO₂/tonne.nm?
- Verification and certification for EEDI would require the ship testing during a sea trail?
- A “Ship Record of Construction for Energy Efficiency” is needed on-board for every applicable ship as a regulatory document?
- Ships of 5000 GT and above are required to collect fuel oil consumption data and report to IMO?
- Part II of SEEMP explains how fuel oil consumption data collection is done on-board the ship?
- Regulation for the EEXI have been agreed?

REMPEC, an IMO / UNEP Centre assisting the Mediterranean coastal States in ratifying, transposing, implementing and enforcing international maritime conventions related to the protection of the marine environment



Thank you

Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC)
Maritime House, Lascaris Wharf, Valletta, VLT 1921, Malta
T: +356 21 337 296/7/8 | F:+356 21 339 951
rempec@rempec.org

www.rempec.org