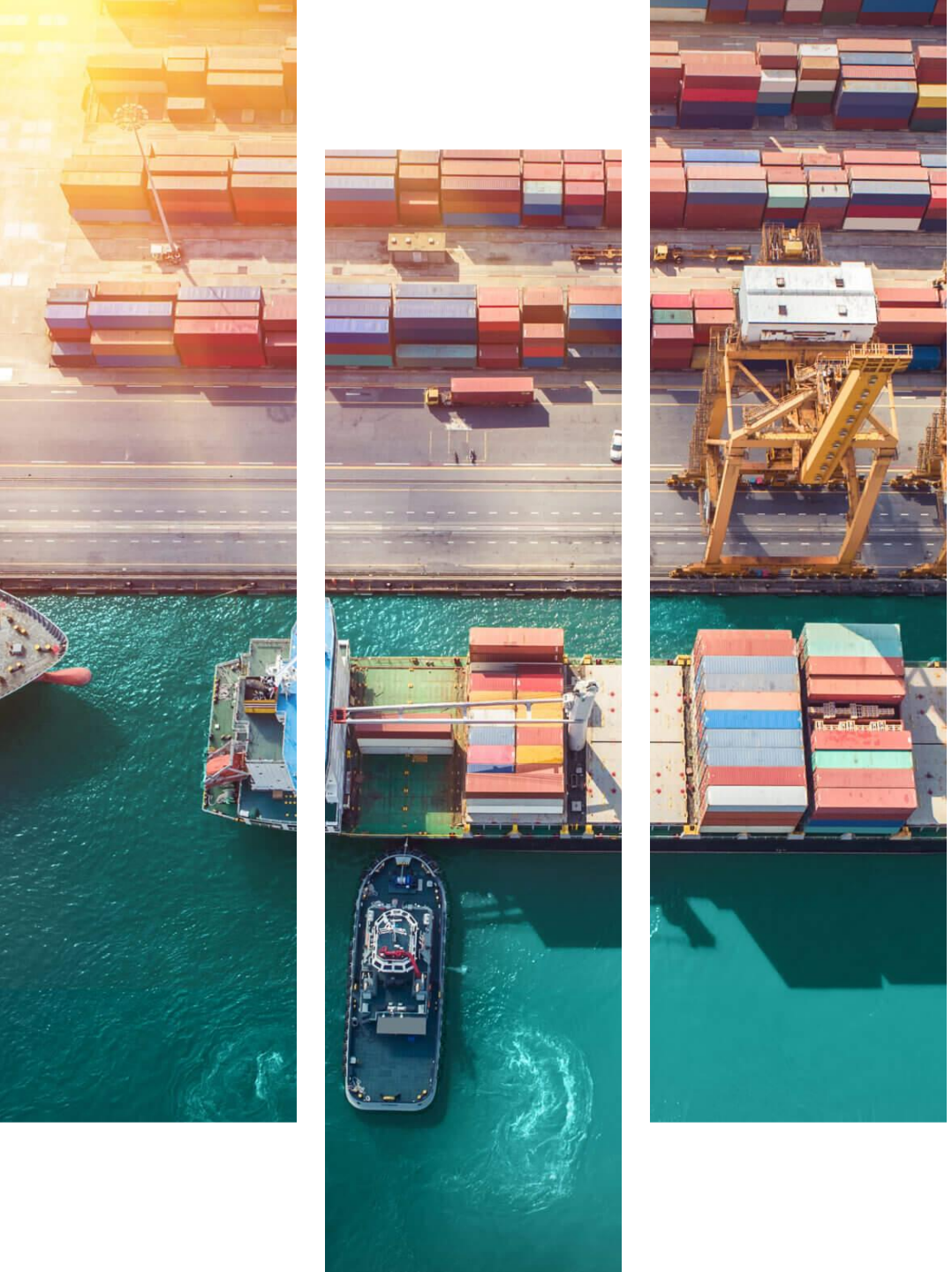
42nd PMAWCA ANNUAL COUNCIL MEETING

Base theme: “The role of Ports against the effects of the climate change”

November 15 - November 18 @ Luanda - Angola



WMD: Leveraging on Technology for Greener shipping

Involvement of Ship-owners & Maritime Organizations in the Reduction of the Carbon Emission and the Options Proposed for this Purpose

