INTERNATIONAL: MARINE: GHG

Background and History

As acknowledged by the Kyoto Protocol, CO_2 emissions from international shipping cannot be attributed to any particular national economy due to its global activities and complex operation. Therefore, the International Maritime Organization (IMO) has been pursuing the limitation and reduction of greenhouse gas (GHG) emissions from international shipping, in recognition of the magnitude of the climate change challenge and the intense focus on this topic.

According to the Second IMO GHG Study 2009, the most comprehensive and authoritative assessment of the level of GHG emitted by ships to date, international shipping was estimated to have emitted 870 million tonnes, or about 2.7 percent of the global anthropogenic emissions of CO_2 in 2007. As the United Nations organization responsible for reducing the intensity of growth in CO_2 emissions from shipping, the IMO used this study to develop a regulatory framework on GHG emissions.

History of IMO work on GHG emissions

- September 1997 - An International Conference of Parties to the MARPOL Convention adopted Resolution 8 on CO_2 emissions from ships. This resolution

invited the Marine Environment Protection Committee (MEPC) to consider what CO_2 reduction strategies might be feasible in light of the relationship between CO_2 and other atmospheric and marine pollutants. The resolution also invited IMO, in cooperation with the UNFCCC, to undertake a study of CO_2 emissions from ships for the purpose of establishing the amount and relative percentage of CO_2 emissions from ships as part of the global inventory of CO_2emissions.

- 2000 - The first IMO GHG Study on GHG emissions from ships was published, which estimated that ships engaged in international trade in 1996 contributed about 1.8 percent of the total global anthropogenic CO_2 emissions.
- December 2003 - The IMO Assembly adopted Resolution A.963(23) on IMO Policies and practices related to the reduction of GHG emissions from ships, which urged MEPC to identify and develop the mechanism(s) needed to achieve the limitation or reduction of GHG emissions from international shipping.
- July 2009 - MEPC finalized a suite of specific technical and operational reduction measures.
- March 2010 - MEPC started the consideration of making the technical and operational measures mandatory for all ships irrespective of flag and ownership.

- July 2011 - Technical measures for new ships and operational reduction measures for all ships were adopted, the first ever mandatory global GHG reduction regime for an entire industry sector. The adopted measures add to MARPOL Annex VI (Resolution MEPC.203(62)) a new Chapter 4 entitled *Regulations on energy efficiency for ships*, making the Energy Efficiency Design Index (EEDI) for new ships and the Ship Energy Efficiency Plan (SEEMP) mandatory for all ships. The EEDI is the first regulation to establish CO_2 standards across a global sector.
- January 2013 - EEDI and SEEMP entered into force and apply to all ships over 400 gross tonnage and above.

Technical and operational measures

In 2011, MARPOL Annex VI, Chapter 4 introduced two mandatory mechanisms intended to ensure an energy efficiency standard for all ships:

1. Energy Efficiency Design Index (EEDI) - a performance-based mechanism that requires a certain minimum energy efficiency in new ships. Ship designers and builders are free to choose the technologies to satisfy the EEDI requirements in a specific ship design.
2. Ship Energy Efficiency Management Plan (SEEMP) - establishes a mechanism for operators to improve the energy efficiency of ships.

The regulations apply to all ships of and above 400 gross tonnage and entered into force on 1 January 2013. Flexibilities exist in the initial period of up to six and a half years after the entry into force, when the IMO may waive the requirement to comply with the EEDI for certain new ships, such as those that are already under construction.

Energy Efficiency Design Index

The EEDI for new ships encourages the use of more energy efficient equipment and engines. The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments. The regulation came into force on 1 January 2013 and is followed by an initial two year phase before new ship design will need to meet the reference level for their ship type. The level is to be strengthened incrementally every five years. The EEDI is performance-based; it is up to the manufacturer to choose a technology to use in a specific ship design. As long as the required energy efficiency level is attained, ship designers and builders are free to use the most cost-efficient solutions for the ship to comply with the regulations.

The EEDI is expressed in grams of carbon dioxide (gCO_2) per ship's capacity-mile (the smaller the EEDI the more energy efficient ship design) and is calculated by a formula based on the technical design parameters for a given ship.

The CO_2 reduction level (grams of CO_2 per tonne mile) for the first phase is set to 10 percent and will be tightened every five years to keep pace with technological developments of new efficiency and reduction measures. The regulation will require most new ships to be 10 percent more efficient beginning in 2015, 20 percent more efficient by 2020 and 30 percent more efficient from 2025, all from a baseline representing the average efficiency for ships built between 2000 and 2010.

The EEDI is in place for the largest and most energy intensive ships around the world and will affect the following ship types: oil tankers, bulk carriers, gas carriers, general cargo, container ships, refrigerated cargo, and combination carriers. For types not covered by the current EEDI formula, updated formulas will be developed that will focus on the largest emitters first.

Ship Energy Efficiency Management Plan

The Ship Energy Efficiency Management Plan (SEEMP) aims to improve the energy efficiency of a ship as cost-effectively as possible and provides a method for shipping companies to focus on ship and fleet efficiency. The Energy Efficiency Operational Indicator (EEOI) is an example of a monitoring tool used to assist owners and operators. The EEOI provides owners and operators with a method of measuring the fuel efficiency of a ship in operation and to estimate the result of any changes, such as improved voyage planning or more frequent

propeller cleaning. The SEEMP encourages the owner and operator to analyze new technologies and practices throughout the life of the plan.

