
PLATFORM
SCHEEPSEMISSIES

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Maritime Seminar

CO_2 Reduction Measures "The new rules"

15 December 2011

Chairman: B. de Jong (ministry of I&E)

PLATFORM SCHEEPSEMISSIES

Program

13.30 - 13.35	Welcome and introduction	Bart de Jong *Ministry of I&E*
13.35 - 14:00	CO2-reduction measures in practice Point of view by the ship owners	Paul Altena *KVNR*
14.00 - 14.25	Reduction targets of the European Union	Ivo de Zwaan *Ministry of I&M*
14.25 - 15.00	Revision of MARPOL Annex VI *Which changes will be there for the industry*	Sibrand Hassing *Ministry of I&E*
15.00 - 15.25	Energy Efficiency Design index (EEDI) *Indexing of small ships*	David Anink *Holland Shipbuilding Ass.*
15.25 - 15.45	Break	
15.45 - 16.10	EEDI / SEEMP and port state control *How will Dutch shipping inspectorate enforce?*	Meindert Vink *Dutch Shipping Inspectorate*
16.10 - 16.35	Ships' Energy Efficiency Management Plan *Requirements and how to set up a SEEMP.*	Paolo Mele *Lloyds Register*
16.35 - 17.15	Discussion	Questions from the audience

PLATFORM SCHEEPSEMISSIES

The presentations can be found on the website by next week

http://www.scheepsemissies.nl/

KVNR KONINKLIJKE VERENIGING VAN NEDERLANDSE REDERS

CO2 Reduction measures in practice

-Shipowners point of view-

Paul Altena
Staffmember Environmental Affairs KVNR

KVNR

Royal Association of Netherlands Shipowners

KVNR

- 400 members, 100 associate members
- 975 ships with Dutch flag, approx. 800 foreign flag, 60% short sea (a.o. Baltic and North Sea)
- 24.000 employees on board/on shore (4.000 Dutch seafarers)
- 1 bn. euro added value
- The Netherlands ranks 5th in Paris MoU
- 12 nautical institutes, > 2.000 students, growing

Shipping Sector I

- Ownership
- Charterers
- Competition with other modalities – SSS
- Lifespan vessels >25 years – average age NL:12 years
- Multiple vessel types/trades
- International

Any (CO_2 reduction) system should take these features into account.

Shipping Sector II

KVNR

- General cargo, multi purpose
- Container
- Liquid bulk
- Ferry- and cruise
- LNG
- Reefers
- Offshore-service
- Roll on roll off
- Ocean going tugs and salvage
- Heavy lift
- New: bulkers, dry cargo

- 1/3 vessels in Baltic under Dutch flag, 60% of Dutch vessels predominantly active in ECA's

KVNR and CO2

KVNR Energy Efficiency goals January 2010

a) In 2050 the Emission Free vessel will be reality
b) From 2020 onwards, shipping sector will grow CO2 neutral
c) In 2050 a CO2-reductie of 50% compared to 2020

Prosea

- 1998 1st Environmentally sustainable shipping course: the “Marine Awareness Course”,
- 2001 Founding of Prosea
- 2011 Model Course IMO STCW approved

-Measures

Shipping sector measures

- Achieved efficiency improvement vessels

-Graph CO2

Shipping sector measures

- A little history:

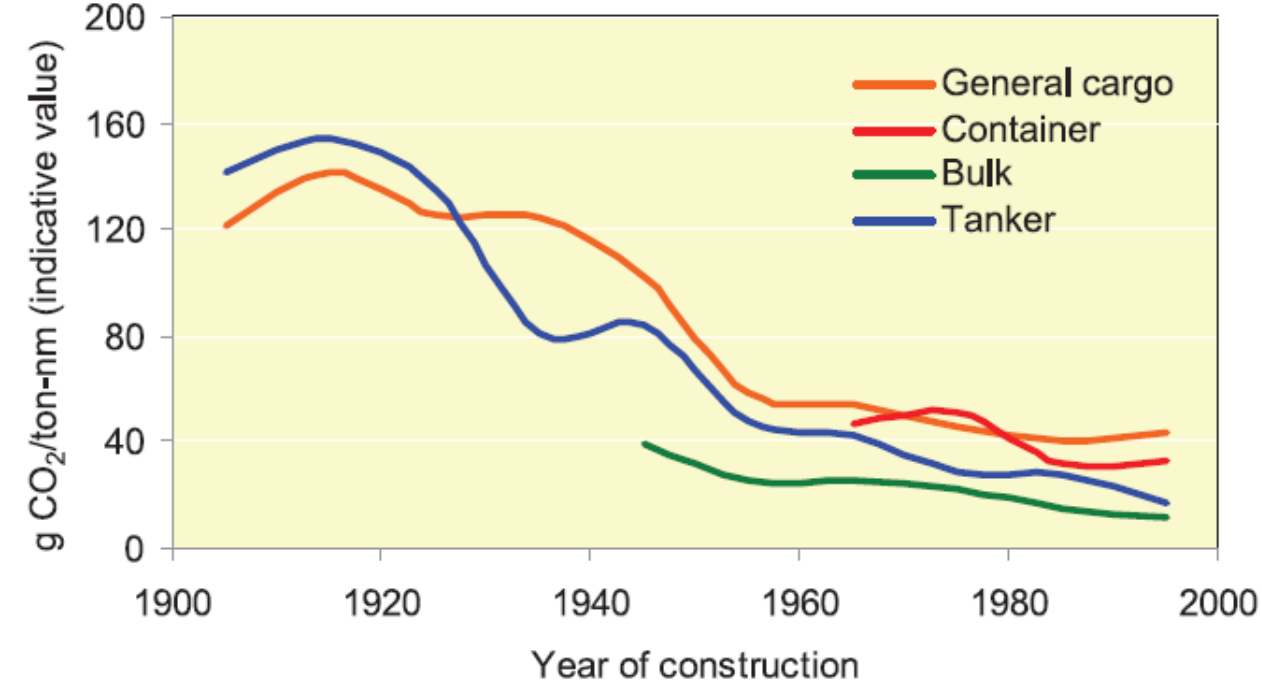

Figure 9.4 *Indicative development in average ship design transport efficiency*

Source: IMO GHG Study 2009

Shipping sector measures

- Achieved efficiency improvement vessels
- Innovations
  - Top Sector Water – “Smart and Clean Ships”
  - Increased cooperation Maritime cluster
  - Optimization hull-propulsion and operations
- Increased transparency sector

- But, more concrete:
  - BIMCO Slow Steaming Standard Contract
  - CO2 covenant

-Covenant

CO2 Covenant I

- Signed yesterday 15th December
  - Royal Association of Netherlands Shipowners
  - EVO (Shippers),
  - Holland Shipbuilding Association,
  - Dutch Association of Dredging Companies,
  - Department of Infrastructure and Environment,

- Increased cooperation
- Going beyond current legislation and reward early movers
- Concrete action points for the whole maritime sector

-Covenant

CO2 Covenant II

Action points:

1) Emission Free Vessel 2050
2) CO2 neutral growth per 2020

} KVNR Goals 2010

-Int. IMO.

CO2 Covenant II

Action points:

1) Emission Free Vessel 2050
2) CO2 neutral growth per 2020

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3) Exchanging best practises

-Int. IMO.

CO2 Covenant II

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3) Exchanging best practises
4) Efficiency as major item for newbuilds - EEDI

-Int. IMO.

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-Int. IMO.

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6) International communication of experiences

-Int. IMO.

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7) Increase transparency efficiency vessels
8) Intensify communication Shore-Ship

-Int. IMO.

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9) Lowering thresholds “green investments”

-Int. IMO.

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5) Research on systematic monitoring fuel consumption
6) International communication of experiences
7) Increase transparency efficiency vessels
8) Intensify communication Shore-Ship
9) Lowering thresholds “green investments”
10) Improve behaviour crew via awareness training at schools -Int. IMO.

International Measures I

IMO

- IMO GHG Study 2009: 25-75% reduction possible
- Technical and operational measures
  - EEDI approved by vote spring 2011
- Market Based Measures – Still under development
  - Levy, ETS, Based on index, Combination
  - Bahama's proposal reduction system
- Expectations MEPC 63, spring 2012

IMO: No More Favourable Treatment

International Measures II

EU

- White Paper Transport
- Regional system
  - Avoid a situation like Aviation and ETS
  - KVNR-CE Delft Study EU ETS

-KVNR study.

International Measures II

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    - Complicated system

-KVNR study.

International Measures II

EU

- White Paper Transport
- Regional system
  - Avoid a situation like Aviation and ETS
  - KVNR-CE Delft Study EU ETS
    - Complicated system
    - Evasion, administration, amount of emissions

- Continues pressure on IMO to deliver
- 2011 deadline for a system with cap

International Measures III

United Nations

- Common But Differentiated Responsibility
- Outcome Durban
  - Kyoto Protocol – political stability uncertain
  - Shipping specific
  - Continues debate up to 2020 for new system

- EU: Climate Change Fund for developing countries

International Measures IV

ICS, ECA and KVNR - Shipowners point of view

- UN Process
  - Cooperation ICS, OXFAM and WWF
  - CO2 reduction for international shipping should be regulated via the IMO
- IMO Process
  - Supporting EEDI and SEEMP
  - Not against contributing to an International Climate Fund

"If countries would decide that international shipping is to be part of a CO2 reduction scheme, the system should be easy to administer. A system based on a fuel levy then seems to be the best option."

-EE. Techn.

Energy Efficiency Measures II

- Technical
  - Increased efficiency
    - Size, hull, cargo, engine
    - Required power optimization
    - Diesel Electric drive
  - EEDI
  - Problems with EEDI General Cargo Vessels
    - Correlation factor : 0.34
    - Not representative of Energy Efficiency
    - Further research needed

-Graph EE

Energy Efficiency Measures III

- Operational
  - SEEMP, EEOI
  - Biofuels
  - Operational:
    - Slow Steaming - BIMCO Standard contract
    - Virtual Arrival (OCIMF & Intertanko)
    - Air venting RoRo's

-Results E&S

Energy Efficiency Measures III

- Operational
  - SEEMP, EEOI
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    - Slow Steaming - BIMCO Standard contract
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EEDI and SEEMP:

- 2020: 151.5 mln. tonnes CO2 reduction (50 bln US$) *
- 2030: 330 mln. tonnes CO2 reduction (200 bln US$) *

* Study IMO-DNV nov 2011

-EE. How.

Energy Efficiency Measures IV

	EEDI reduction measure	SEEMP Related measure
1	Optimised hull dimensions and form	Engine tuning and monitoring
2	Lightweight construction	Hull condition
3	Hull coating	Propeller condition
4	Hull air lubrication system	Reduced auxiliary power
5	Optimisation of propeller-hull interface and flow devices	Speed reduction (operation)
6	Contra-rotating propeller	Trim/draft
7	Engine efficiency improvement	Voyage execution
8	Waste heat recovery	Weather routing
9	Gas fuelled (LNG)	Advanced hull coating
10	Hybrid electric power and propulsion concepts	Propeller upgrade and aft body flow devices
11	Reducing on-board power demand (auxiliary system and hotel loads).	
12	Variable speed drive for pumps, fans, etc.	
13	Wind power (sail, wind engine, etc.)	
14	Solar power	
15	Design speed reduction (new builds)	

* Study IMO-DNV nov 2011

-EE. Slow.

Energy Efficiency Measures V

- Slow Steaming
  - Relatively easy to describe
  - Difficult to administer
  - Unintended consequences
    - Commercially very sensitive
    - Flexibility market
    - Competition with other modes (SSS)
    - Existing (long term) contracts
  - Ultra/Super slow steaming
    - Consequences vessel/engine
    - Market circumstances
- **Other dev**

Other developments I

- Scrubber, extra power required
  - Closed loop: 1% *
  - Open loop: 3% *
- Sulphur
  - Increased emissions at refinery
- Ballastwater
- LNG
  - Methane emissions total chain well – engine
- NOx dilemma

* Source: Wartsila

-Nox Graph

Engine Efficiency vs NOx

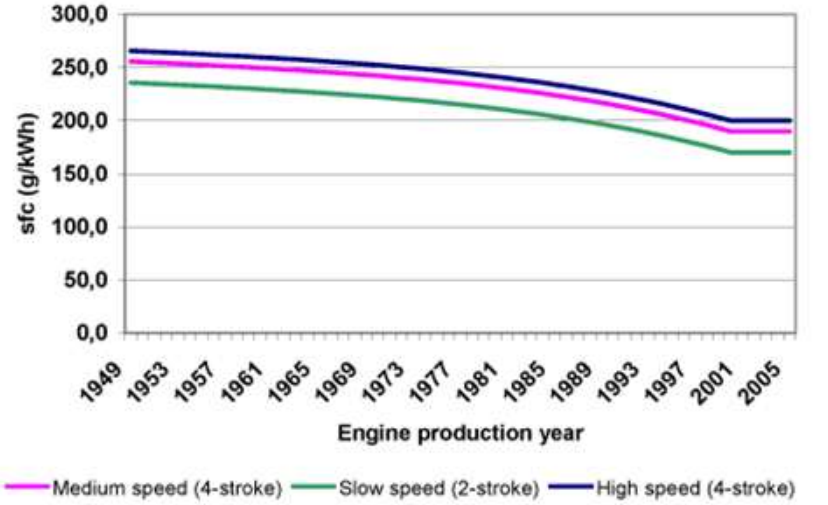


Figure 2.3 Specific fuel consumption for marine engines related to the engine production year (g/kWh)

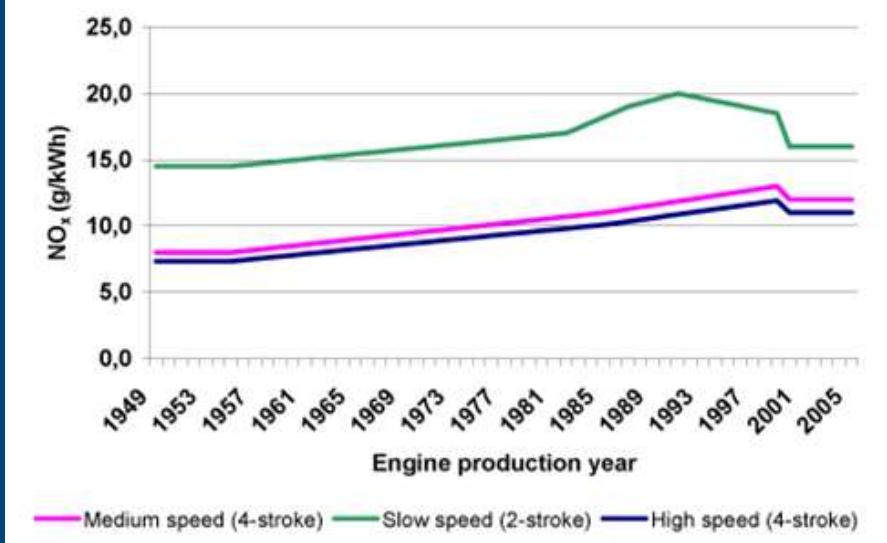


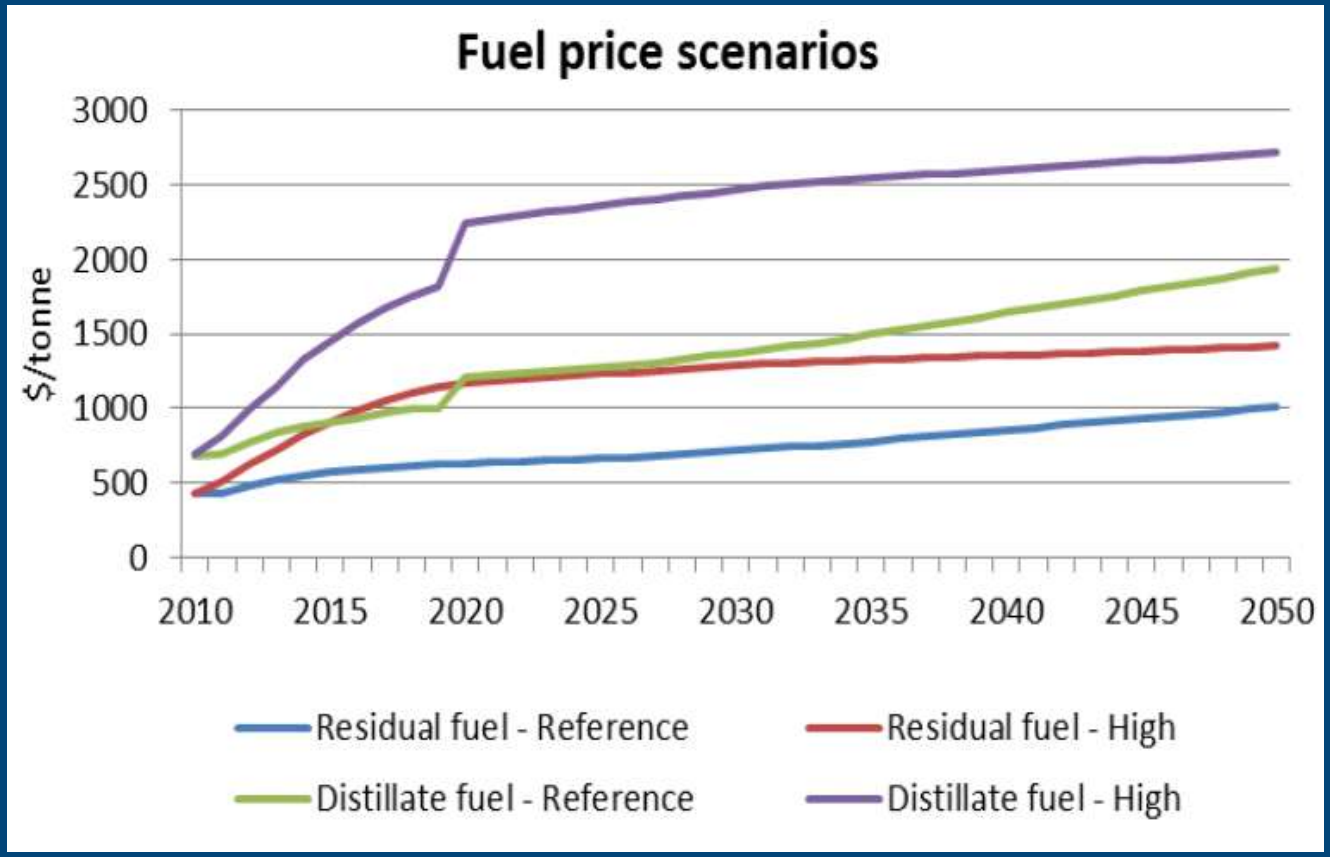
Figure 2.5 NO_x emission factors for ship engines built before 2006 (g/kWh)

Source: Study Danish government (2009)

-Fuel price

Other developments II

Fuel price



Source: IMO-DNV Study nov 2011

-Future outl.

