Trends and Challenges in Maritime Energy Management

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The Least Emission Boat in the World
Motivation and Drivers (Why?)

• Environmental impact of Air Pollutants and GHGs (climate change, ..)

• More stringent environmental regulations (MARPOL Annex VI Chapter 4)

• Volatile fuel oil price

• World population, energy demand and prices

• Energy resources scarcity and Energy security

• UN2030 Agenda (SDGs 7, 12 & 13 in particular)
Maritime Energy Management (What?)

• “Understanding the transformation of energy sources into different energy forms, and

• Managing its consumption in an optimised way in order to be able to minimise negative environmental and economical consequences resulting from this consumption” (Ölçer and Ballini, 2018), (Ölçer, Baumler, Ballini and Kitada 2017)

• The above will result in increased energy efficiency (EE)
Key Pillars of Maritime Energy Management

• Regulatory framework

• Energy efficiency

• Renewable/cleaner energy

• Technology and innovation

• Human factors

• Economics of energy management
Key Thematic Areas and LC Perspective

KEY THEMATIC AREAS
- ENERGY EFFICIENCY
- REGULATORY FRAMEWORK
- RENEWABLE ENERGY
- HUMAN FACTORS
- ECONOMICS
- TECHNOLOGY & INNOVATION

LIFE-CYCLE
- DESIGN
- PRODUCTION
- OPERATION
- RECYCLING

FOCUS
- SHIPS
- ONSHORE FACILITIES (PORTS & SHIPYARDS)
- OCEANS

IMO Response and Enhancing EE

• Technical Measures
  (Better design of ships and equipment)

• Operational Measures
  (Better operation of ships)

• MBM
  (Discussions suspended)
Ship Design and EE

Fuel → Power → Thrust → Speed

- Engine Efficiency
- Propeller Efficiency
- Integration Efficiency

SHIP RESISTANCE AND PROPULSION
Design Solutions for EE

• Wave-making resistance

• Viscous resistance
  (WSA, boundary layer)

• PIDs (Ducted propellers, fins, PBCF etc.) to improve hull efficiency

• ....
Accuracy

- Numerical
- Model tests
- Sea-trial
- Full scale
Ship Operation and EE

- Optimal ship handling
- Fuel efficient ship operation
- Maintenance (engine, hull, propeller)
- Ship-port interface
- Training of crew and on-shore staff
- Load management
Decision Making Under Trade-Off

- Cost/Benefit
- Cost? (CAPEX, OPEX, Externality?)
- Benefit?
- Perspective and decision maker
- Individual solutions and right combination? (Source: IMO/MEPC-67-INF-9-TARGETS)
Future Ship Propulsion

• From Human to Diesel Engines

• Fuel cells, batteries

• Nuclear (Thorium?)

• Hybrid (right mix?)

• Alternative fuels (LNG, bifuel, Methanol)

(Ref: Shipping innovation, Figure 407, page 378)
Barriers

• Individual
• Organisational
• Technological
• Economical
• ..........
Other Challenges

• Maritime Digitalisation (big data)

• Autonomous shipping

• System blindness

• ..
The Latest Springer Book
WMU Studies in Maritime Affairs (Vol.6)

Thank You

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