Strategies

Technologies and operations strategies

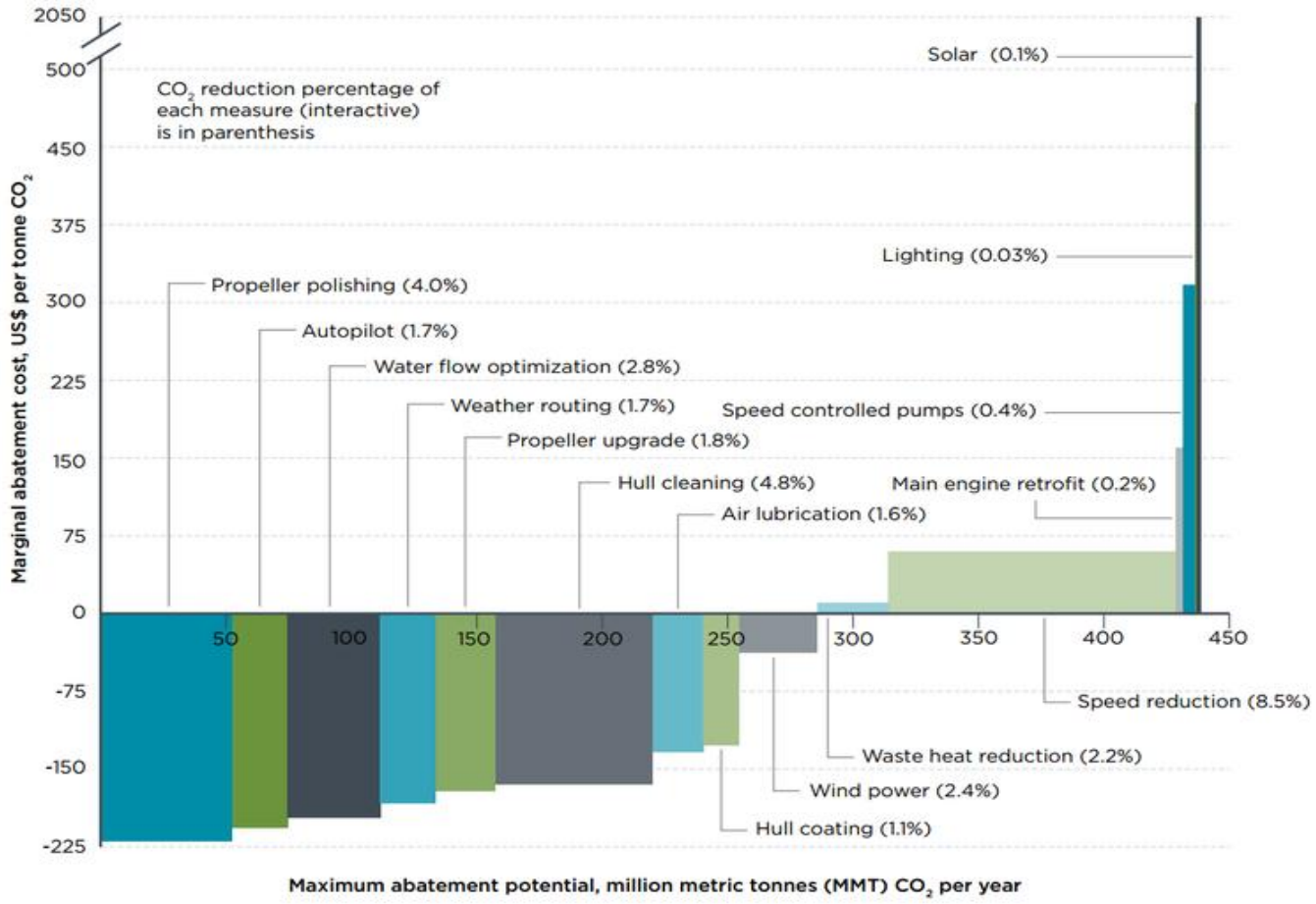
In 2011, the ICCT collaborated on a major study and identified 53 different ship types to which efficiency technologies could be applied and for each evaluated the potential benefits of 22 existing technical and operational measures that could be deployed immediately or in the near future and had sufficient operational data to analyze. The measures that were considered are grouped into 15 general categories and are listed below.

Technologies and operations strategies to reduce GHG emissions from ships		
Propeller Polishing	Hull Cleaning	Speed Reduction
Autopilot Upgrade	Air Lubrication	Main Engine Retrofits
Water Flow Optimization	Hull Coating	Speed Controlled Pumps and Fans
Weather Routing	Wind Power	High-Efficiency Lighting
Propeller Upgrade	Waste Heat Reduction	Solar Panels

Cost and reduction potential

The relative cost and reduction potential of each measure is shown in the figure below. Reading from left to right, efficiency measures are arranged according to increasing cost per tonne of CO_2 averted. It was assumed that the measure with the lowest marginal abatement cost would be adopted first, followed by the one with the second lowest Marginal Abatement Cost (MAC) curve, etc. the emission reduction potential of the remaining measures decreases and the cost increases as each additional measure is implemented.

The width of each bar represents the potential of the measure to reduce CO_2 emissions from the world fleet. the height of each bar represents weighted average marginal cost of avoiding one tonne of CO_2emissions through that measure, assuming that all measures to the left are already applied. propeller polishing has the lowest average MAC, with moderate CO_2 reduction potential. Speed reduction has the largest reduction potential, with moderate cost. Solar panels have the highest MAC, with limited CO_2 reduction potential.



Marginal CO_2 abatement costs of analyzed technologies[1]

Market-based mechanisms

According to the IMO, technical and operational measures will not be sufficient to satisfactorily reduce the amount of GHG emissions from international shipping in view of the growth projections of human population and world trade.

Therefore, market-based mechanisms have also been considered and would serve two main purposes: providing a fiscal incentive for the maritime industry to invest in more energy efficient manner and off-setting of growing ship emissions.

Source: http://transportpolicy.net/index.php?title=International:_Marine:_GHG