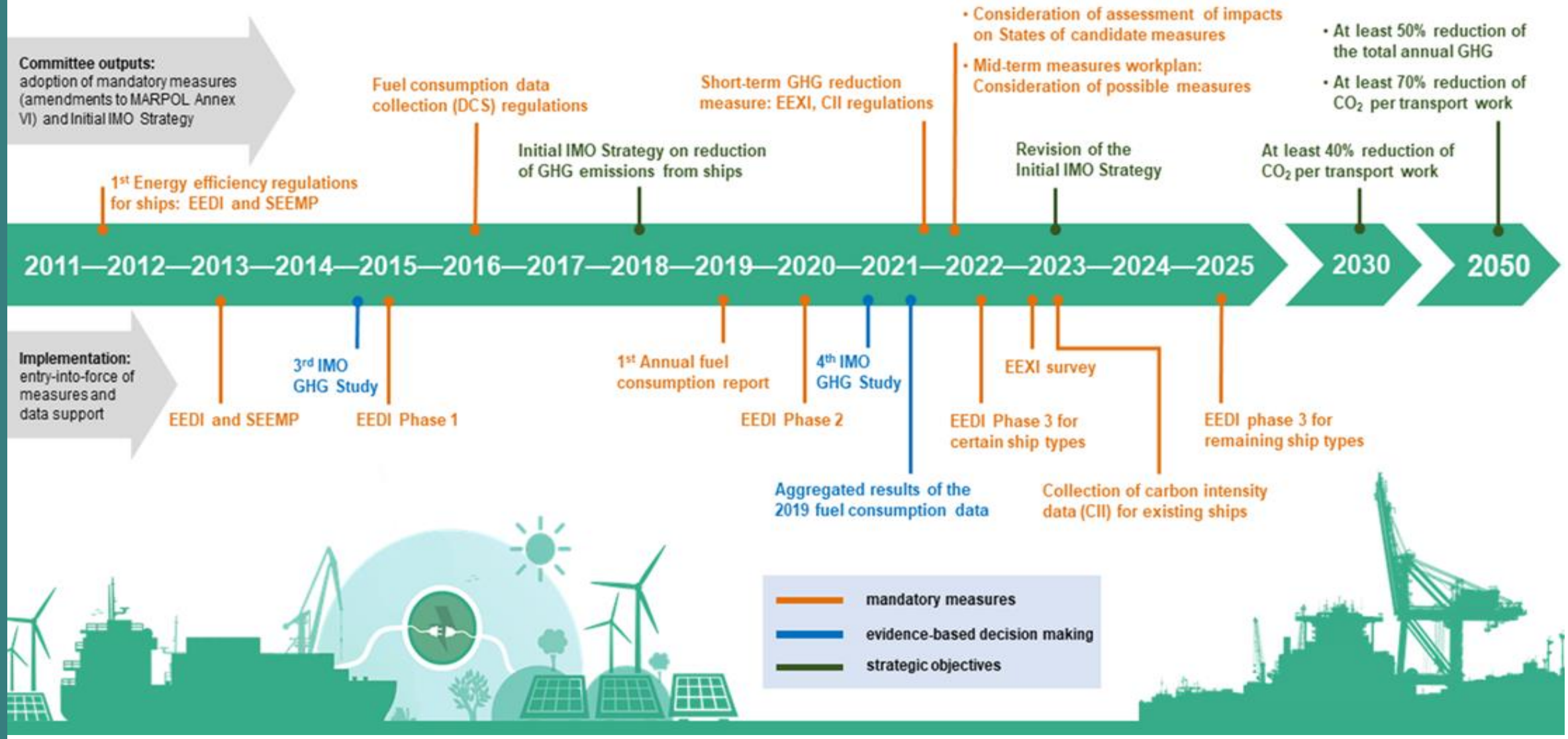
Capt. Sunday Umoren

Secretary General (Abuja Mou)

Contents

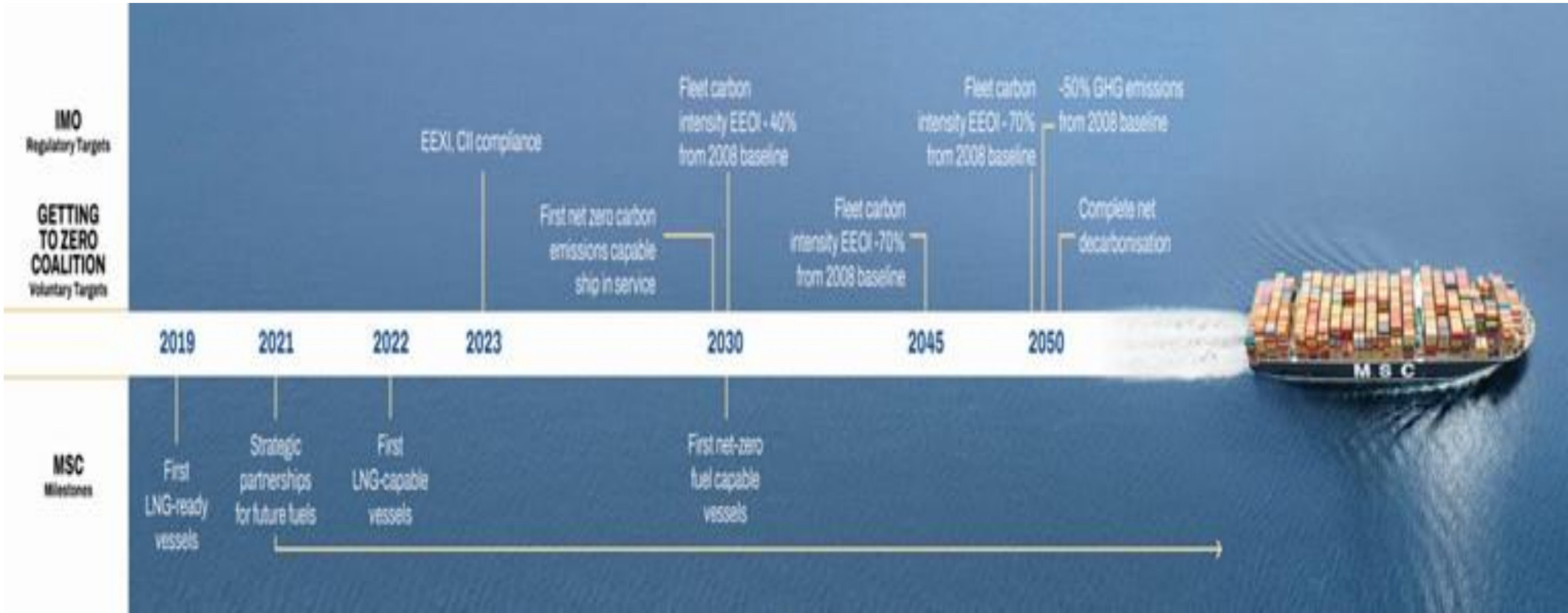
Addressing climate change

A decade of **regulatory action** to cut GHG emissions from shipping:
towards phasing out GHG emissions from shipping as soon as possible in this century



INTRODUCTION

Marine transport is still one of the most carbon efficient means of transport for international trade. Currently, the shipping sector accounts for 2%-3% of global carbon emissions, fiercely working to decrease its output year-by-year in view of the IMO 2050 strategy. However, decarbonising logistics is as critical as it is difficult to achieve. Emerging solutions and latest technologies might prove to be powerful tools to support the low-carbon transition in transport.



IMO REGULATIONS

- The IMO has a two pronged approach to achieving its targets: Design approach and the operational approach.
- The design approach places emission limits on new vessels using the Energy Efficiency Design Index (EEDI); and Existing vessels using the Energy Efficiency Existing Ship Index (EEXI)
- The operational approach includes the requirement for a Ship Energy Efficiency Management Plan (SEEMP) and a Carbon Intensity Indicator (CII)

In IMO words the whole essence is in ‘reflecting the need to support a green transition of the maritime sector into a sustainable future, while leaving no one behind

Are we familiar with and supporting the SDGs. particularly SDGs 13 and 14 on climate action and sustainable use of the oceans, seas and marine resources; SDG 9 on industry, innovation and infrastructure; and SDG 17, which highlights the importance of partnerships and implementation to achieve these goals

Shipping & CO_2 Emissions

By moving the world's goods from factories and farms to shops and households, international shipping plays a key role in global trade and economic development. Yet, shipping is also a significant source of greenhouse gas emissions (GHG), accounting for around three percent of global GHG emissions annually. These emissions continue to grow and are far from being aligned with the Paris Agreement's temperature goal of limiting global warming to 1.5 degrees Celsius.

The industry currently accounts for a relatively small share of global CO_2 emissions — between 2% and 3%. At current growth rates, shipping could represent some 10% of global greenhouse gas emissions by 2050.

Until recently, the shipping industry has made few inroads toward decarbonization. That needs to change if the world is going to achieve net zero emissions by 2050.

What is the impact of Carbon Emission from Shipping?

The Third IMO GHG Study (2014) estimated that for the period 2007-2012, shipping emitted about 1,000 Mt CO2 per year, equaling approximately 3.1% of annual global CO2 emissions.

The latest update showed the possibility of shipping emissions increasing by up to 120% by 2050

Under a business-as-usual scenario and if other sectors of the economy reduce emissions to keep the global temperature increase below 2 degrees Celsius, shipping could represent some 10% of global GHG emissions by 2050.