Future Outlook

- Uncertain economic circumstances
- Large investments needed – Availability finance
    - Ballastwater 2016, Nox Tier 2, SOx 2015, CO2

-But..

Future Outlook

- Uncertain economic circumstances
- Large investments needed – Availability finance
    - Ballastwater 2016, Nox Tier 2, SOx 2015, CO2

- SEEMP,EEDI,EEOI
    - Definition Vessels
    - General Cargo Vessels
    - Other vessel types
- Market Based Measures

-So should be

Future Outlook

- Uncertain economic circumstances
- Large investments needed – Availability finance
    - Ballastwater 2016, Nox Tier 2, SOx 2015, CO2

- SEEMP,EEDI,EEOI
    - Definition Vessels
    - General Cargo Vessels
    - Other vessel types
- Market Based Measures
- Increase
    - Maritime transportation (?)
    - Awareness and cultural change
    - Innovation
    - Transparency sector

-End

Thank you for your attention

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Ministerie van Infrastructuur en Milieu

EU & Global Climate Policy

Ivo de Zwaan
International Affairs
Ministry of Infrastructure and Environment

Maritime Environment Seminar, 15 december 2011

EU & Global Climate Policy

- Introduction
- EU Climate Policy
- Global climate policy: Durban Climate Conference

EU Climate Policy

EU Climate and Energy package (December 2008):

Targets for 2020:

- **cutting greenhouse gases** by at least 20% of 1990 levels (30% if other developed countries commit to comparable cuts)

- **cutting energy consumption** by 20% of projected 2020 levels - by improving energy efficiency

- **increasing use of renewables** (wind, solar, biomass, etc) to 20% of total energy production (currently ± 8.5%)

EU Climate Policy

EU Climate and Energy package (December 2008):

- Power plants and energy-intensive industries: 21% below 2005 levels (ETS)
- Non-ETS (transport (excl. Aviation/shipping), farming, housing): 10% below 2005 levels (binding national targets)
- Renewables: 20% of total energy use;
  10% of transport fuels)

EU Climate policy

Roadmap for moving to a low-carbon economy in 2050

- 2°C global goal
- 2050: global reduction CO2 and other GHG's: 50%
- Developed countries share: 80-95% by 2050
- EU: -80% by 2050, compared to 1990 levels

EU Climate policy

<u>Targets for maritime transport:</u> None

But:

- "In the event that no international agreement which includes international maritime emissions in its reduction targets through the International Maritime Organisation has been approved by the Member States or no such agreement through the UNFCCC has been approved by the Community by 31 December 2011, **the Commission should make a proposal to include international maritime emissions according to harmonised modalities in the Community reduction commitment,** with the aim of the proposed act **entering into force by 2013**. Such a proposal should minimise any negative impact on the Community's competitiveness while taking into account the potential environmental benefits. (Directive 2009/29/EC)"

Global climate policy: Durban Climate Conference

Result:

The CoP

- *Agrees to continue its consideration of issues related to addressing emissions from international aviation and maritime transport;*

Global climate policy: Durban Climate Conference

Global climate policy: Durban Climate Conference

Negotiating text on long term climate finance:

- *"Decides that financial resources raised by specific actions to reduce emissions from* maritime bunker fuels which may be designed and implemented by the International Maritime Organization pursuant to [paragraph [x] of this decision][decision [X]/CP.17 Sectoral Approaches)], shall be distributed, inter alia, to developing countries to **ensure no net incidence** of such actions on them through an **appropriate compensation mechanism of direct financial transfers**, and to **finance climate adaptation** through the Green Climate Fund;"

Next steps

- IMO: continued discussions on MBM
- UNFCCC: continued discussions on bunker fuels emissions
- EU: proposal for regional MBM end 2012?

Thank you!

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Ministry of Infrastructure and the Environment

Amendments to MARPOL ANNEX VI

Energy Efficiency Measures
EEDI – SEEMP

By: Sibrand Hassing
Directorate-General for Mobility and Transport - Shipping

15 December 2011

Amendments to MARPOL ANNEX VI - EE

Content

- Introduction
- Why an EEDI & SEEMP?
- Main components of Ch. 4 MARPOL Annex VI
  (I) – EEDI
  (II) - SEEMP
- Likely impacts of EEDI & SEEMP

Amendments to MARPOL ANNEX VI - EE

Introduction (1)

- MEPC 62 agreed 15 July 2011 a new Chapter 4 in MARPOL Annex VI on "*Regulations on Energy Efficiency of Ships*"* - for ships > 400GT;
- Makes mandatory the ***Energy Efficiency Design Index (EEDI)***, for **new** ships;
- Makes mandatory the ***Ship Energy Efficiency Managent Plan (SEEMP)***, for **all** ships;
- Will enter into force on **1 January 2013**.

* Resolution MEPC.203(62)

Amendments to MARPOL ANNEX VI - EE

Introduction (2)

- EEDI & SEEMP are part of IMOs' package approach;
- 'Package' = Technical- (EEDI), Operational- (SEEMP) and Marketbased measures;
- MBMs' on agenda coming IMO/MEPC meeting (MEPC 63 – spring 2012);
- Outcome not predictable – a very political discussion

Amendments to MARPOL ANNEX VI - EE

Why an EEDI & SEEMP?

- CO_2 emissions from ships are expected to increase (approx. 3% in 2007 $\rightarrow$ 12-18% in 2050*);
- Shipping needs also to take its responsibility;
- All emission reducing measures, incl. technical & operational measures - such as EEDI & SEEMP, will also decrease shippings' CO_2 footprint;
- Technical- and operational EE measures are identified as measures with a significant potential*;
- CO_2 emissions are proportional to fuel consumption.

* Second IMO Greenhouse Gas Study 2009

Amendments to MARPOL ANNEX VI - EE

Main components of Ch. 4 MARPOL Annex VI

(I)→ EEDI;

- An ***attained EEDI*** shall be calculated for ships which falls into one of the categories defined in reg. 2.25 to 2.35 – reg. 20;

  = *EEDI value achieved by an individual ship*

- **Required EEDI** for ships which falls into one of the categories defined in reg. 2.25 to 2.31 – reg. 21;

  = *maximum value of attained EEDI allowed by reg. 21*

Amendments to MARPOL ANNEX VI - EE

Attained EEDI

- Bulk carrier
- Gas carrier
- Tanker
- Container ship
- General cargo ship
- Reefer
- Combination carrier
- Passenger ship
- Ro-ro cargo ship (vehicle carrier)
- Ro-ro cargo ship
- Ro-ro passenger

Required EEDI

- Bulk carrier
- Gas carrier
- Tanker
- Container ship
- General cargo ship
- Reefer
- Combination carrier

Amendments to MARPOL ANNEX VI - EE

Attained EEDI ↔ Required EEDI

Attained EEDI ≤ Required EEDI = (1 – X*/100) x Reference line value

* Where X is the Reduction Factor

Reduction Factor implementation phases:

1. Phase 0 01.01.2013 – 31.12.2014 (0 or n/a**)
2. Phase 1 01.01.2015 – 31.12.2019 (10 or 0 – 10**)
3. Phase 2 01.01.2020 – 31.12.2024 (20 – or 0 – 20**)
4. Phase 4 01.01.2025 - …… (30 or 0 – 30**)

** pending ship size

Amendments to MARPOL ANNEX VI - EE

- Reference line refer to statistically average EEDI curves; derived from data of existing ships
- Reference line value = a x b^{-c} Parameters can be found in Table 2 to regulation 21.3
- If the design of the ship allows to fall into more than one ship type definitions, the required EEDI for the ship shall be the most stringent (the lowest) required EEDI.
- Betwwen Phase 1 and midpoint of Phase 2 – review of the status of technological developments → if felt necessary time periods and EEDI reference line parametrs can be amended.
- In compliance with the EEDI regulations ⇒ ***International Energy Efficiency Certificate (EEDI in grams-CO_2/tonne-mile)***

Amendments to MARPOL ANNEX VI - EE

(II) → SEEMP (1);

Regulation 22 – <u>each ship</u> shall keep on board a specific SEEMP

- May form part of the ship's SMS;
- In developing take into account guidelines developed by IMO ⇒ **<u>MEPC.1/Circ.683</u>: *GUIDANCE FOR THE DEVELOPMENT OF A SHIP ENERGY EFFICIENCY MANAGEMENT PLAN (SEEMP)****

  Note: does not need a formal approval by flag State and/or RO

* Still under further development

Amendments to MARPOL ANNEX VI - EE

(II)→ SEEMP (2);

- A list of all the possible stakeholders in the efficiency of a single voyage is long; such as charterers, ports and vessel traffic management services, etc., for the specific voyage. All involved parties should consider and coordinate the inclusion of efficiency measures in their operations both individually and collectively.

- Fuel efficient operations, e.g. by: improved voyage planning – weather routeing – just in time – speed optimization – optimized shaft power – optimum trim – optimum ballast - optimum propeller and propeller inflow considerations - optimum use of rudder and heading control systems (autopilots) - hull maintenance - propulsion system maintenance - waste heat recovery - improved fleet management – improved cargo handling – energy management

Amendments to MARPOL ANNEX VI - EE

Likely impacts of EEDI & SEEMP

- More energy efficient ships;
- Use of alternative fuels (e.g. LNG);
- Slower speed ships (= most effective measure);
- Pressure on sector to improve its CO_2 footprint (especially existing ships);
- Increase of newbuilding costs;
- Risk of modal shift (especially for short sea).

Thank you for your attention.

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HOLLAND SHIPBUILDING association

Results from research projects into the impact of EEDI on ship design

David Anink

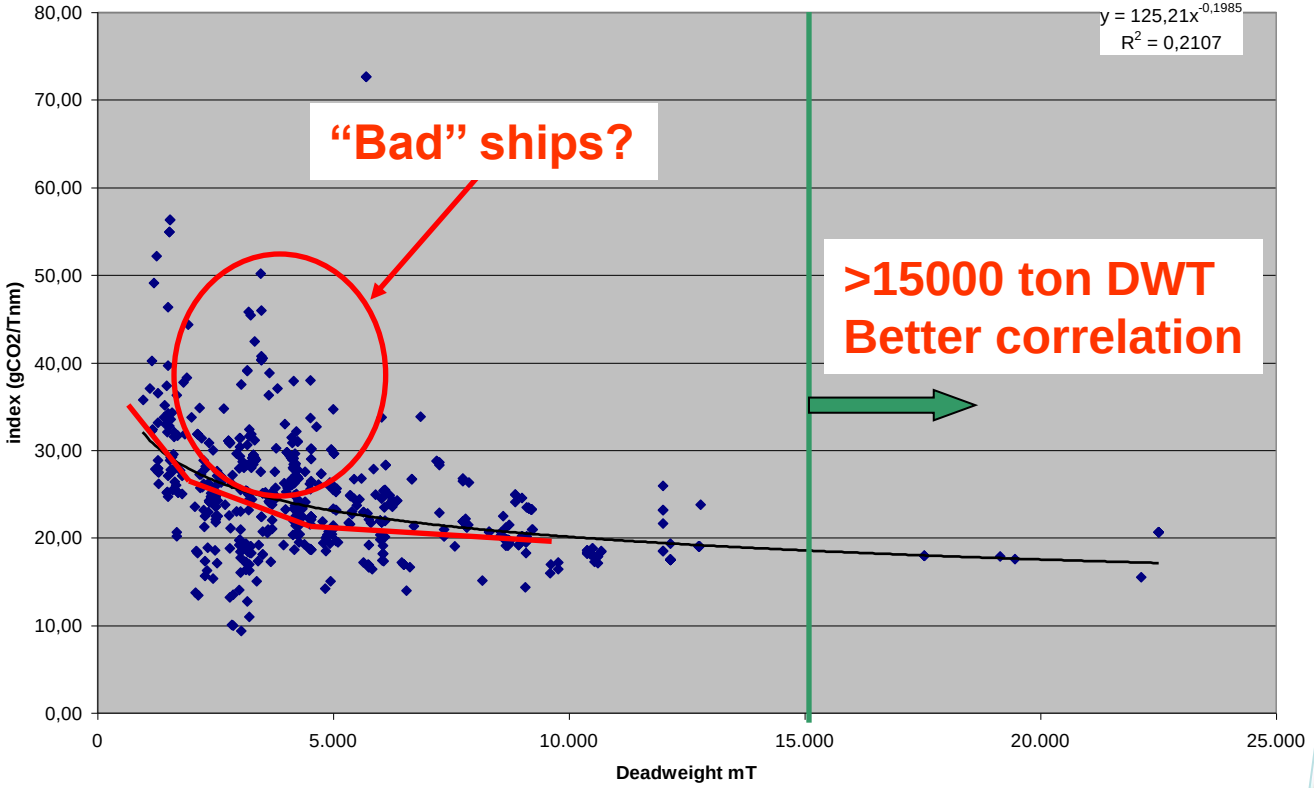
Content

- The index, what is it doing
- Analysis of the effect of the index on ships
- Possible sub optimization due to the index
- Reduction potential of the index
- Verification process
- Effect on intellectual property
- conclusion

Studies

- CMTI Study: The IMO efficiency Design Index, a Netherlands Trend study
- CMTI Study: Energy efficiency of small ships and non-conventional propelled ships
- CMTI study: Analysis of the effect of the new requirements on Dutch build and Flagged Ships