In 2018, global shipping emissions represented 1 076 million tonnes of CO2, and were responsible for around 2.9% of global emissions caused by human activities.

Émissions dans l'atmosphère provenant des navires et leurs impacts

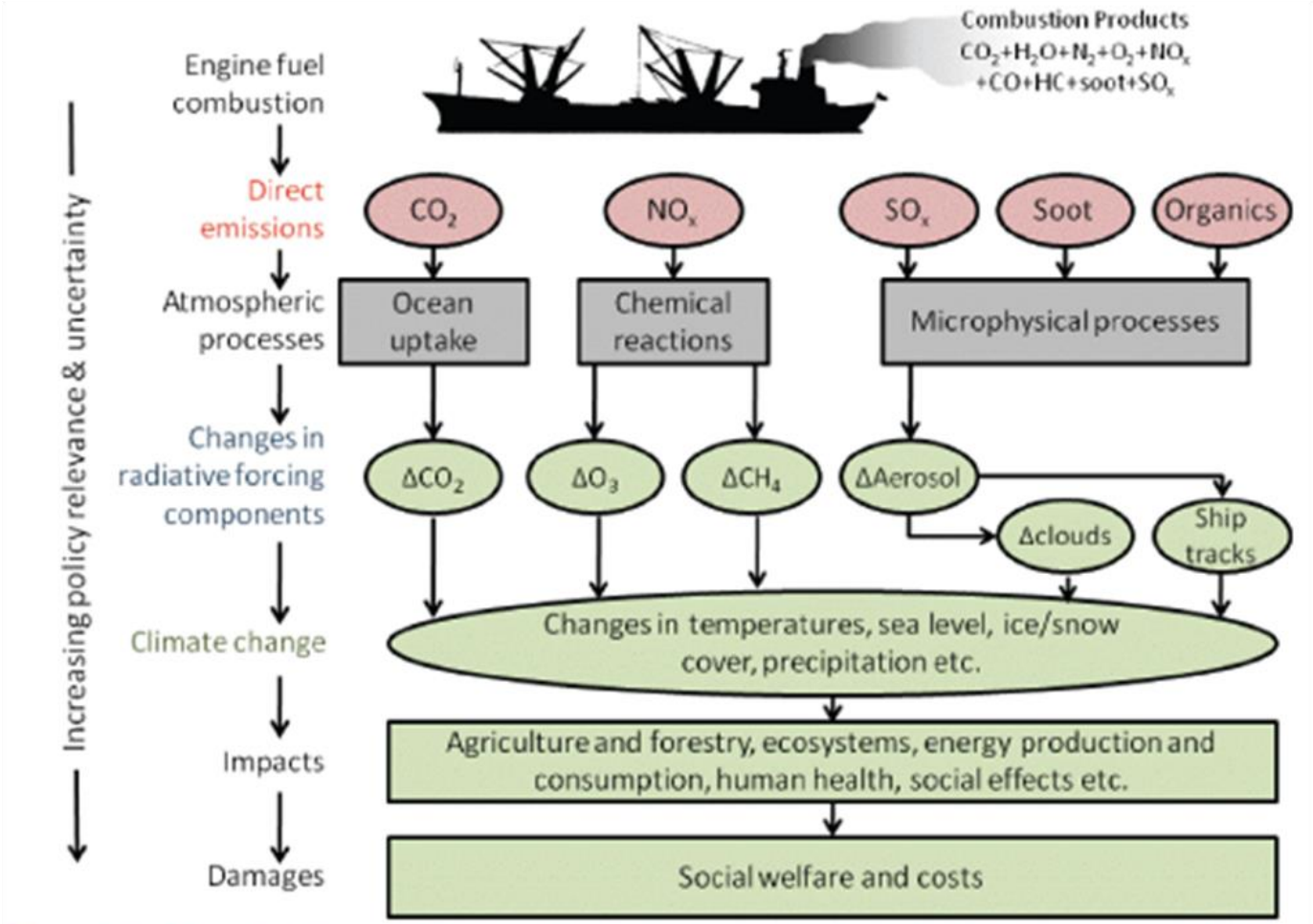


Figure 8.1 *Schematic diagram of the overall impacts of emissions from the shipping sector on climate change (from Lee et al., 2009a)*

Air

Marpol Annex VI

Others

Ballast Management Convention

Others

Anti- Fouling

Effluent

Marpol Annex 1

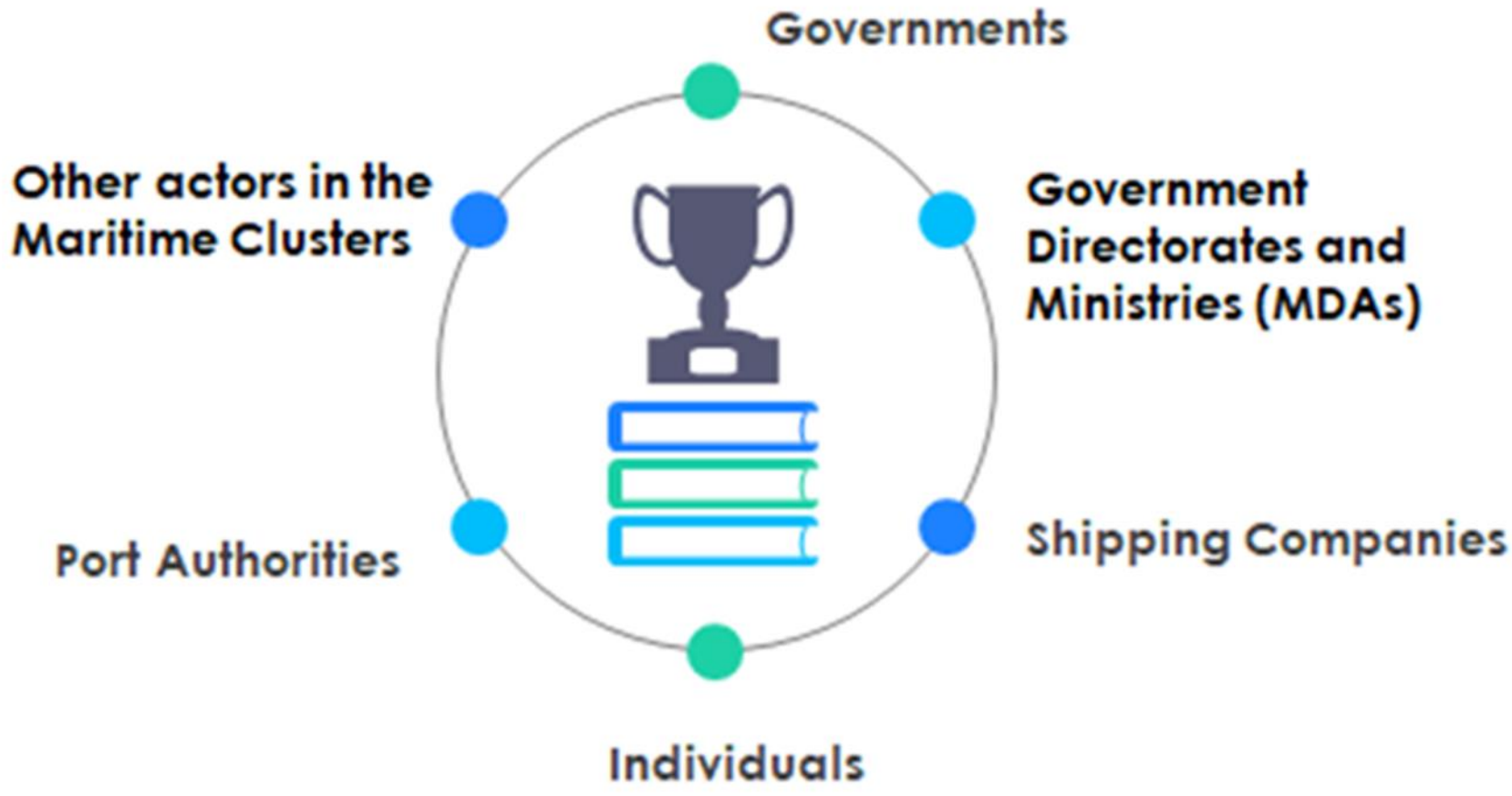
Others

Wrecks

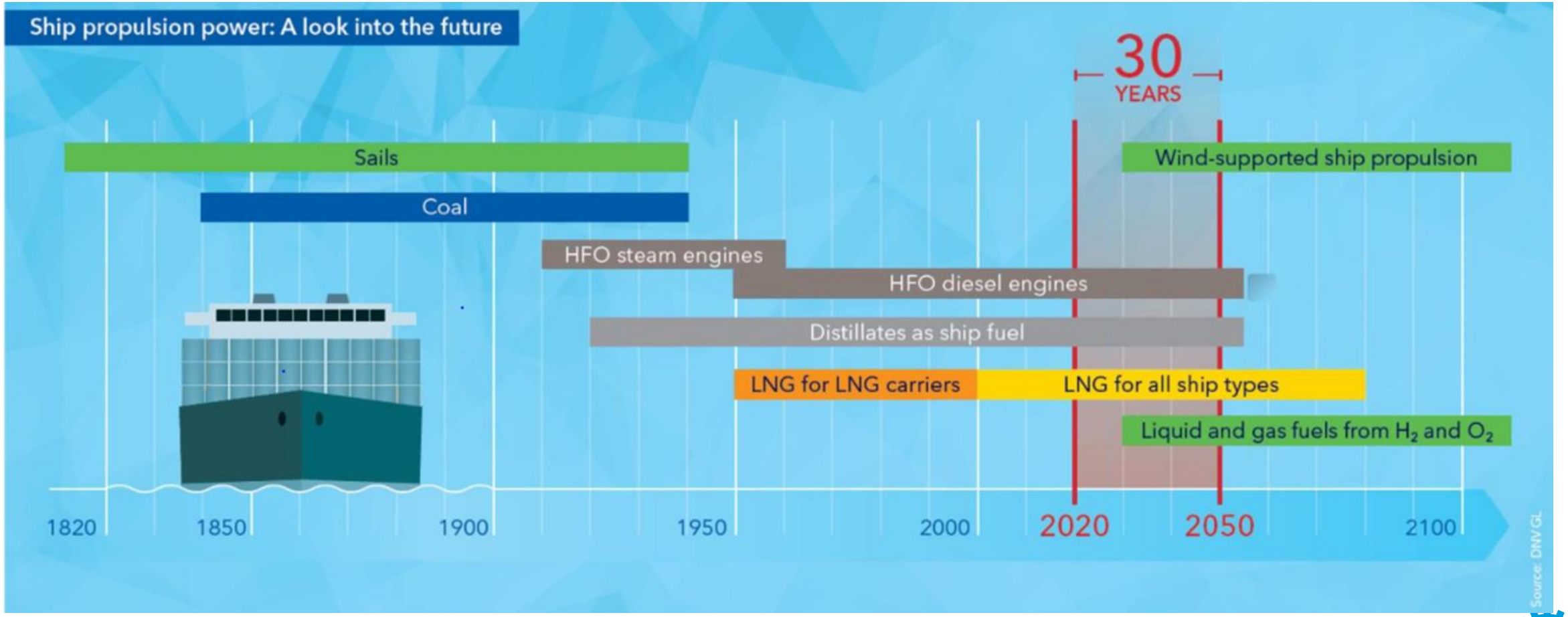
Encapsulates environmental management practice with great emphasis on: (1) Reduction in waste generation and reduction during operations (2) resource conservation in handling and distributing cargoes. Lai et al. (2011Lai et al.) (3) Reduction of negative impact on: (a) the environment and (b) Humans / Aquatic life forms