EEDI of Dutch general cargo ships



EEDI

Deadweight

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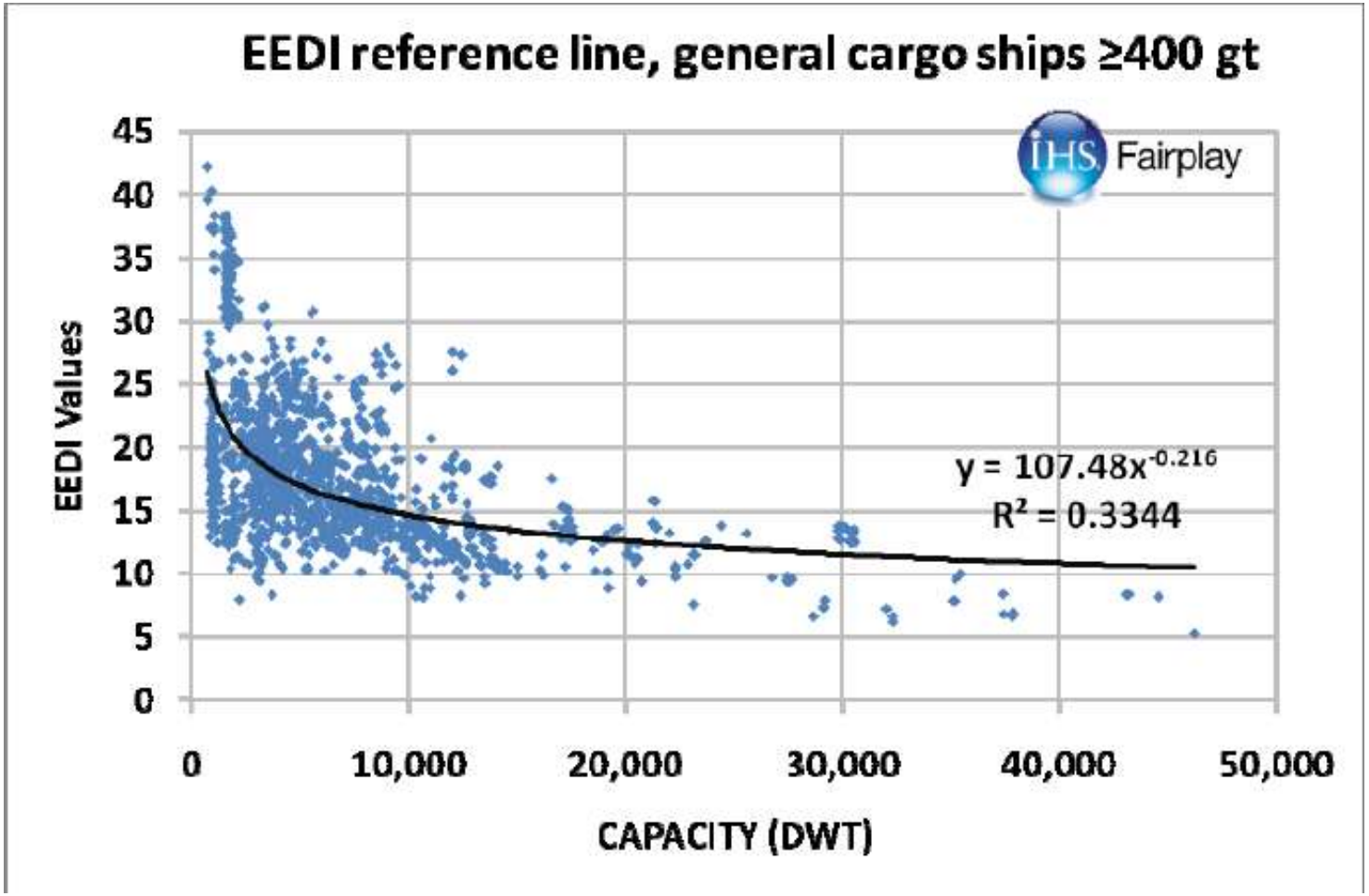
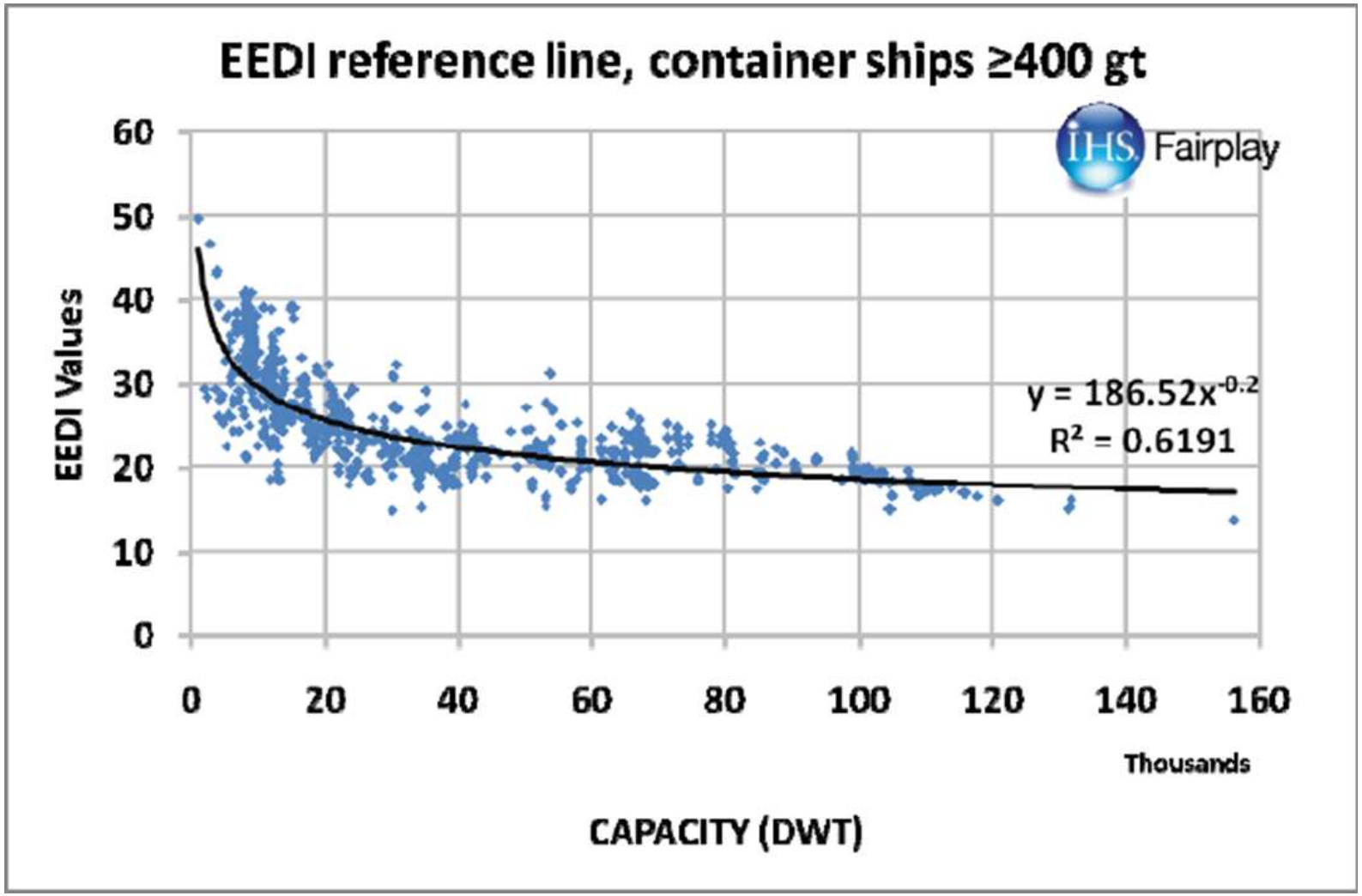


HOLLAND SHIPBUILDING association



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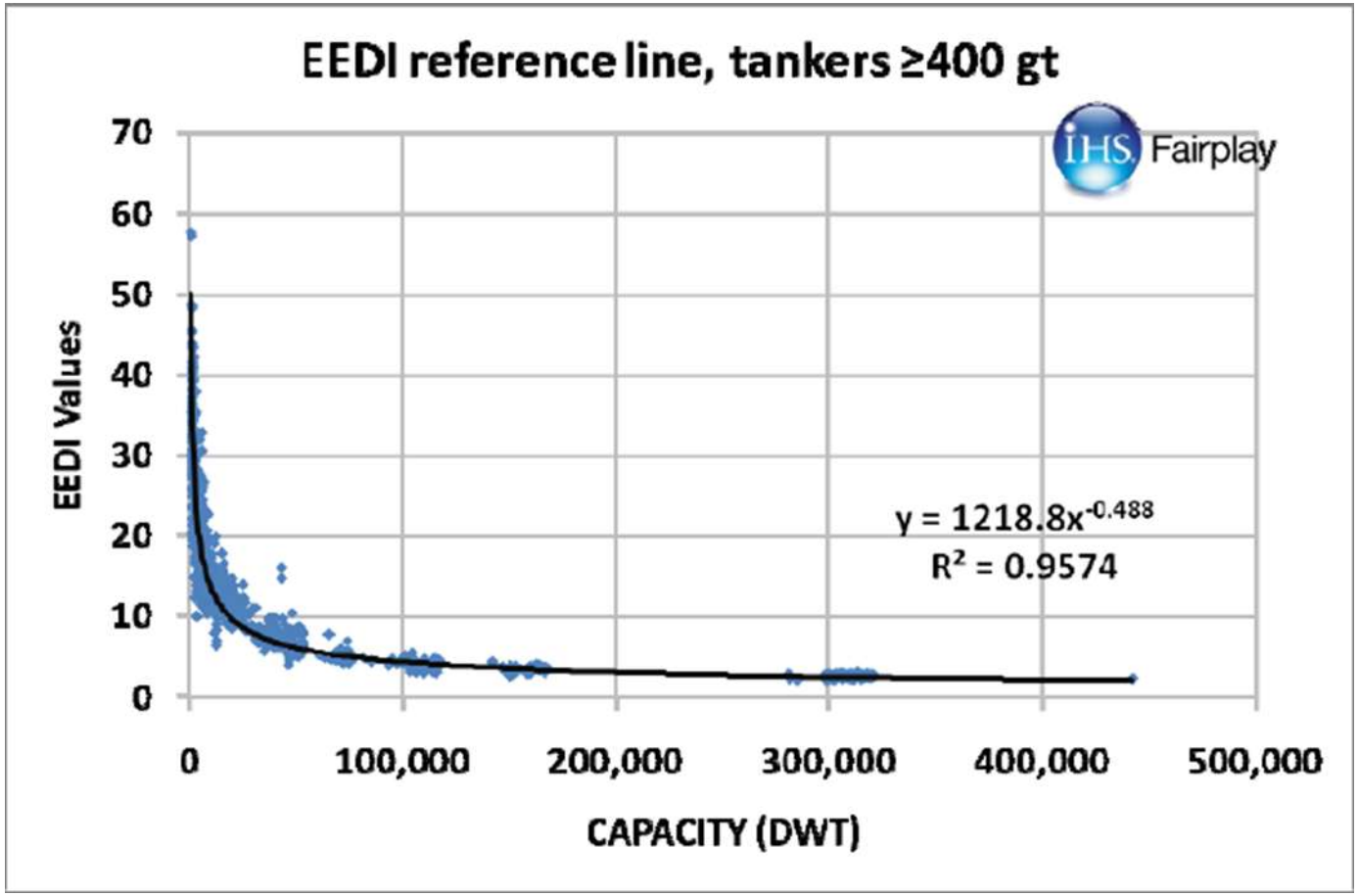

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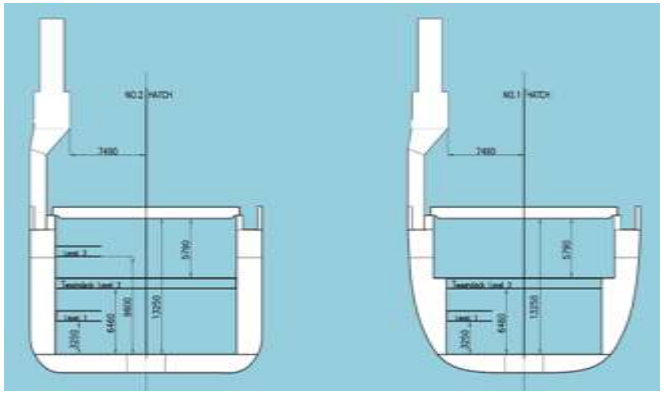
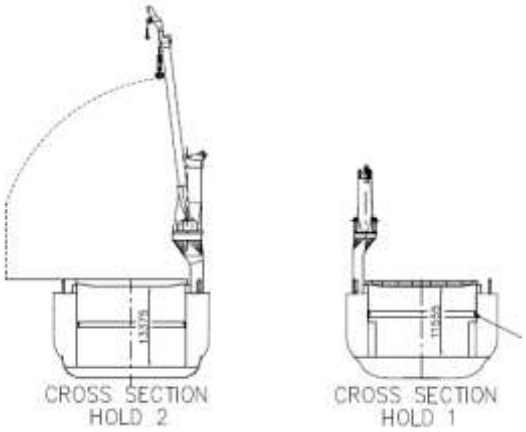
SHIPBUILDING
association

Comparison of two ships

		General cargo ship	Heavy lift ship
Deadweight	Tonnes	18143	18163
Reference Speed Vref	Kn	17	13
MCR	kW	8400	8400
P_{PTO}	kW	900	900
Ice class		1A	1A
Attained EEDI	CO2/Tonmile	9,71	12,71
Year of built		2009	2010