Stakeholders' Identification

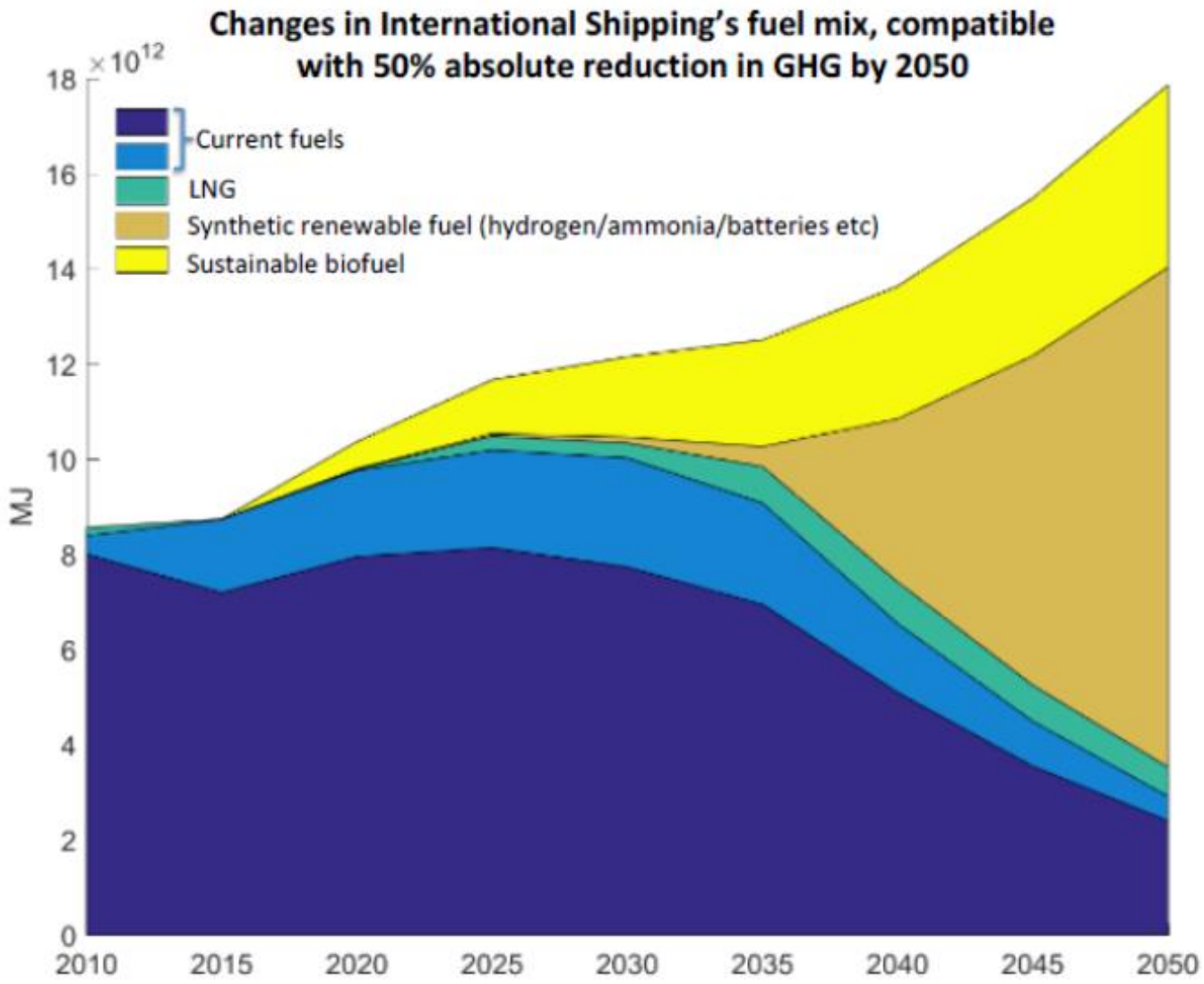
The effectiveness of Port State Control regime is beneficial to all stakeholders;

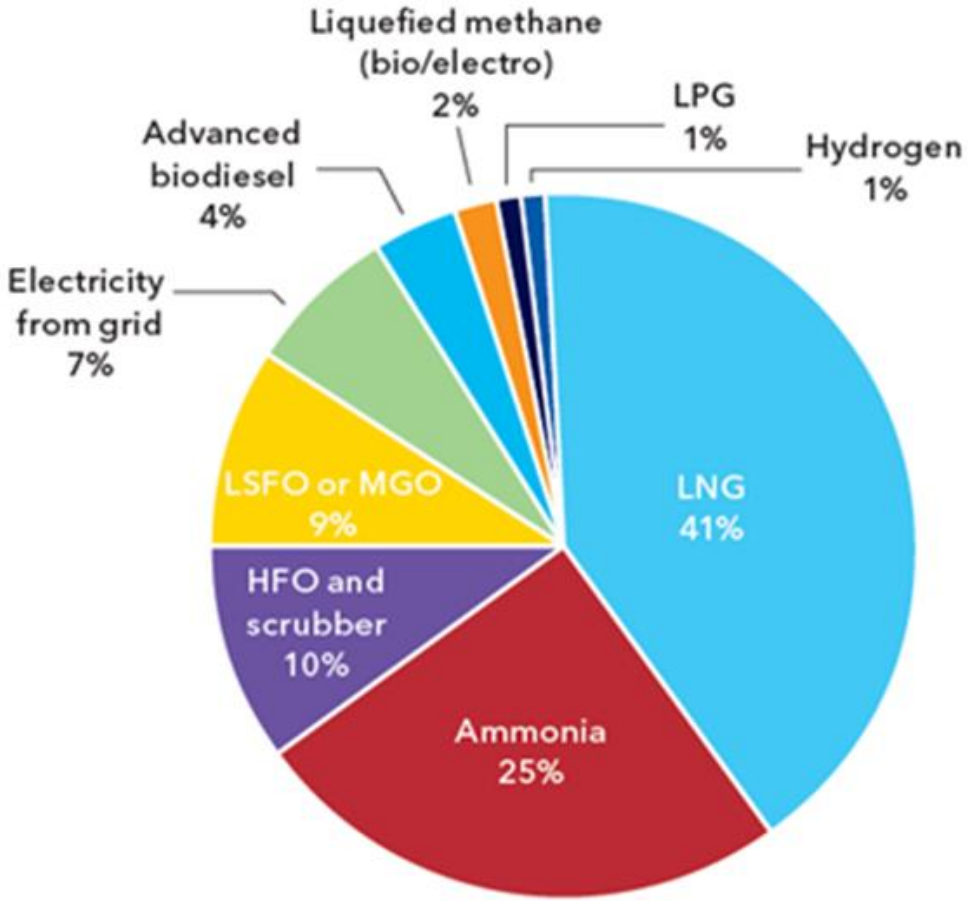


The Journey to decarbonize maritime transport?



What distribution of fuels in 2050?





EVOLUSION OF MARINE FUEL USAGE

Until 1800

Wind PROPULSION

Sub-text here.

1800-1950

Steam Propulsion

Sub-text here.

1930 - Today

HFO as Propulsion Fuel

Sub-text here.