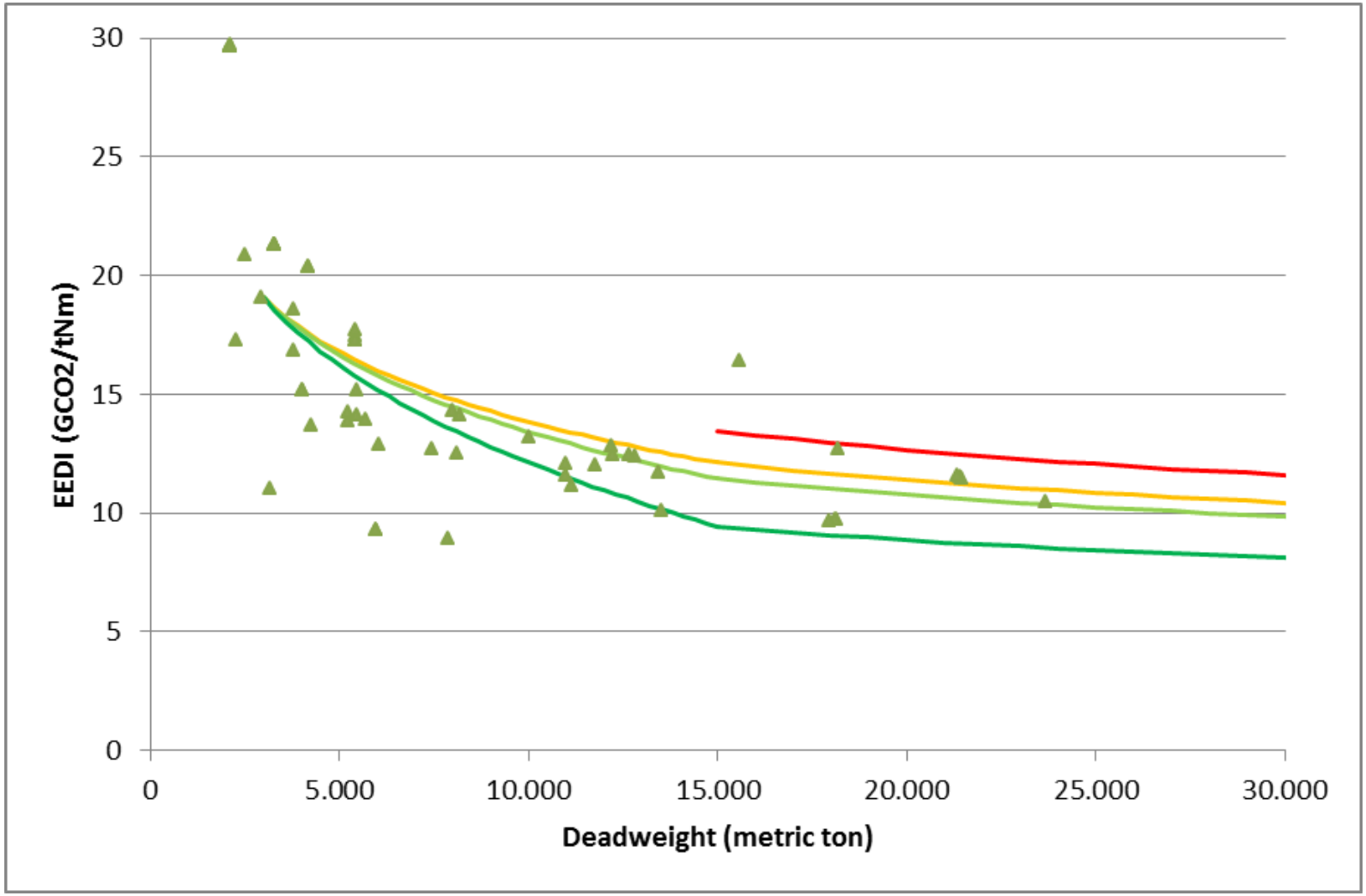
Same ship, different optimization



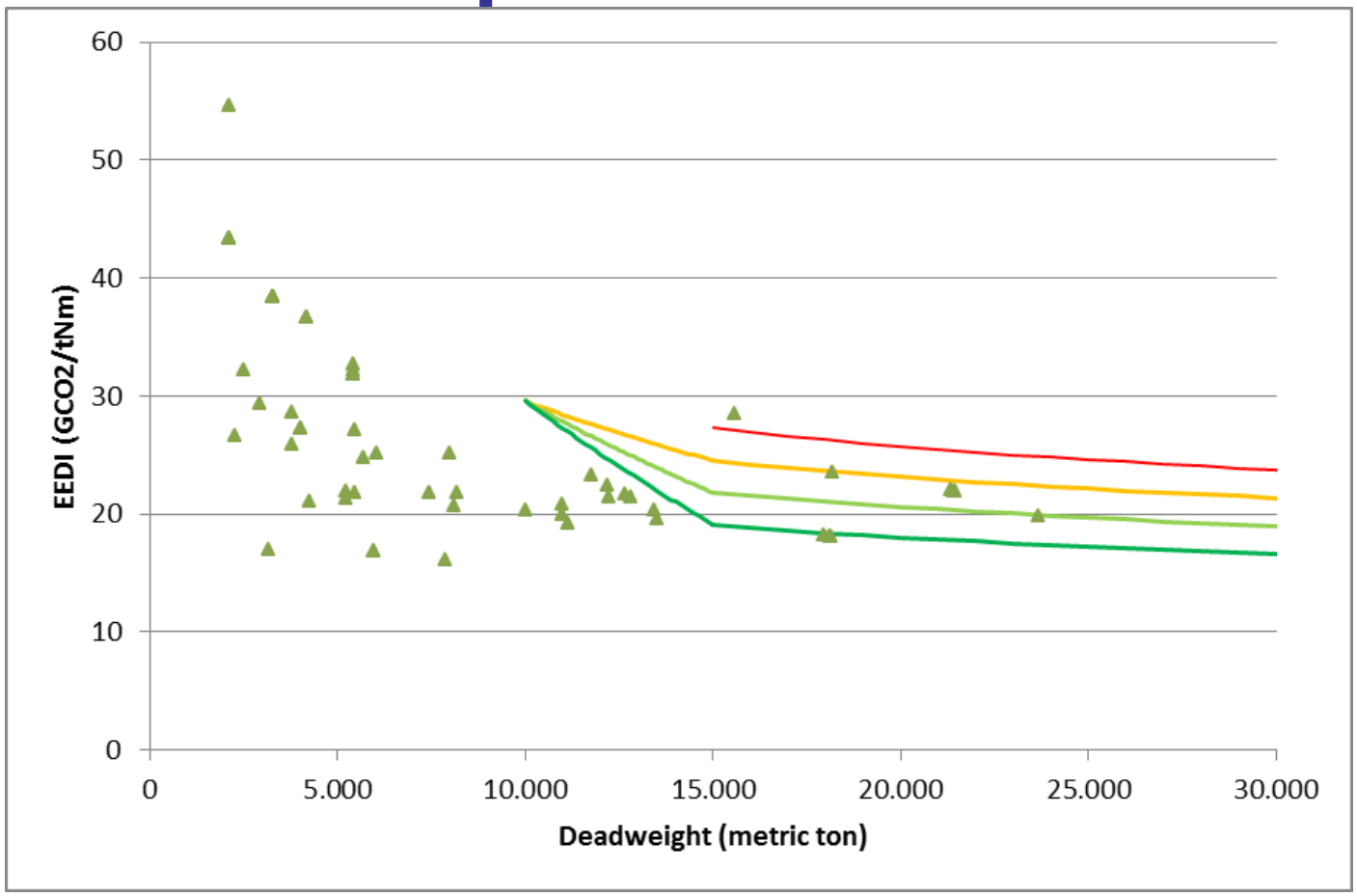


HOLLAND SHIPBUILDING association

General Cargo Ships

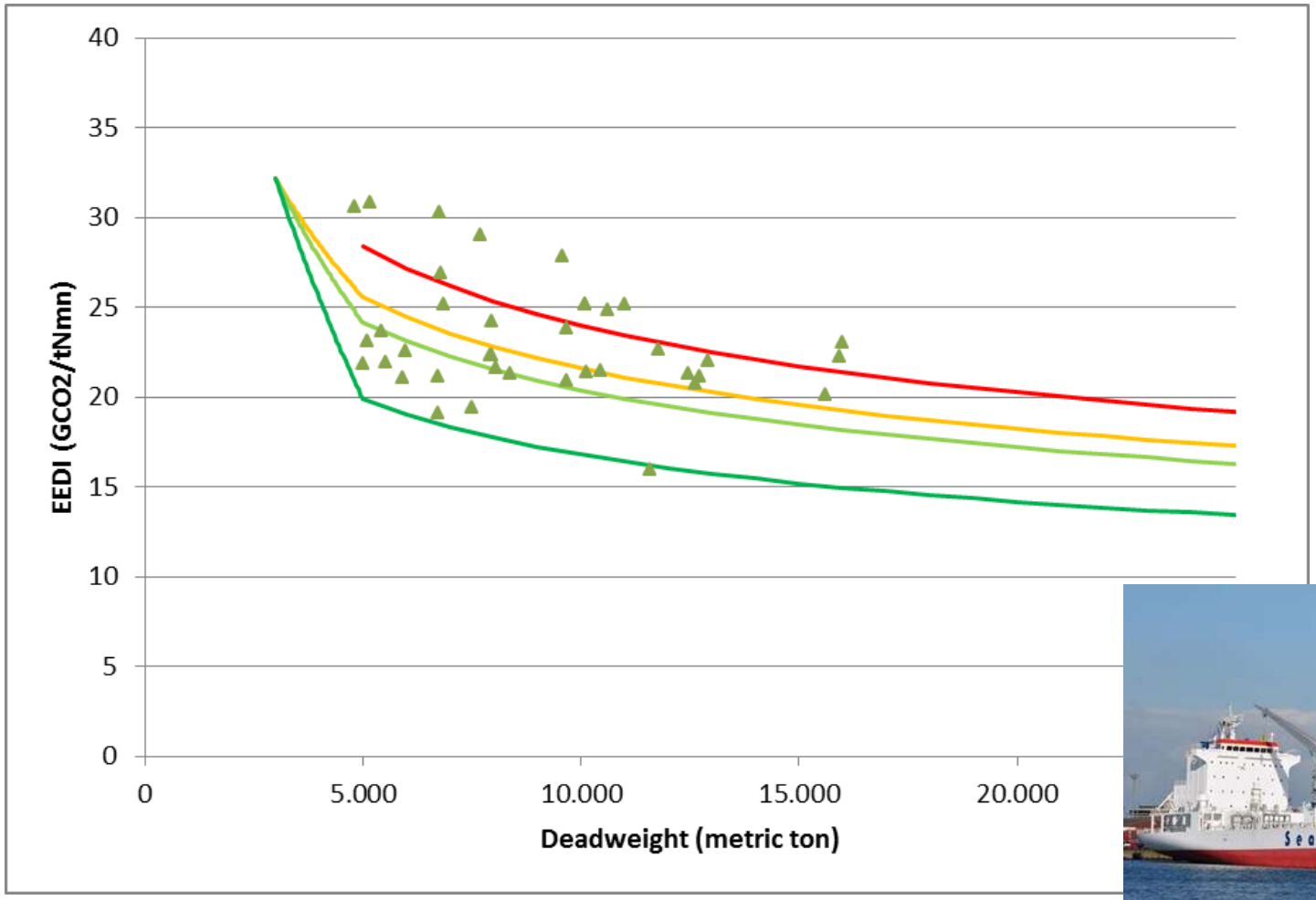


General cargo vs container ship requirements



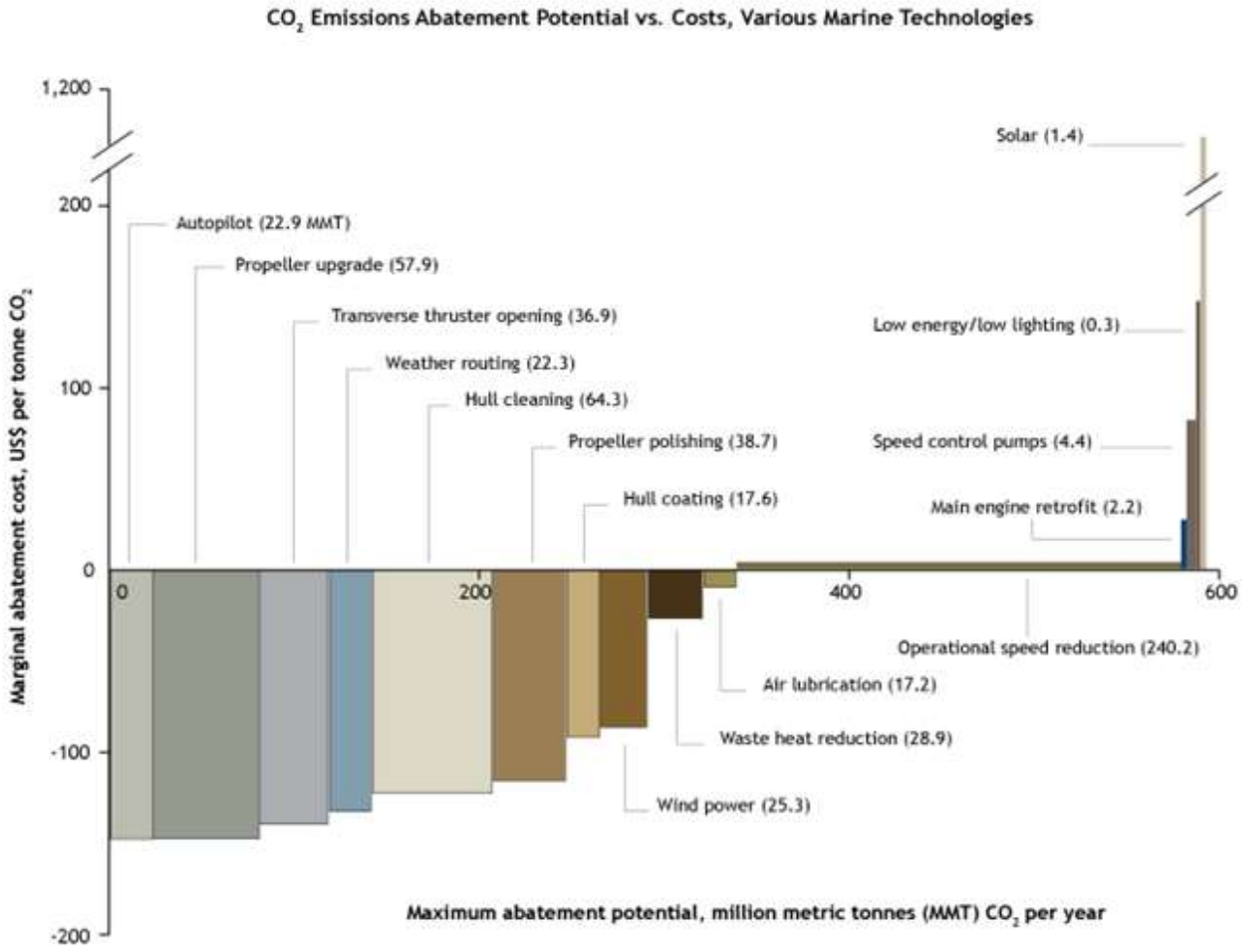
HOLLAND SHIPBUILDING association

Reefer ships



HOLLAND SHIPBUILDING association

Effect on ship design



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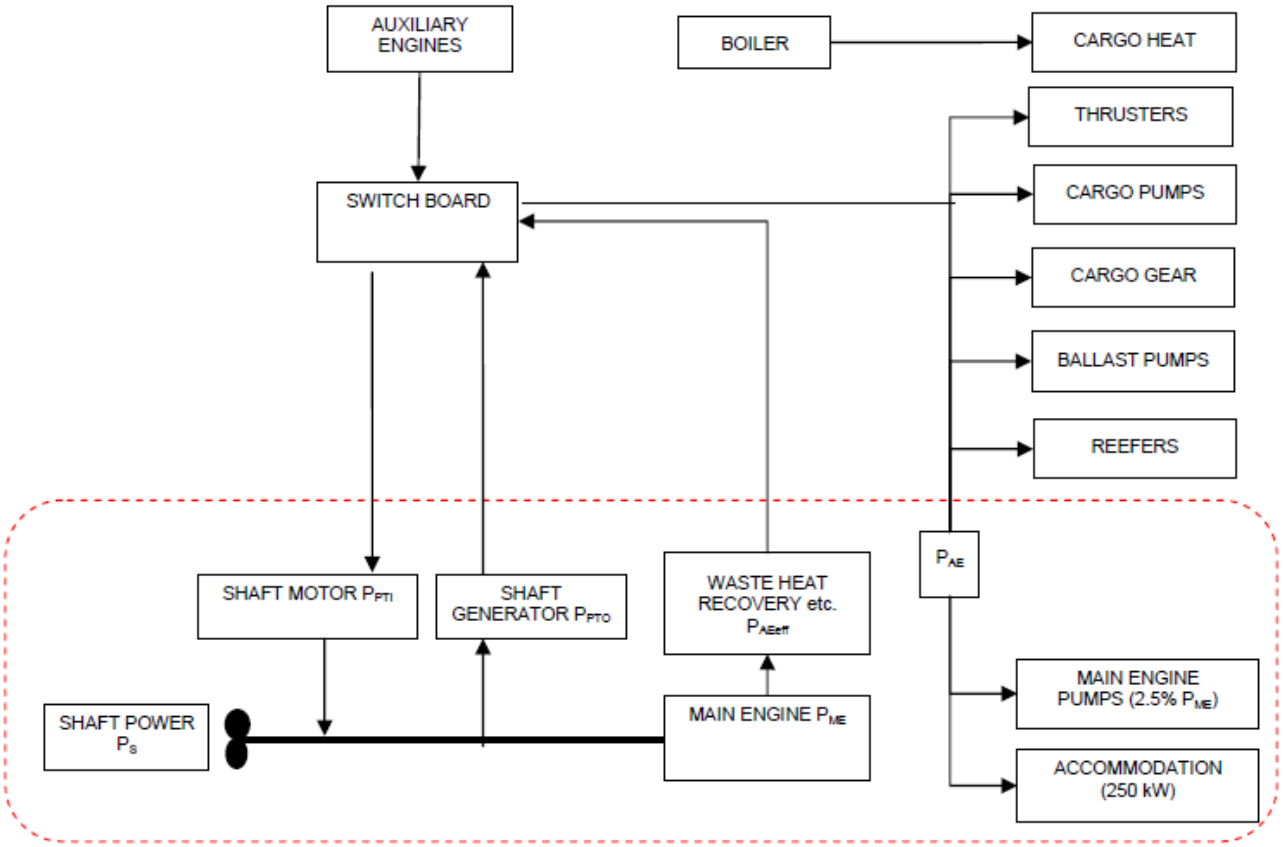
Sub optimization



Calculation of reduction potential

- How much CO2 reduction potential is expected on the current EEDI
- Based on Dutch fleet developments
- Based on current requirements

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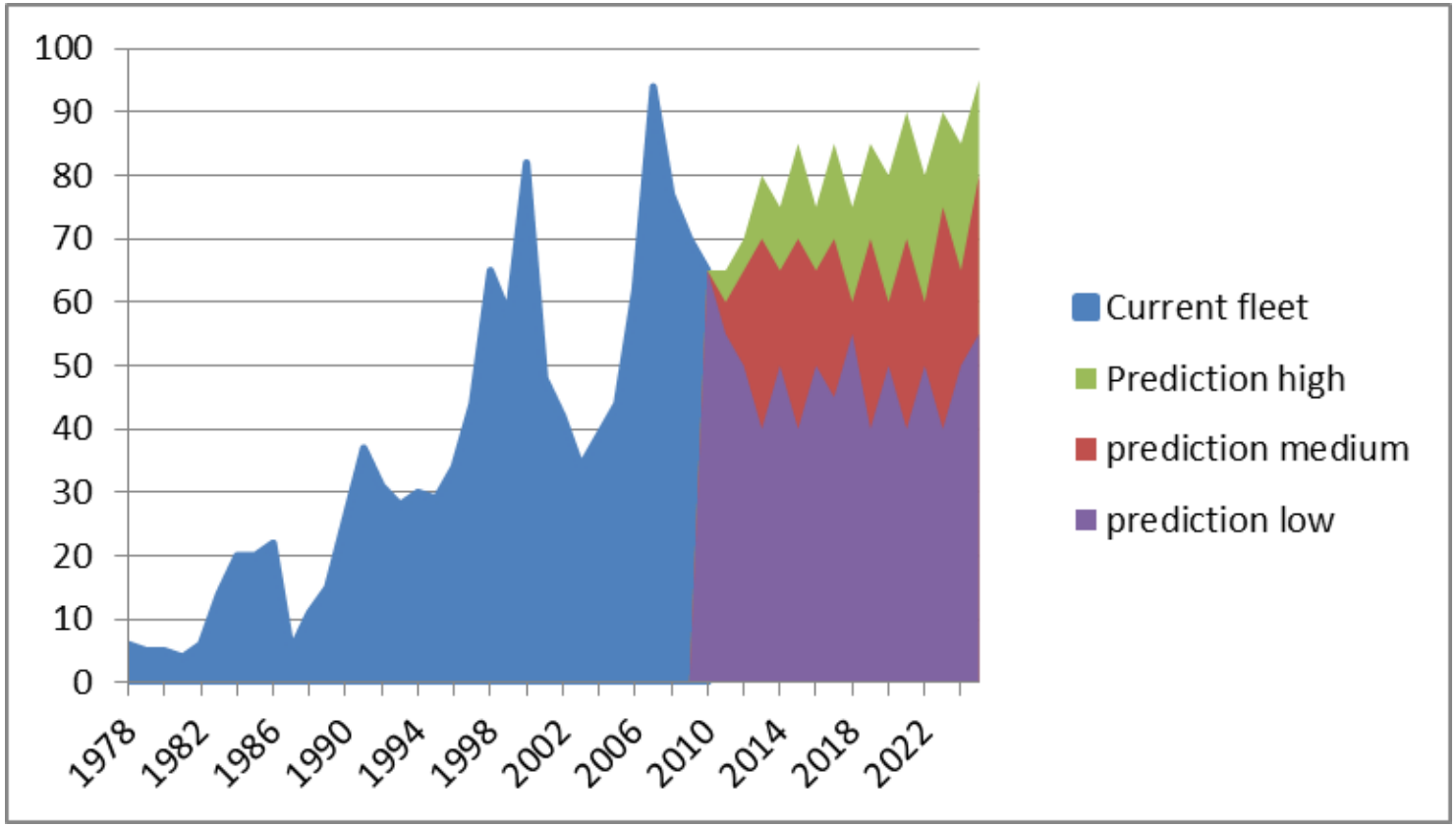
Fleet development



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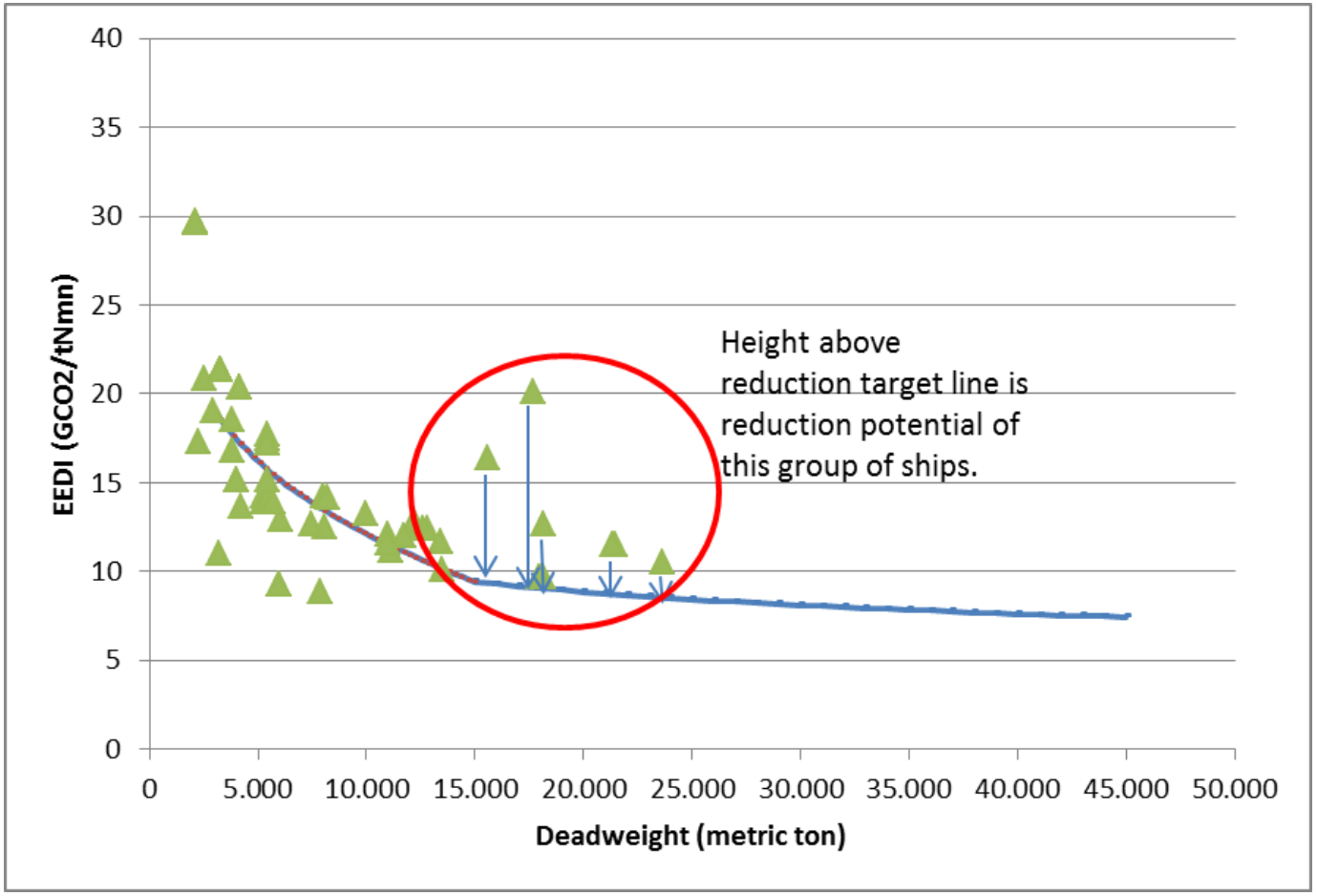
Reduction Potential



Reduction potential of EEDI

	attained	phase 0	phase 1	phase 2	phase 3
General cargo	933,98	10,22	38,31	44,03	74,78
Gas tankers	279,22	0,00	22,20	23,43	24,66
Ref car	883,76	23,97	64,83	94,34	218,28
Tanker	31,77	0,00	0,64	1,42	2,20
Bulkers	12,45	0,09	0,45	0,82	1,57
Container	35,35	0,00	0,00	0,00	0,00
	2176,53	34,28	126,44	164,04	321,50
		1,6%	5,8%	7,5%	14,8%

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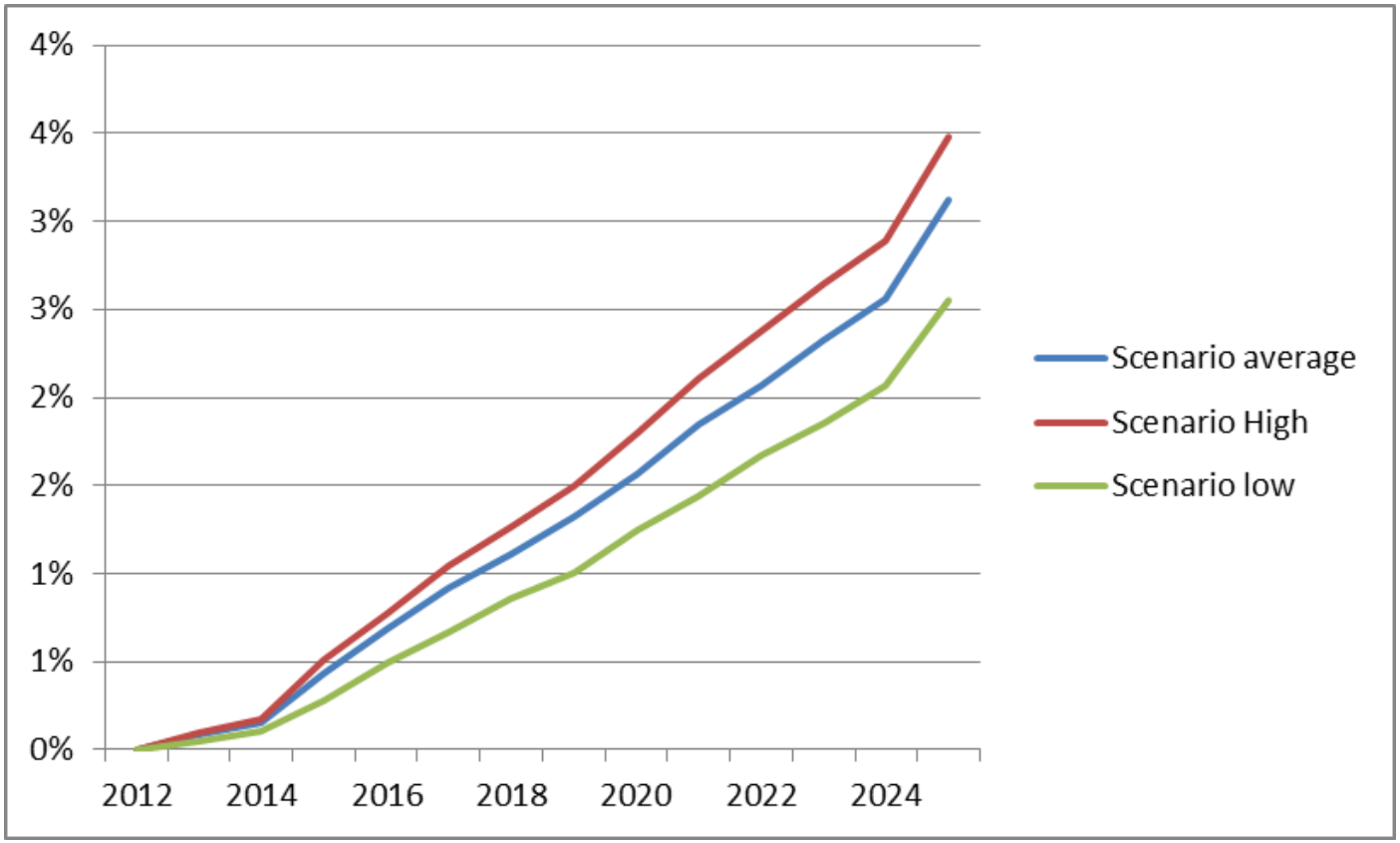
Actual Reduction potential



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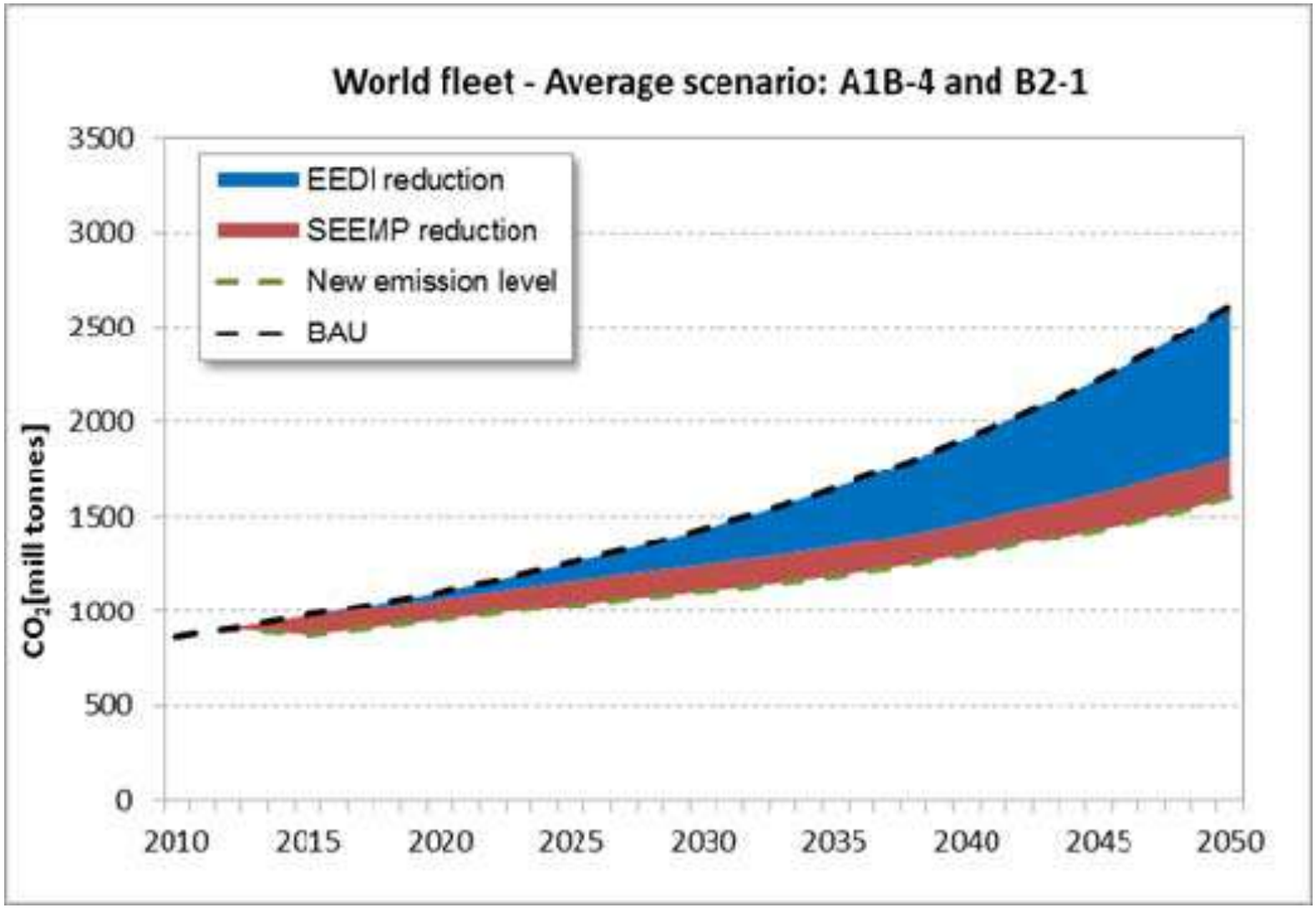

- Speed will be a dominant factor
- First phase will have little effect on ships
- After 2020 the effect of the EEDI kicks in
- Niche ship design will have difficulties in fulfilling the requirements
- Operational profile is not taken into account
- Index might create sub optimization in power management
- Reduction potential up to 2025 is no more than 4%

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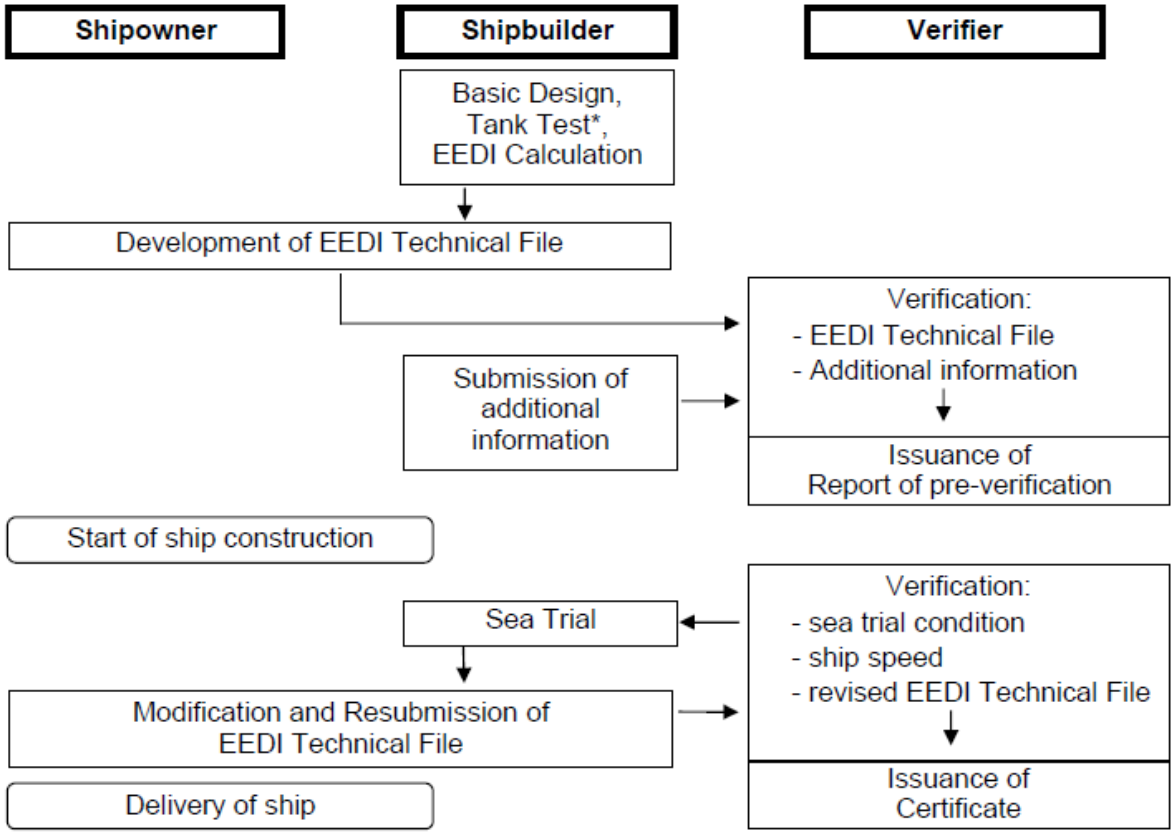
Verification process



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4.2.7 Additional information that the verifier may request the shipbuilder to provide directly to it (i.e. not to be contained in Technical File) includes but not limited to:

.1 descriptions of a tank test facility; this should include the name of the facility, the particulars of tanks and towing equipment, and the records of calibration of each monitoring equipment;

.2 lines of a model ship and an actual ship for the verification of the appropriateness of the tank test; the lines (sheer plan, body plan and half-breadth plan) should be detailed enough to demonstrate the similarity between the model ship and the actual ship;

.3 lightweight of the ship and displacement table for the verification of the deadweight;

.4 detailed report on the method and results of the tank test; this should include at least the tank test results at sea trial condition and at the intended summer load draught;

.5 detailed calculation process of the ship speed, which should include the estimation basis of experience-based parameters such as roughness coefficient, wake scaling coefficient; and

Intellectual Property Right

Regulation 23

Promotion of technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships

1 Administrations shall, in co-operation with the Organization and other international bodies, promote and provide, as appropriate, support directly or through the Organization to States, especially developing States, that request technical assistance.

2 The Administration of a Party shall co-operate actively with other Parties, subject to its national laws, regulations and policies, to promote the development and transfer of technology and exchange of information to States which request technical assistance, particularly developing States, in respect of the implementation of measures to fulfil the requirements of chapter 4 of this annex, in particular regulations 19.4 to 19.6."

Conclusions

- Verification process needs to be updated and demands much from the shipbuilding side
- Verification of speed during sea trials is unclear
- Intellectual property is not sufficiently protected
- This is the biggest challenge for the shipbuilding industry

HOLLAND SHIPBUILDING association

Thank You

Inspectie Verkeer en Waterstaat
Ministerie van Infrastructuur en Milieu

EEDI

Energy Efficiency Design Index

Enforcement by PSC / FSC

RESOLUTION MEPC.203(62)

Adopted on 15 July 2011

AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO

(Inclusion of regulations on energy efficiency for ships in MARPOL Annex VI)

A new Chapter 4 added at the end of the Annex

RESOLUTION MEPC.203(62)

- Approved not mentioned
- Issue of "International Energy Efficiency Certificate" (>400GT)
  - Valid throughout the life of the ship

- Administration mentioned +/ - 20 times
  - In relation to
    - Major conversion
    - Ships less than 400 GT (Only Ch 3)
    - Administration or any organization duly authorized by it (Class)
    - Transfer of Flag
    - Waivers (Info to IMO) (Initial period)
    - Promotion of technical co-operation

MEPC.1/Circ.682

17 August 2009

INTERIM GUIDELINES FOR VOLUNTARY VERIFICATION OF THE ENERGY EFFICIENCY DESIGN INDEX

4.2.6 second note:

For ensuring the quality of tank tests, it would be desirable in the future that an organization conducting a tank test be authorized by the Administration or an organization recognized by it in accordance with the guidelines developed by the Organization.

MEPC.1/Circ.681

17 August 2009

INTERIM GUIDELINES ON THE METHOD OF CALCULATION OF THE ENERGY EFFICIENCY DESIGN INDEX FOR NEW SHIPS

Port / Flag State Control

- ***Port State Control on Operational Requirements***

- A new paragraph 5 is added at the end of the regulation as follows:

- 5. In relation to chapter 4, any port State inspection shall be limited to verifying, when appropriate, that there is a valid International Energy Efficiency Certificate on board, in accordance with article 5 of the Convention.

- This means, PSC shall check if the certificate is still valid and of all conditions are complied with.

Port / Flag State Control

- Check if there is on board

- Attained Energy Efficiency Design Index (Waived)
- Required EEDI (Waived)
- Ship Energy Efficiency Management Plan
- EEDI technical file (Waived, part of EEDI)

Q&A

????