2015 - Today

LNG as propulsion Fuel

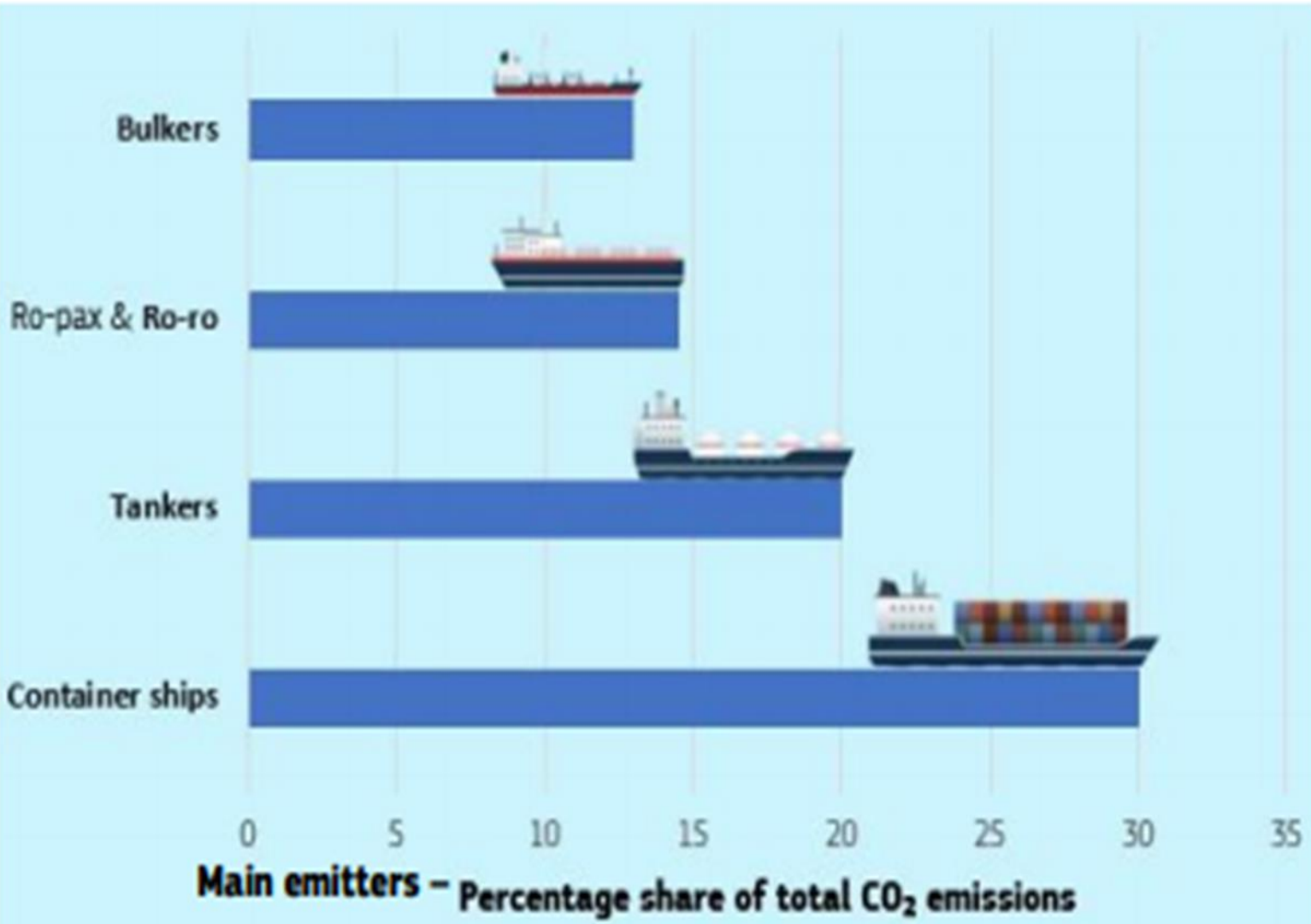
Sub-text here.

2020 – To date

The Rise of VSFO Bunker Fuel and Scrubbers

Sub-text here.

Container ships: the largest CO_2 emitters



Case studies:

Container ships

- **30% of total CO_2 emissions**
- 18% of the monitored fleet (DWT)
- Distance travelled: >70 million nm
- Average speed: 14 knots.

Bulkers

- **13% of total CO_2 emissions**
- 37% of the monitored fleet (DWT)
- Distance travelled: >55 million nm
- Average speed: 10.5 knots.

2019 Annual Report on CO_2 Emissions from Maritime Transport

Case Study: Apapa Port, Lagos, Nigeria

A study by Olumide Oyewole (2022) showed the following findings on CO_2 Emissions based on container vessels call at Apapa Port in 2021.

14,537.3
Tons of CO2 Emitted

€1,453,730
Estimated Economic Cost of this CO2 Emission

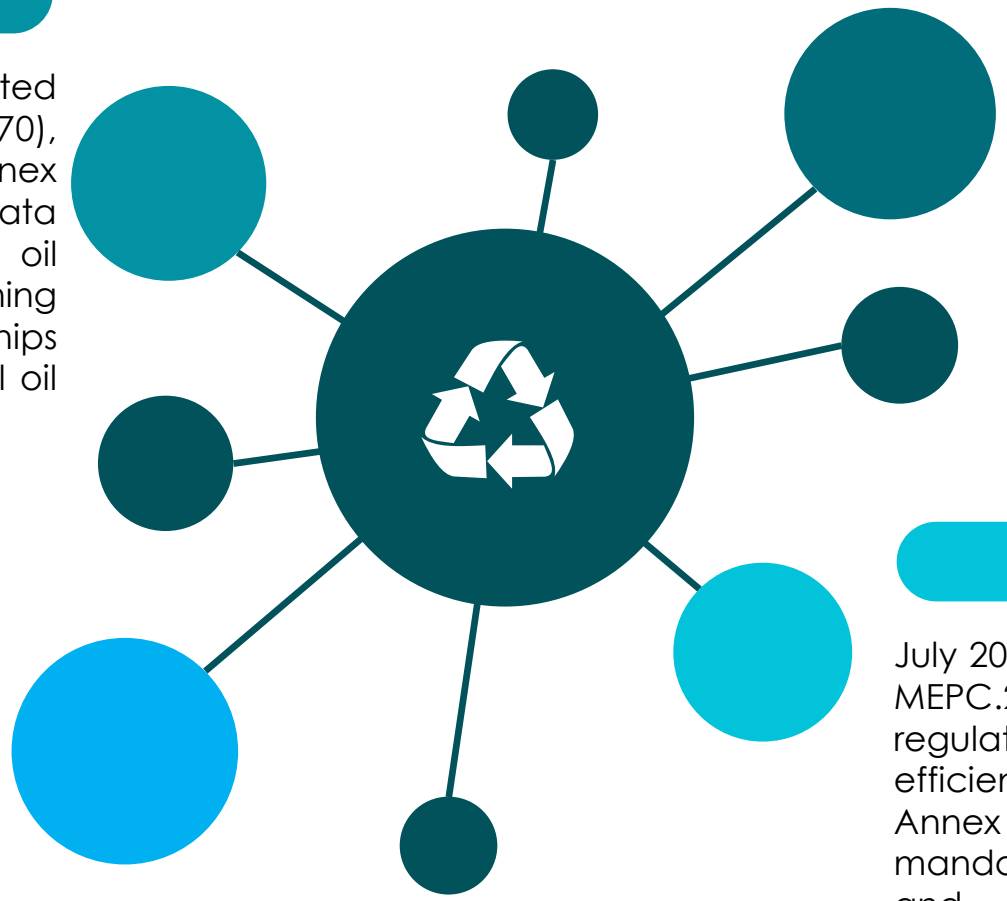
This study shows a 596% increase from a study in 2018

Carbon Emission Goal as set by IMO

The Goal

IMO's Present Measures to Reduce Carbon Emissions

October 2016 - Adopted resolution MEPC.278(70), amendments to MARPOL Annex VI to introduce the data collection system for fuel oil consumption of ships, containing mandatory requirements for ships to record and report their fuel oil consumption.



Dec 2003 - Introduction of Assembly resolution A.963(23) on IMO policies and practices related to the reduction of greenhouse gas emissions from ships.

May 2013 - Adopted resolution MEPC.229(65) on Promotion of technical co-operation and transfer of technology relating to the improvement of energy efficiency of ships

July 2011 - Adopted resolution MEPC.203(62) on Inclusion of regulations on energy efficiency for ships in MARPOL Annex VI introducing mandatory technical (EEDI) and operational (SEEMP) measures for the energy efficiency of ships.