Lloyd's Register: Marine

Ship Energy Efficiency Management Plan (SEEMP) Training

Postillion Hotel Amersfoort

Mr. Paolo Mele

Version 1.0 November 2011

Lloyd's Register
LIFE MATTERS

SEEMP DEVELOPMENT GUIDELINES

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Operator – specific requirements (energy efficiency)

- Vessels MUST have systems and practices which will foster the pursuit of energy efficiency

- Each vessel MUST develop a specific SEEMP

- The following initiatives may be used as guidance:
  - Vessel optimisation initiatives…
  - Propulsion management initiatives…
  - Machinery optimisation initiatives…
  - Energy / Emission conservation initiatives…

Operator – specific requirements (energy efficiency)- cont'd

- In order to measure progress, a 'baseline' criterion is to be established e.g. EEOI

- To enable monitoring, real-time performance monitoring processes could be used, thus enabling implementation of prompt corrective action and comparison with ship benchmarking related to energy efficiency and process improvement

- As part of the Companies' training program, personnel should be trained with the use of the SEEMP

IMO SEEMP GUIDELINES (MEPC.1/CIRC.683)

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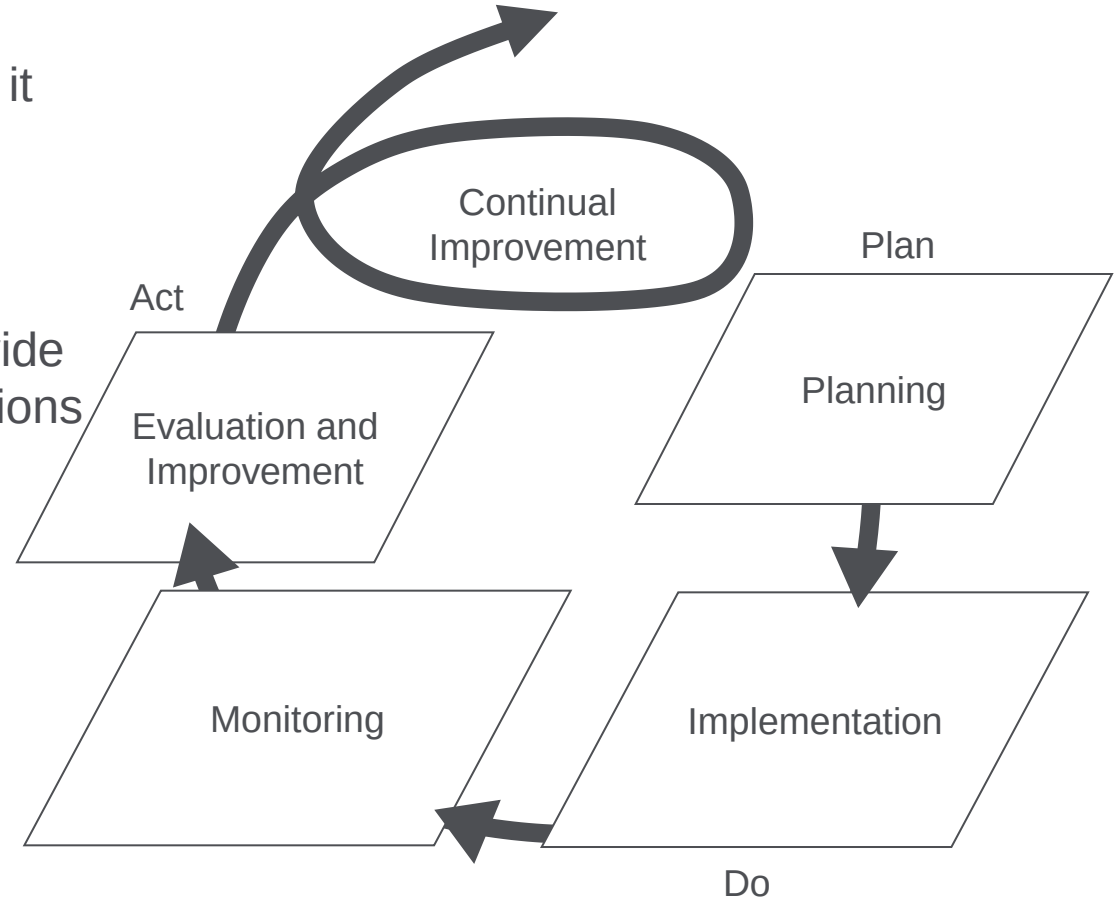
SEEMP is a management manual

- As a management manual, it should follow PDCA improvement cycle
- As a manual, it should provide clear guidance and instructions on what needs to be done



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SEEMP - Main objectives

A mechanism for a company and/or ship to improve energy efficiency of a ship's operation

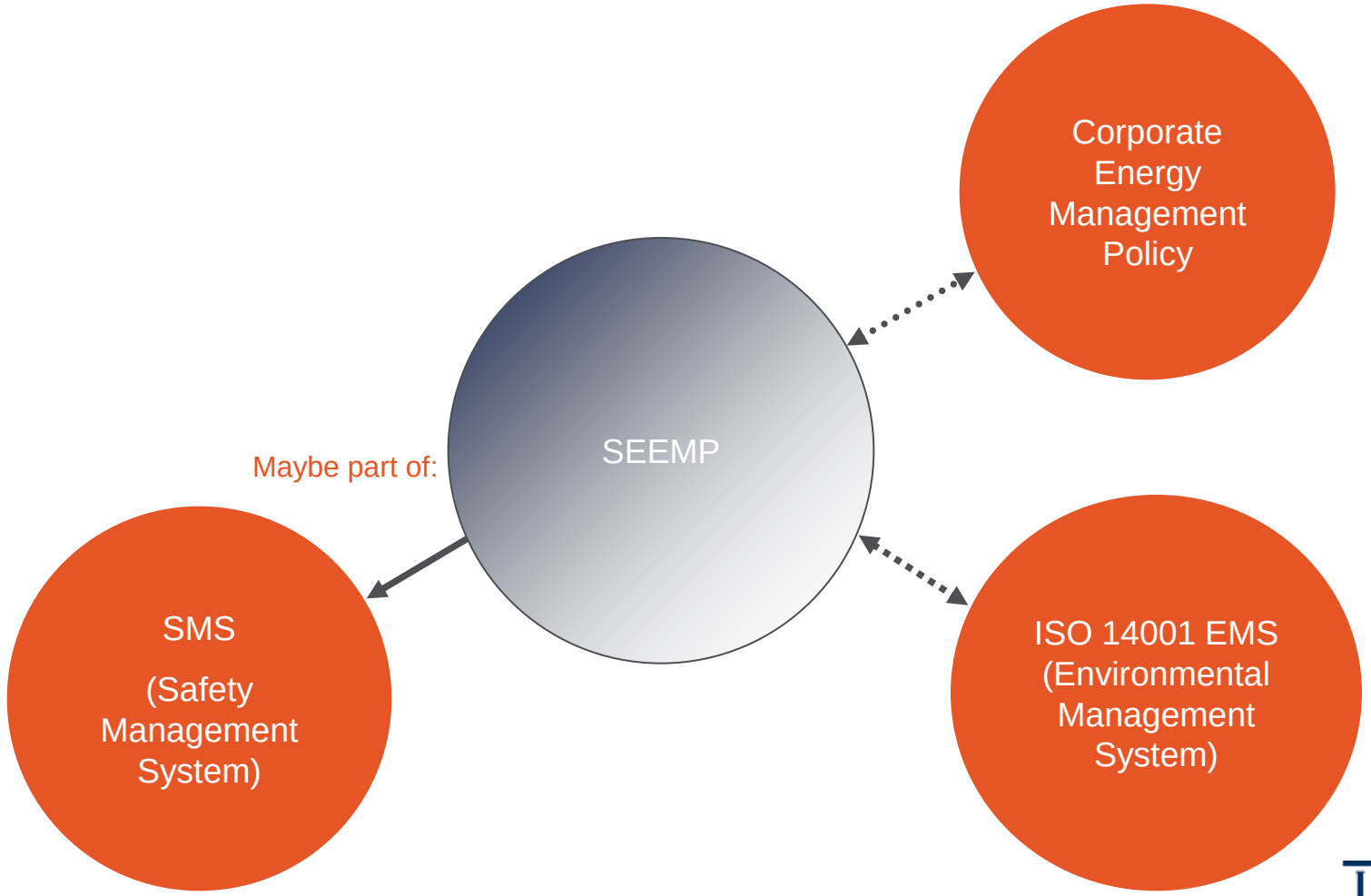
Provides guidance for the development of a SEEMP that should be adjusted to the characteristics and needs of individual companies and ships

The SEEMP should be developed as a ship-specific plan by the company.

SEEMP Stakeholders

- More coordination between stakeholders is more rewarding in energy efficiency
- Company should do the coordination rather than the ship
- A company-specific energy management plan could support this process

SEEMP – Link to other management systems



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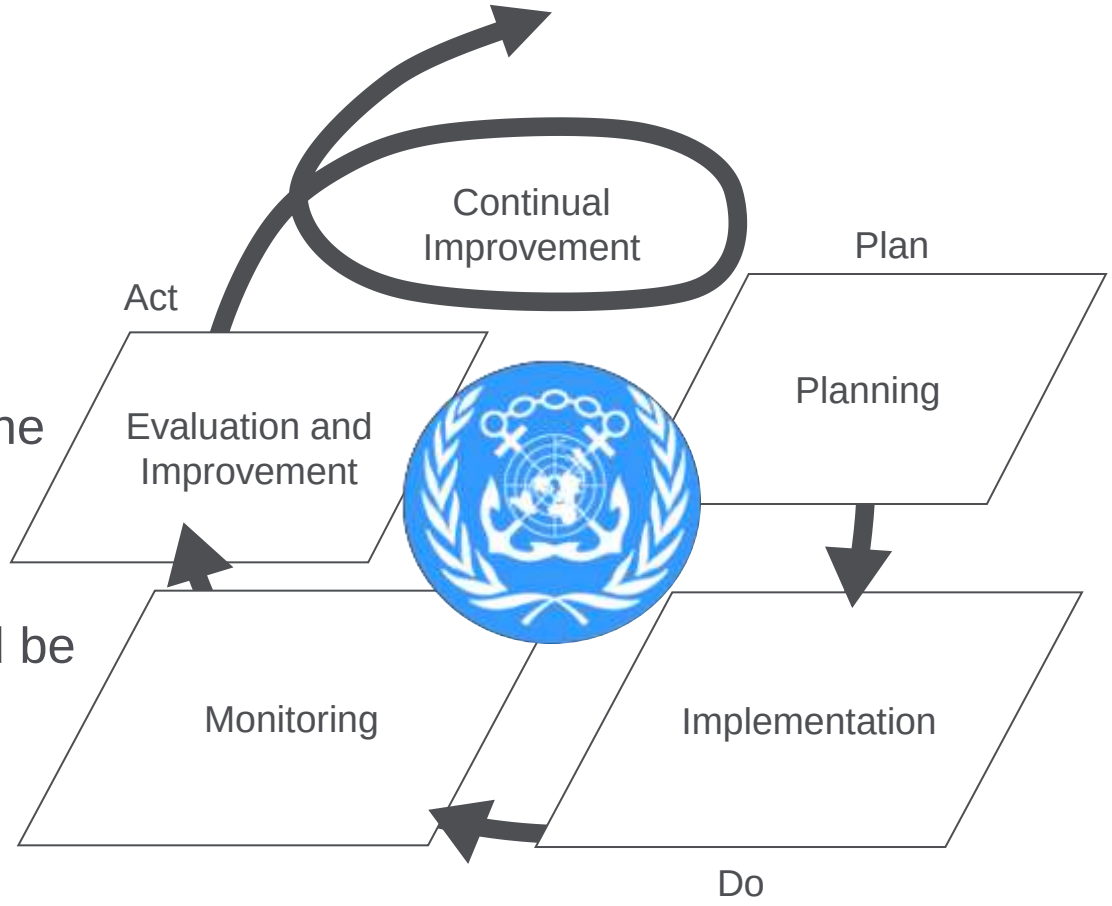
LIFE MATTERS

SEEMP is Based on PDCA Management Cycle

- A continuous cycle for improving ship energy management
- With each iteration of the cycle, some elements of the SEEMP may change
- Therefore, SEEMP should be considered as a "live" documents and require planned updates



IMO SEEMP GUIDELINES (DETAILS)

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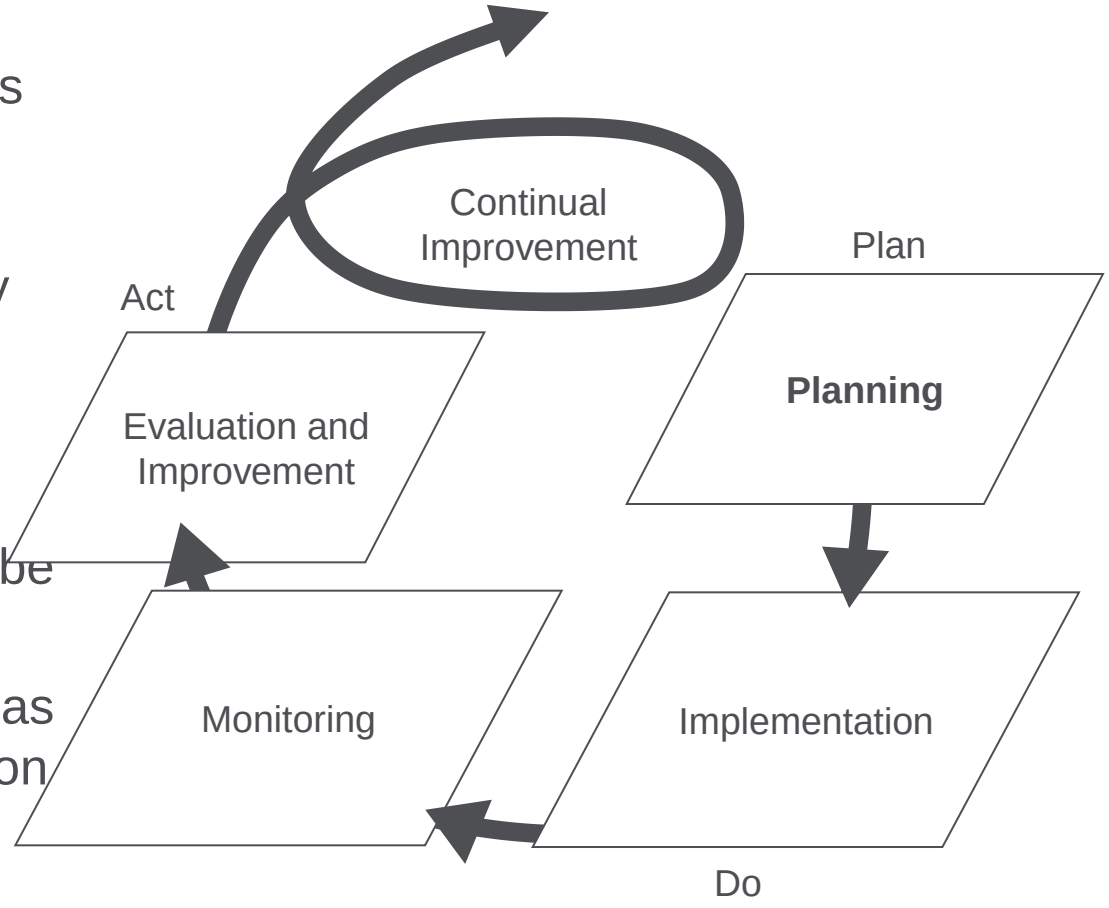
Planning – Identifying Energy Efficiency Measures (EEMs)

- Determine the current status of ship energy usage
- Determine the expected improvement of ship energy efficiency
- Generic EEMs should be identified
- Ship-specific EEMs should be identified
- The EEMs should be listed as a package for implementation

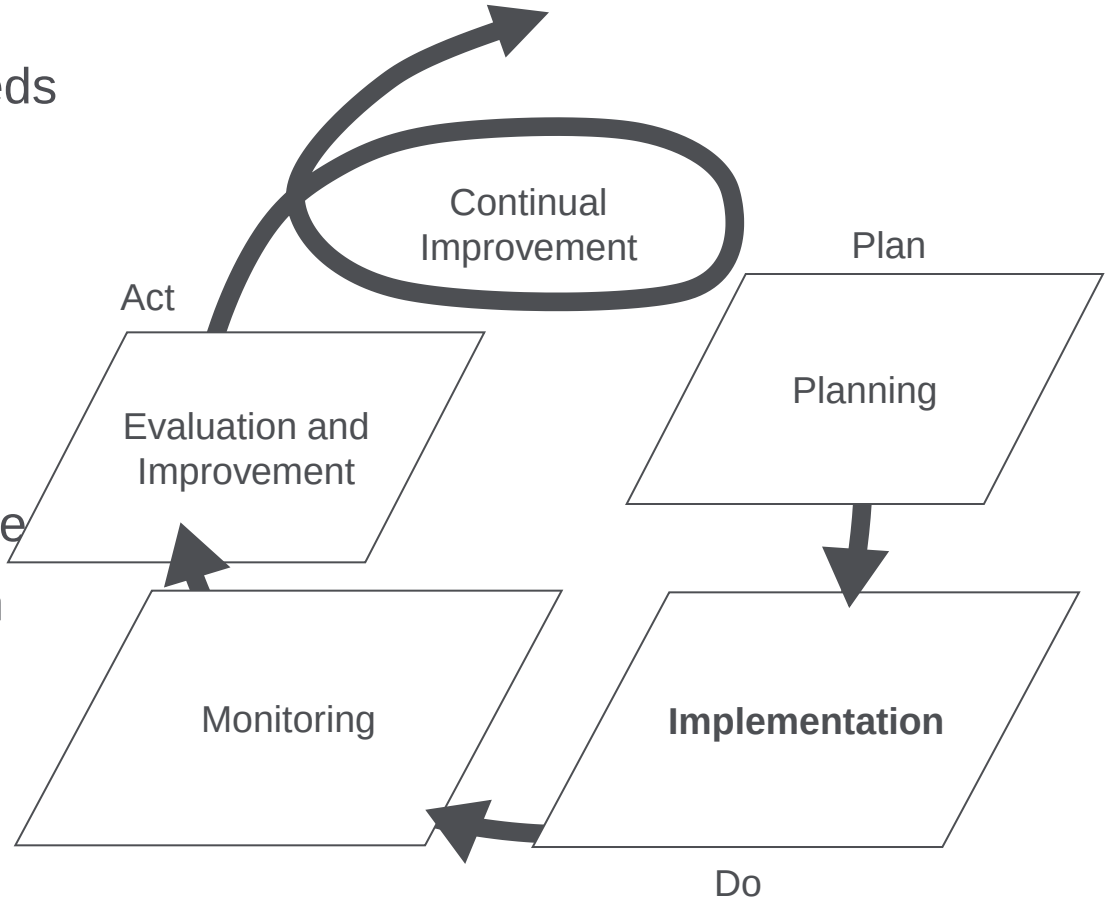


SEEMP – Goal Setting

- Goal setting is part of planning
- Goal settings are voluntary and there is no need for announcement to public nor are they subject to external inspection
- Purpose of goal setting is to increase commitment to improving energy efficiency
- The goal can take any form:
  - Annual fuel consumption
  - EEOI targets
- The goal should be measurable and easy to understand

SEEMP – Implementation System

- Implementation system needs to be defined:
  - Identify measures
  - Tasks to be done
  - Procedure for implementation
  - Roles and responsibilitie
- The implementation system should be defined at the planning phase



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SEEMP – Training

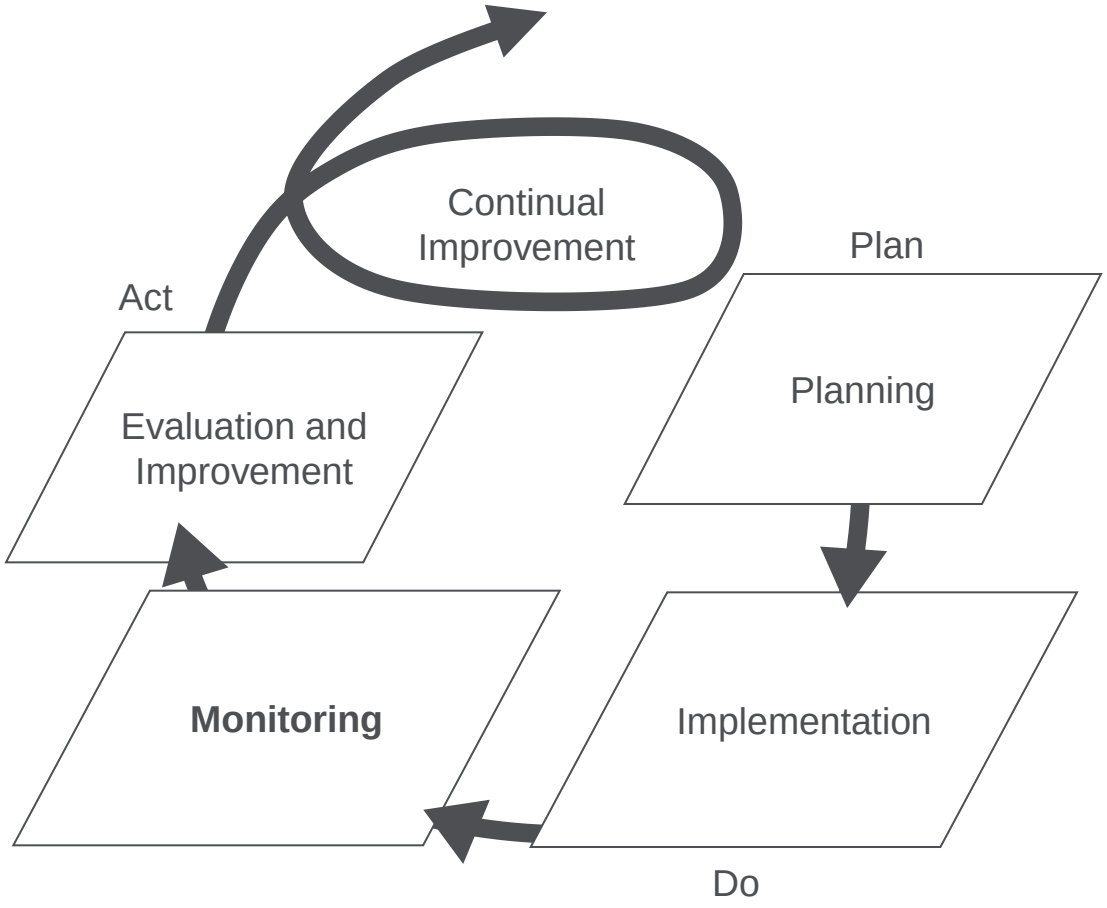
- Raising awareness should be planned & implemented
- Providing necessary training for both onshore and onboard staff
- Human resources developments should be part of SEEMP implementation

SEEMP – Record keeping

- Record keeping for implemented EEMs is important for self-evaluation

SEEMP – Monitoring

- The Energy Efficiency of a ship should be monitored quantitively
- This should be done by an established method, preferably by an international standard
- EEOI is one internationally established tool that can be used for this purpose
- EEOI can be considered as the primary monitoring tool
- In addition to the EEOI, other measurement tools can be used:
  - In this case, the concept of the tool and the method of monitoring may be determined in SEEMP



LIFE MATTERS

Monitoring Tools: EEOI (Energy efficiency Operational Indicator)

- If used, EEOI must be calculated according to IMO Guidelines (MEPC.1/Circ.684)
- If appropriate, a Rolling Average Index of the EEOI values may be calculated for monitoring over time

$$EEOI = \frac{\sum_j FC_j \times C_{Fj}}{m_{cargo} \times D}$$

j = Fuel type

FC = Mass of consumed fuel

CF = Fuel mass to CO2 mass conversion factor for fuel j

m_{cargo} = Cargo carried (tonnes) or work done (No. TEU or passengers)

D = Distance (nautical miles) corresponding to work done

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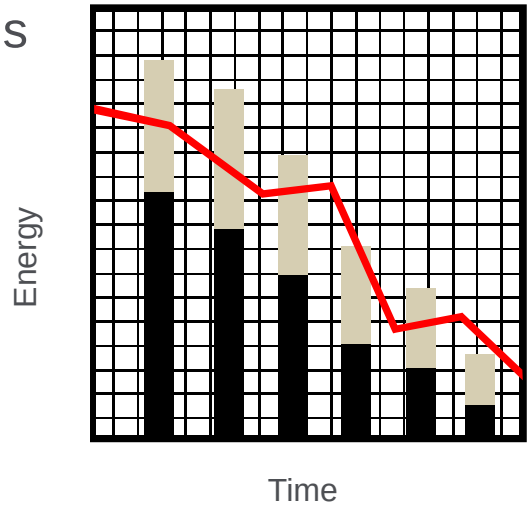
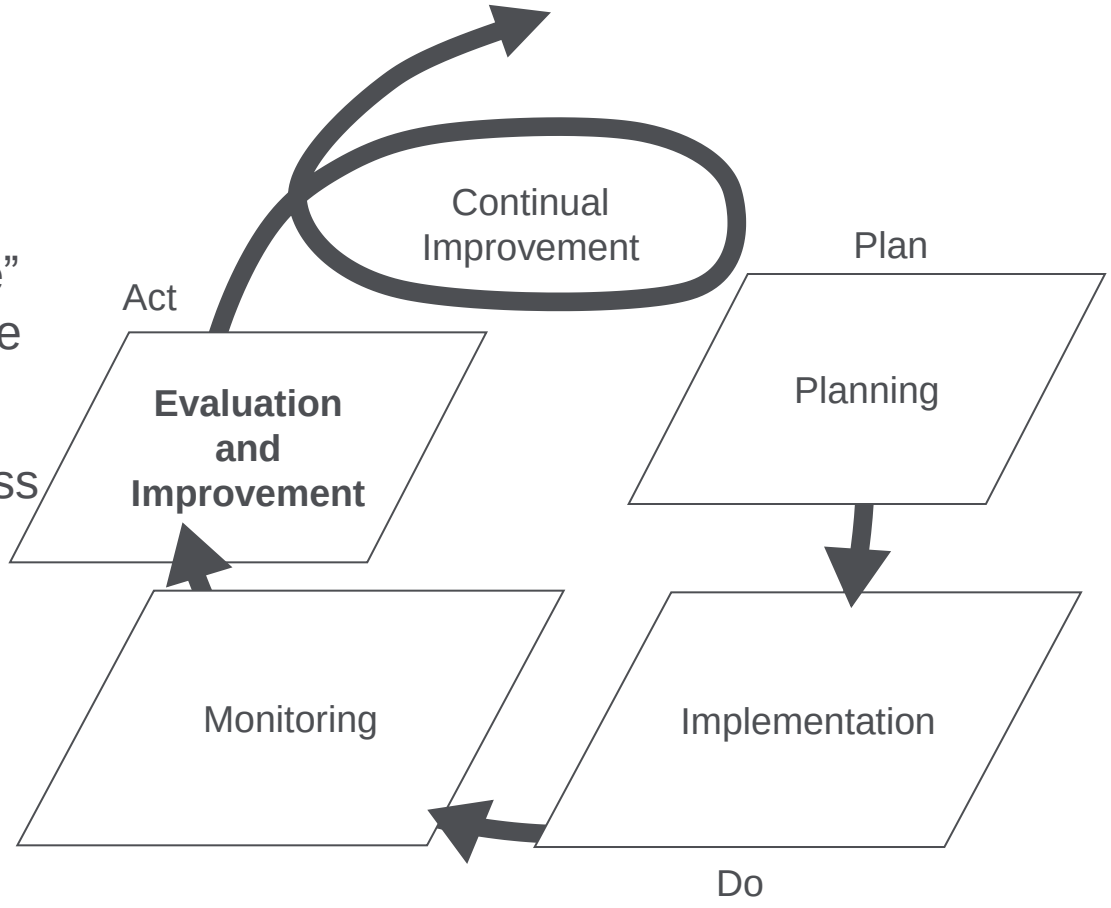
Monitoring System

- Irrespective of the type of monitoring tool, continuous and consistent data collection is the foundation of monitoring
- Monitoring system includes:
  - Procedures for collecting data
  - Responsible personnel
- To reduce ship-board workload:
  - Monitoring should be carried out as far as possible by shore-staff
  - Data should be mainly those that are already available in the official and engineering log-books, oil record books, etc
- Additional data could be obtained as appropriate



Self-Evaluation and Improvement

- Final phase of management-cycle
- Should produce meaningful feedback for "planning phase" of the next improvement cycle
- Purpose:
  - Evaluate the effectiveness of planned EEMs
  - Identify success in implementation of the EEM
  - Understand trend in efficiency improvements
  - Decide how to improve the SEEMP for next cycle



Self-Evaluation and Improvement

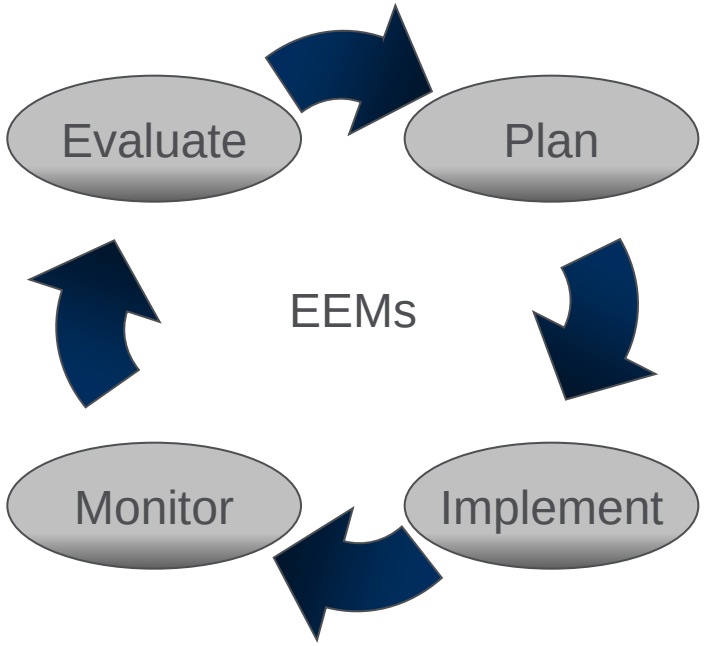
- Procedure for self-evaluation of ship energy management should be developed
- Self-evaluation should be done periodically by using data collected through monitoring
- Time should be invested in identifying the cause-and-effect of the performance during the evaluation period
    - To be used to improve the next stage of the management plan

Voluntary Reporting

- Some companies may wish to make public:
  - The results of SEEMP implementation
  - How the actions have impacted the efficiency of their ships
- Voluntary reporting and review should be encouraged through incentives
- Incentive types:
  - Some national administrations, ports or partnerships may wish to recognise the efforts of these leading companies
  - Some ports already offer environmentally differentiated harbour fees and other rewards

SEEMP Implementation

- Periodical review
- Setting new targets?



- Clear instructions to ship staff on what to do
- Clear instructions to shore staff

- Recording
- Reporting
- Inspection / Audit

- Define roles and responsibilities
- Clear instructions on how to implement
- Who should do what

Ideally, the above cycle should be observed for each EEM

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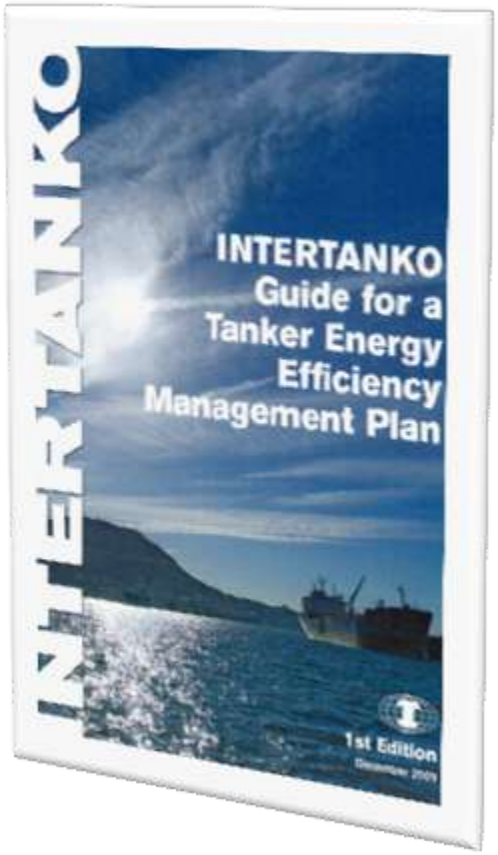
TEEMP

- TEEMP is the Tanker Energy Efficiency Management Plan

- It is applicable only to tankers and contains additional EEMs that may assist in energy improvement for example:
  - Fuels (quality, additives)
  - Other (incinerator usage, bow thruster usage)
  - Cargo vapour control
  - Waste heat recovery



Summary of learning points

- SEEMP is an energy management manual with management system characteristics (PDCA).
- SEEMP needs to be devised for each ship.
- Main features are those that been given in IMO Guidelines.
- Specific features depends on ship owner/operator.
- Main elements of a SEEMP will include:
  - EEMs (Energy efficiency measures)
  - Implementation
  - Monitoring
  - Evaluation
- Data recording, record keeping will be part of the implementation

LLOYD’S REGISTER SEEMP DOCUMENTS

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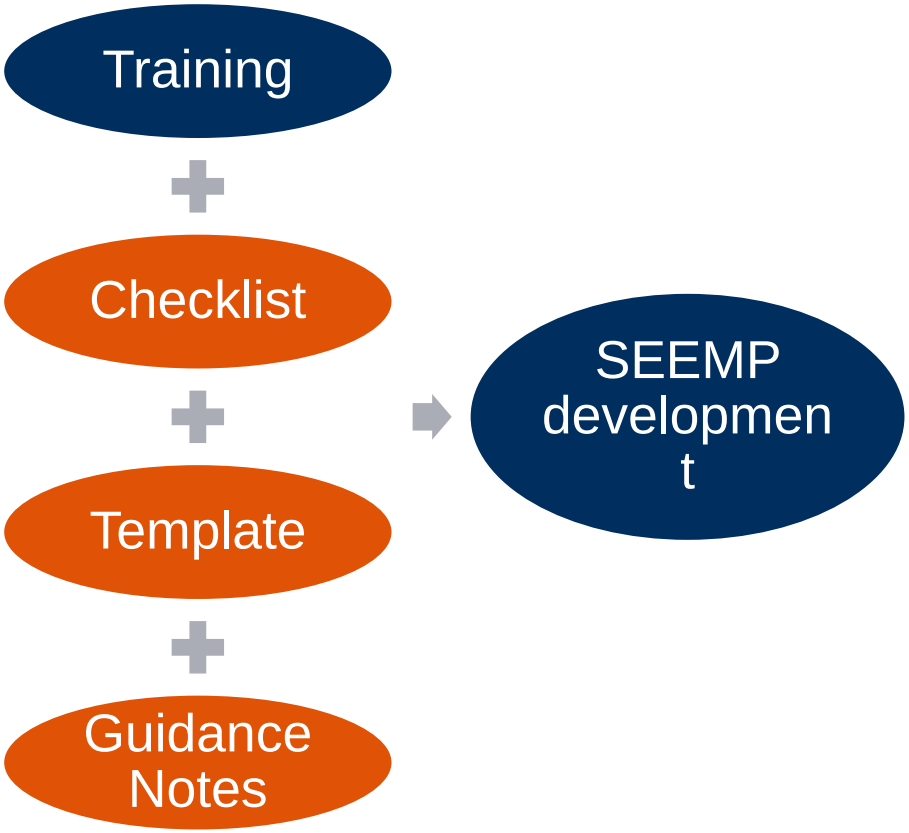
Lloyd's Register SEEMP documents



SEEMP checklist

- Follows IMO guidelines structure and requirements
- Planning, implementation and monitoring questions:
  - Non-technical questions
  - Helps you understand the requirements of the SEEMP
  - Shore personnel / head office
- Energy efficiency measures and practices questions:
  - What do you currently implement / what could be implemented
  - Helps you complete the technical part of the SEEMP
  - Head office and ship crew

How to use the checklist

- For <u>each</u> question

1.	Planning		Supporting evidence / documentation	Responsible person (s)	Additional comments
1.1	**Goal setting**				
1.1.1	Are goals set for increasing the energy efficiency?	**Yes/No/NA**	*State the goal set (such as the annual fuel consumption or a specific target of EEOI)*		
1.1.2	Are you planning on making the goals public?	**Yes/No/NA**	*Please state how are you planning on publishing your goals*		

Simple answer

Support the answer. If you cannot, then maybe the answer is no

Who?

Space for comments

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SEEMP template

- Follows the checklist structure
- Title page, ship particulars
- Introductory page (does not need to be long). Use the input from planning, implementation and monitoring questions
- Energy efficiency measures (EEMs) – main part of the SEEMP. Contains all the actions. Use the input from energy efficiency measures and practices questions

- Essentially, you take the answers from the checklist and copy them into the template format

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SEEMP template – title and introduction

2. SEEMP Template

2.1 Cover page

In this page you can include the main vessel particulars as well as company name and logo. For example:

[Company name] Ship Energy Efficiency Management Plan (SEEMP)

[XXXX for logos, stamps, etc.]	

Ship main particulars		SEEMP details	
Ship Name / Yard No.	Example Ship	Date of development	01/01/2011
Flag	Example Flag	Implementation period	From 01/02/2011
LR / IMO No.	1234567		Until 01/02/2012
Call sign	XY123	Planned date of next evaluation	01/02/2012
Ship Type	Tanker		
Deadweight	75,000	Developed by	Example Ship Owner/Operator
Port of registry	Example Port	Implemented by	Example Ship Owner/Operator

TEMPLATE

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2.2 Introductory page(s)

Use this section for a short introductory statement about the SEEMP. You may wish to state the purpose of this SEEMP and how it aligns with company energy management systems (such as ISO 14001).