IMO's Present Measures to Reduce Carbon Emissions

- ✓ Further improvement of the existing energy efficiency framework with a focus on Energy Efficiency Design Index (EEDI) and Ship Energy Efficiency Management Plan (SEEMP), taking into account the outcome of the review of EEDI regulations.
- ✓ Develop technical and operational energy efficiency measures for both new and existing ships.
- ✓ Establishment of an Existing Fleet Improvement Programme.
- ✓ Consider and analyse the use of speed optimization and speed reduction.
- ✓ Encourage the development and update of national action plans.
- ✓ Enhance technical cooperation and capacity-building.
- ✓ Consider & analyse measures to encourage port developments for reducing GHG emission.
- ✓ Initiate research and development activities.
- ✓ Develop robust lifecycle GHG/carbon intensity guidelines for all types of fuels.

Short Term Plan (2018- 2023)

IMO's Present Measures to Reduce Carbon Emissions

- ✓ Implementation programme for the effective uptake of alternative low carbon and zero-carbon fuels, including update of national actions plans to specifically consider such fuels.
- ✓ Operational energy efficiency measures for both new and existing ships
- ✓ New/innovative emission reduction mechanism(s), possibly including Market-based Measures (MBMs), to incentivize GHG emission reduction.
- ✓ Further continue and enhance technical cooperation and capacity-building activities such as under the ITCP.
- ✓ Development of a feedback mechanism to enable lessons learned on implementation of measures to be collated and shared through a possible information exchange on best practice.

Medium Term Plan (2023 - 2030)

IMO's Present Measures to Reduce Carbon Emissions

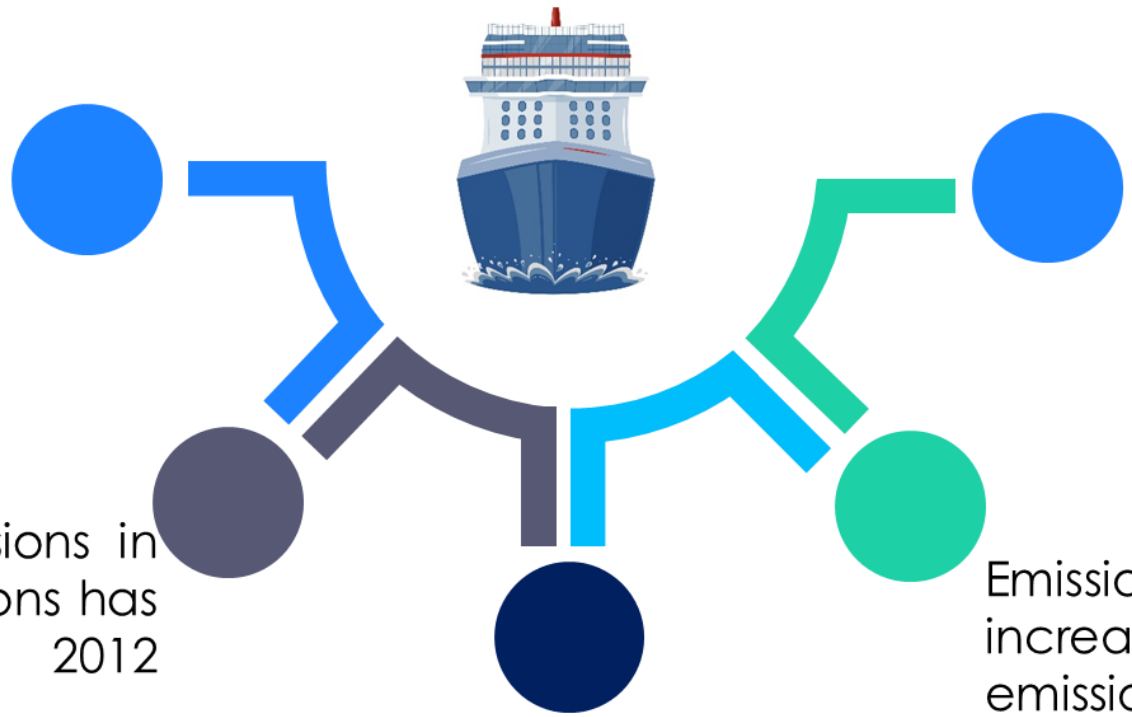
- ✓ Pursue the development and provision of zero-carbon or fossil-free fuels to enable the shipping sector to assess and consider decarbonization in the second half of the century.

- ✓ Encourage and facilitate the general adoption of other possible new/innovative emission reduction mechanism(s).

Long Term Plan (Beyond 2030)

Current Situation: Where we are

In 2012, there was 962 million tonnes CO2 emissions. In 2018 this amount grew 9.3% to 1,056 million tonnes of CO2 emissions



The overall carbon intensity, as an average across international shipping, better in 2018 than in 2008. This is primarily due to increased ship size, and design and operational improvements such as decreased traveling speed.

The share of shipping emissions in global anthropogenic emissions has increased from 2.76% in 2012 to 2.89% in 2018.

In 2021, 833m tonnes of CO2 was emitted based, compared with 794m tonnes in 2020 and 800m tonnes in 2019

Emissions are projected to increase from about 90% of 2008 emissions in 2018 to 90-130% of 2008 emissions by 2050 for a range of plausible long-term economic and energy scenarios