Also, you may wish to include the SEEMP continuous process figure below:

2.2.1 Planning

Briefly describe how the planning process is going to be executed. For instance, in this section you can mention any specific goals you have set and what (if any) are made public (such as overall energy efficiency improvement expressed in EEOI terms by x% over the next y months). Also, you may wish to mention the criteria for assigning personnel (competence, role, experience and skills) to the actions within this SEEMP and any training and human resource –related aspects.

2.2.2 Implementation

Briefly describe how the implementation process is going to be executed. For instance, you may state who is overall responsible for the implementation of the SEEMP or any training you have provided to asset all responsible personnel with the implementation of the SEEMP.

2.2.3 Monitoring

Briefly describe how the monitoring process is going to be executed. For instance, you can mention any specific monitoring tools and systems you are using for monitoring (such as the EEOI).

2.2.4 Self evaluation and improvement

Briefly describe how the self evaluation and improvement process is going to be executed. For instance, describe the tools and processes in place for self evaluation and improvement and also how the results of this SEEMP can be fed in for developing an improved SEEMP for the next cycle.

TEMPLATE

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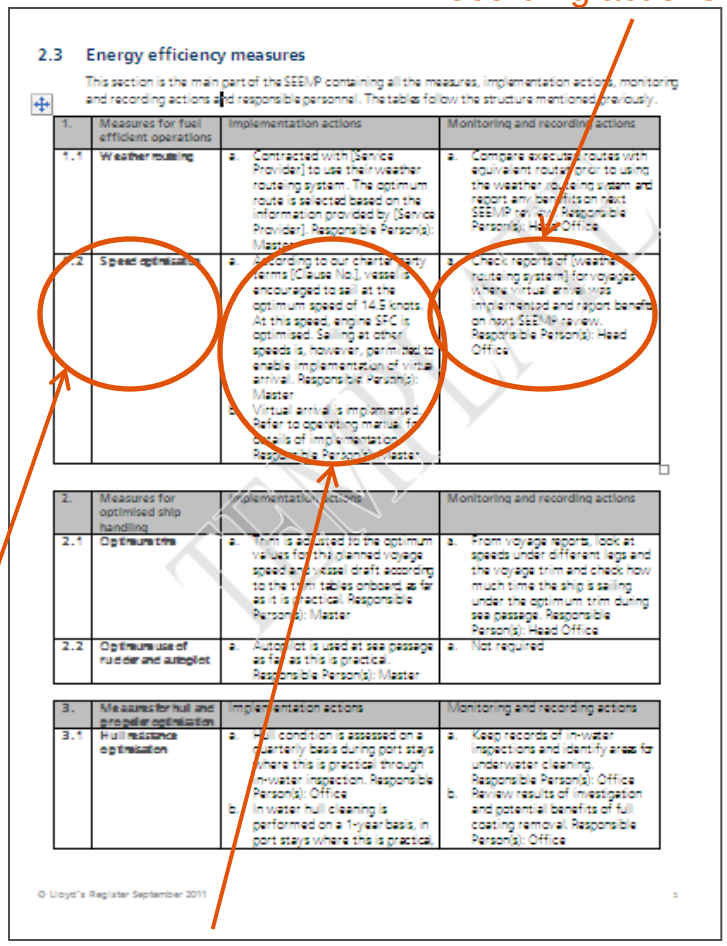
SEEMP template - EEMs

- EEM categories:
  - Fuel efficient operations
  - Optimised ship handling
  - Hull and propulsion
  - Machinery and equipment
  - Cargo handling optimisation
  - Energy conservation and awareness



2.3 Energy efficiency measures

This section is the main part of the SEEMP containing all the measures, implementation actions, monitoring and recording actions and responsible personnel. The tables follow the structure mentioned previously.

1.	Measures for fuel efficient operations	Implementation actions	Monitoring and recording actions
1.1	Weather routeing	a. Contracted with [Service Provider] to use their weather routeing system. The optimum route is selected based on the information provided by [Service Provider]. Responsible Person(s): Master	a. Compare executed routes with equivalent routes prior to using the weather routeing system and report any benefits on next SEEMP review. Responsible Person(s): Head Office
1.2	Speed optimisation	a. According to our charter party terms [Clause No.], vessel is encouraged to sail at the optimum speed of 14.5 knots. At this speed, engine SFC is optimised. Sailing at other speeds is, however, permitted to enable implementation of virtual arrival. Responsible Person(s): Master b. Virtual arrival is implemented. Refer to operating manual for details of implementation. Responsible Person(s): Master	a. Check reports of [weather routeing system] for voyages where virtual arrival was implemented and report benefits on next SEEMP review. Responsible Person(s): Head Office

2.	Measures for optimised ship handling	Implementation actions	Monitoring and recording actions
2.1	Optimum trim	a. Trim is adjusted to the optimum values for the planned voyage speed and vessel draft according to the trim tables onboard as far as it is practical. Responsible Person(s): Master	a. From voyage reports, look at speeds under different legs and the voyage trim and check how much time the ship is sailing under the optimum trim during sea passage. Responsible Person(s): Head Office
2.2	Optimum use of rudder and weather	a. Autopilot is used at sea passage as far as this is practical. Responsible Person(s): Master	a. Not required

3.	Measures for hull and propeller optimisation	Implementation actions	Monitoring and recording actions
3.1	Hull resistance optimisation	a. Hull condition is assessed on a quarterly basis during port stays where this is practical through in-water inspection. Responsible Person(s): Office b. In water hull cleaning is performed on a 1-year basis, in port stays where this is practical.	a. Keep records of in-water inspections and identify areas for underwater cleaning. Responsible Person(s): Office b. Review results of investigation and potential benefits of full coating removal. Responsible Person(s): Office

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TEMPLATE

Monitoring and recording actions

Measures

Implementation actions

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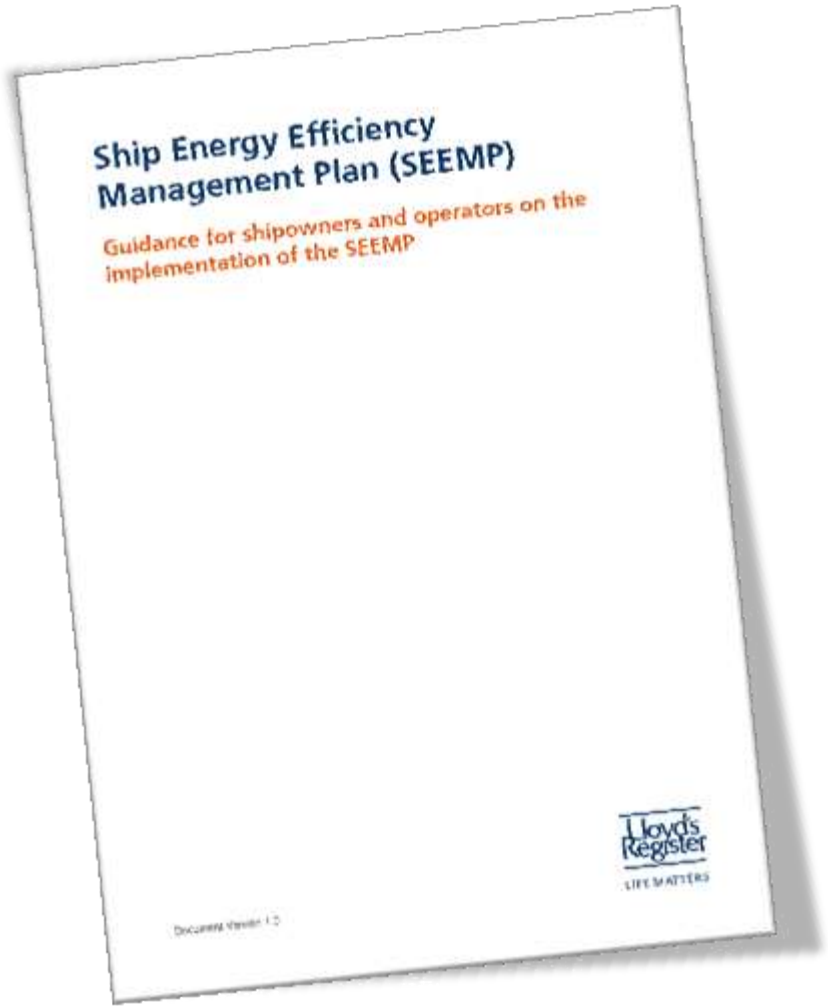
SEEMP Guidance Notes



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EEMS IMPLEMENTATION

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Definition of an EEM

- Any aspect of ship design or operation or technical that can be cost-effectively used to reduce ship energy consumption.

- EEMs can be categorized to:
  - Ship design changes
  - Ship operation
  - Ship technical management
  - Etc.

- The above breakdown should help with defining roles and responsibility and also better structuring of the SEEMP.

EEM – Implementation

- For each EEM, the following to be defined:
  - Tasks to be done
  - Procedure for implementation
  - Procedures for monitoring
  - Roles and responsibilities

EEM – Goal Setting

- It will be good to be able to set a goal for each EEM
- EEM goal setting is not easy and should be approached carefully.
- Purpose of goal setting is to increase commitment to improving energy efficiency
- The goal should be measurable and easy to understand

EEM Monitoring

- Can each EEM be monitored?
- Monitoring helps with subsequent evaluation of effectiveness of each EEM.
- Monitoring is best to be carried out against "goals".
- If "goals" are quantitative, data for monitoring need to be recorded.
- Record keeping for implemented EEMs is important for self-evaluation.

Evaluation and Improvement

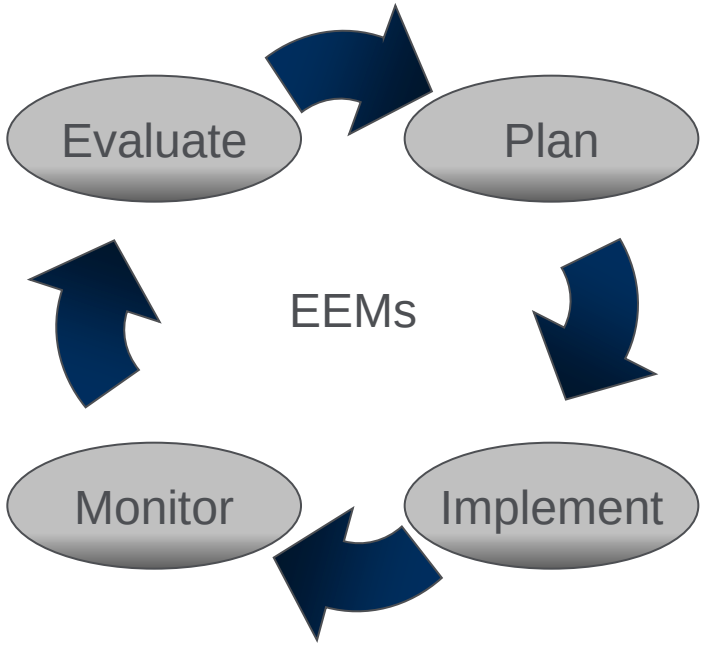
- For each EEM, an evaluation needs to be made
- If evaluation showed that EEM is not correctly chosen, then it should be removed from SEEMP.
- If evaluation indicated that goals have not been achieved, reasons should be identified and SEEMP or its implementation system should be improved.

EEM Reporting

- Reporting to internal bodies on individual EEM will not be needed
- Reporting for a group of EEMs may be a good idea
- Reporting of the full SEEMP performance should be part of best practice

EEM Implementation

- Periodical review
- Setting new targets?



- Clear instructions to ship staff on what to do
- Clear instructions to shore staff

- Recording
- Reporting
- Inspection / Audit

- Define roles and responsibilities
- Clear instructions on how to implement
- Who should do what

Ideally, the above cycle should be observed for each EEM

Summary of Learning Points

- EEM refers to any aspect of ship that can be used cost effectively to reduce its energy consumption.
- A set of EEMs needs to be devised for each ship
- EEMs need to be properly planned for implementation
- Main elements of an EEM will include:
  - Tasks to be done
  - Implementation
  - Monitoring
  - Evaluation
- Data recording and record keeping will be part of the implementation of an EEM, subject to definition at planning stage.

EEM CASE EXAMPLES

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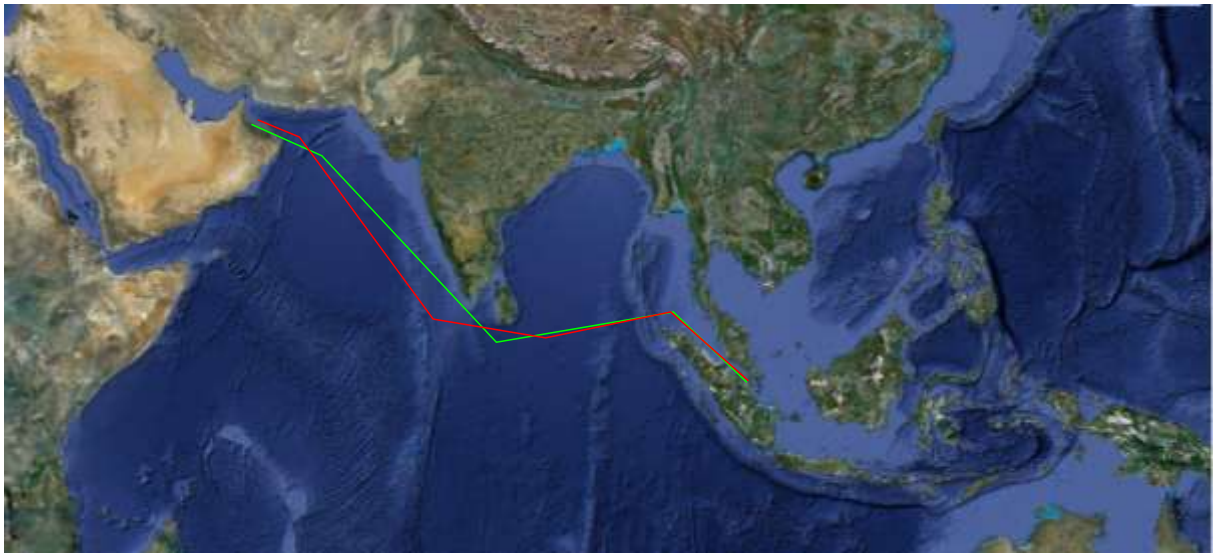
Case Example – Weather Routeing

- Optimisation of voyage plan based on environmental data, tidal data, route requirements
- Applicable on non-coastal routes e.g. trans-Atlantic / Pacific and Asia / Pacific routes

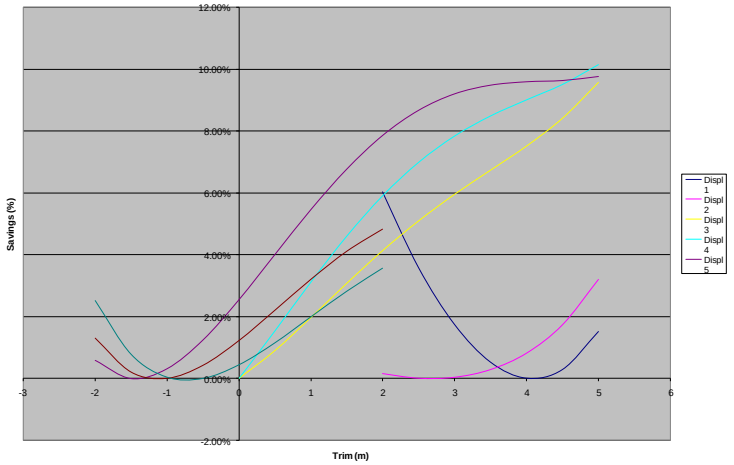


Case Example – Speed Optimisation

- Optimising speed to avoid 'sprint-loiter' approach
- Ensuring vessel maintains constant average speed in regards to:
  - Required Time Arrival at berth
  - Forecast weather conditions
  - Charter Party agreement

Case Example – Trim Optimisation

- For every ship there is one (or more) optimum trims depending on draught and speed
- This can be calculated based on ship modelling either through computer-based methods or model testing



Speed		14 – 15.9 knots					
Trim (metres)		-2 – -1.51	-1.5 – -1.01	-1 – -0.51	-0.5 – -0.01	0.01 – 0.5	0.51 – 1
Draught (metres)	7.9 – 8.5	Avoid 6.4%	Fair 2.5%	Good 1.6%	Optimal 0.0%	Fair 2.2%	Avoid 8.5%
	7.2 – 7.85	Fair 2.0%	Good 0.6%	Optimal 0.0%	Good 0.3%	Good 0.9%	Fair 2.8%
	6.5 – 7.15	Good 0.6%	Good 0.2%	Optimal 0.0%	Good 0.6%	Fair 2.0%	Avoid 3.0%

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Case Example – Use of Advanced Hull / Propeller Coatings

- Underwater performance is affected by hull and propeller condition
- Careful monitoring of speed (through water), shaft power and rpm characteristics can help define whether fouling or damage has occurred on the hull or propeller
- Use of advanced coatings can aid performance improvement with manufacturers quoting significant savings
- Careful monitoring through the between dry-docking period can assess the rate of degradation of underwater performance e.g. compared to baseline speed v power curves

International

HEMPEL

JOTUN

PPG Industrial Coatings

Case Example – Engine Performance Assessment

- Perform routine assessment of machinery
- Refer to manufacturer for ways to optimise the performance:
  - Cylinder pressures
  - Exhaust temperatures
  - Charge air pressure
  - Turbocharger parameters
- Trend the SFOC over time to track efficiency improvements and set benchmark performance

Case Example – Training

- Effective training is the only way to reduce energy efficiency
- It requires staff 'buy-in' in order to drive the EEMs and ensure they are implemented successfully
- Consider use of incentive schemes or ship competition
- Training should not be a one-time occurrence – it is a continuous process to ensure best-practice throughout the fleet

Any questions?

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