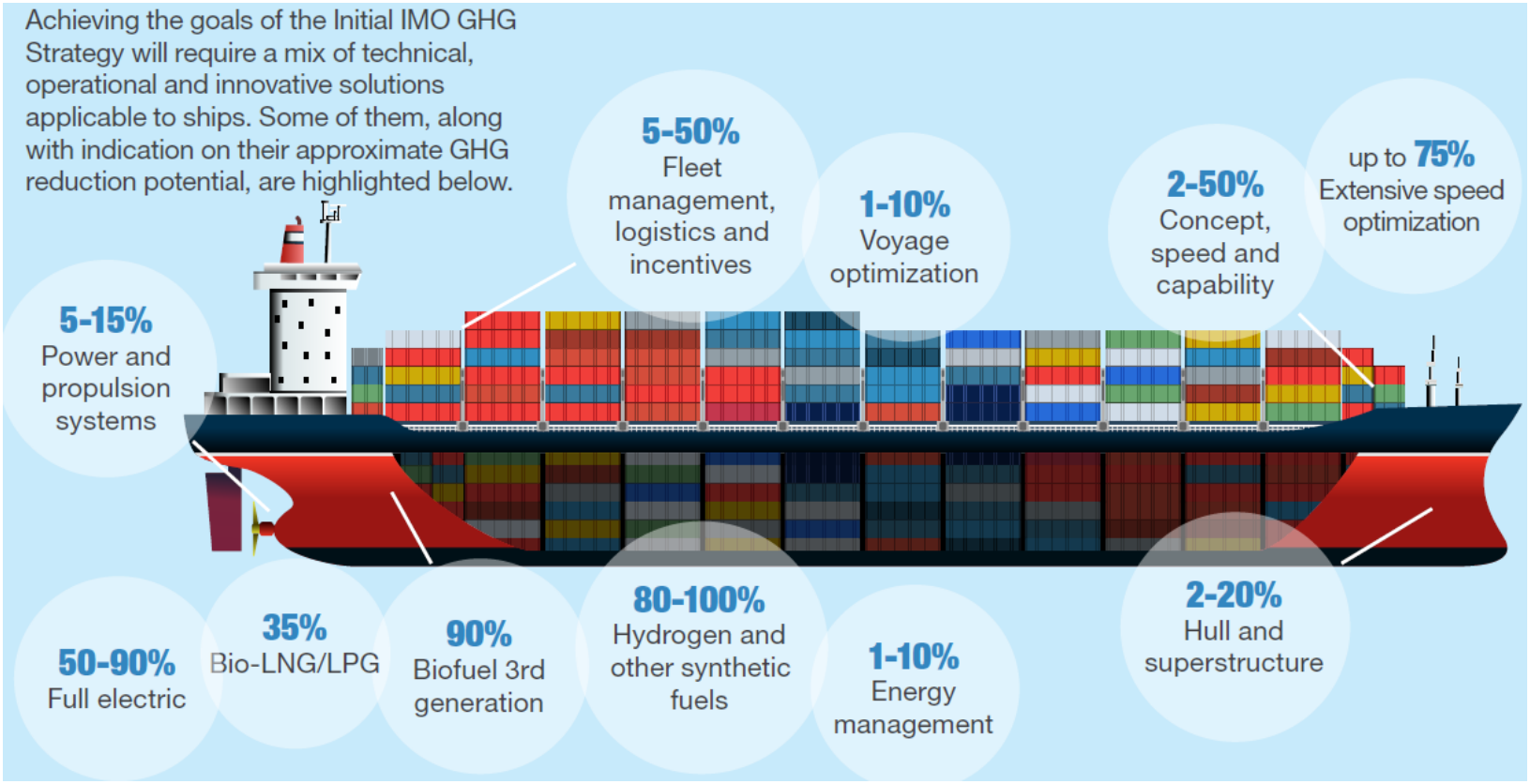
Source: IMO GHG Report, 2020; Lloyd's Intelligence, 2021

GROUPINGS OF VARIOUS MEASURES

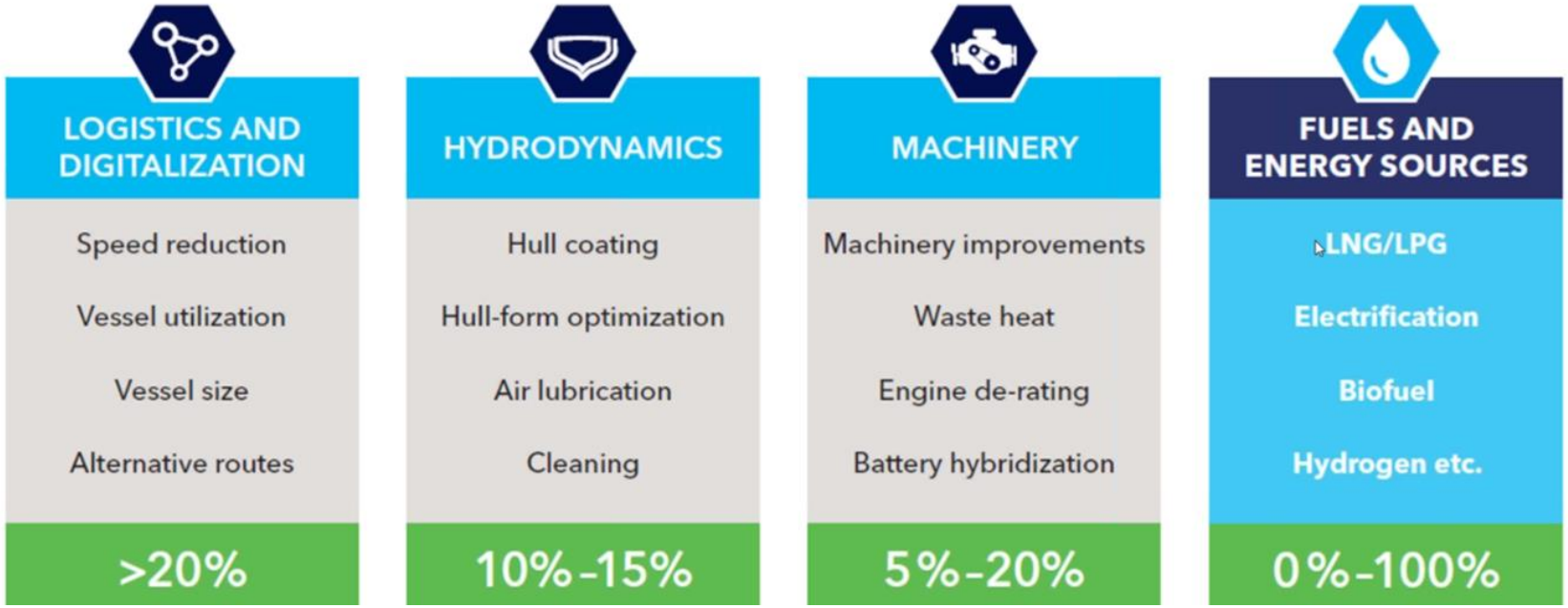
GROUPINGS OF VARIOUS MEASURES

MEPC 75: Approval of the short-term measure applicable to existing ships

- MEPC 75 approved draft new mandatory rules aimed at reducing the carbon intensity of existing ships. The draft amendments to the MARPOL Convention require ships to combine technical and operational measures to reduce their carbon intensity. (+ details below, MEPC 76)



Wide range of promising GHG reduction measures



Logistique et numérisation
- Réduction de la vitesse
- Utilisation et dimensions du navire
- Routes de substitution

Hydrodynamique
- Revêtement de la coque
- Optimisation de la forme de la coque
- Lubrification à l'air
- Nettoyage

Machines
- Amélioration des machines
- Récupération de la chaleur résiduelle
- Hybridation à l'aide de batteries
- Déclassement du moteur

Combustible; stockage énergie
- GNL/GPL
- Électrification
- Biocombustibles
- H, etc.

Source: *DNV-GL Maritime forecast to 2050*, 2018

GROUPINGS OF VARIOUS MEASURES

Lai et al. (, 2013) identified six dimensions:
a)company policy and procedure
b)shipping documents,
c)shipping equipment,
d)shipping service providers' cooperation,
e)shipping materials, and
f) shipping design for compliance (I will have added to the list)
g)shipping operations.

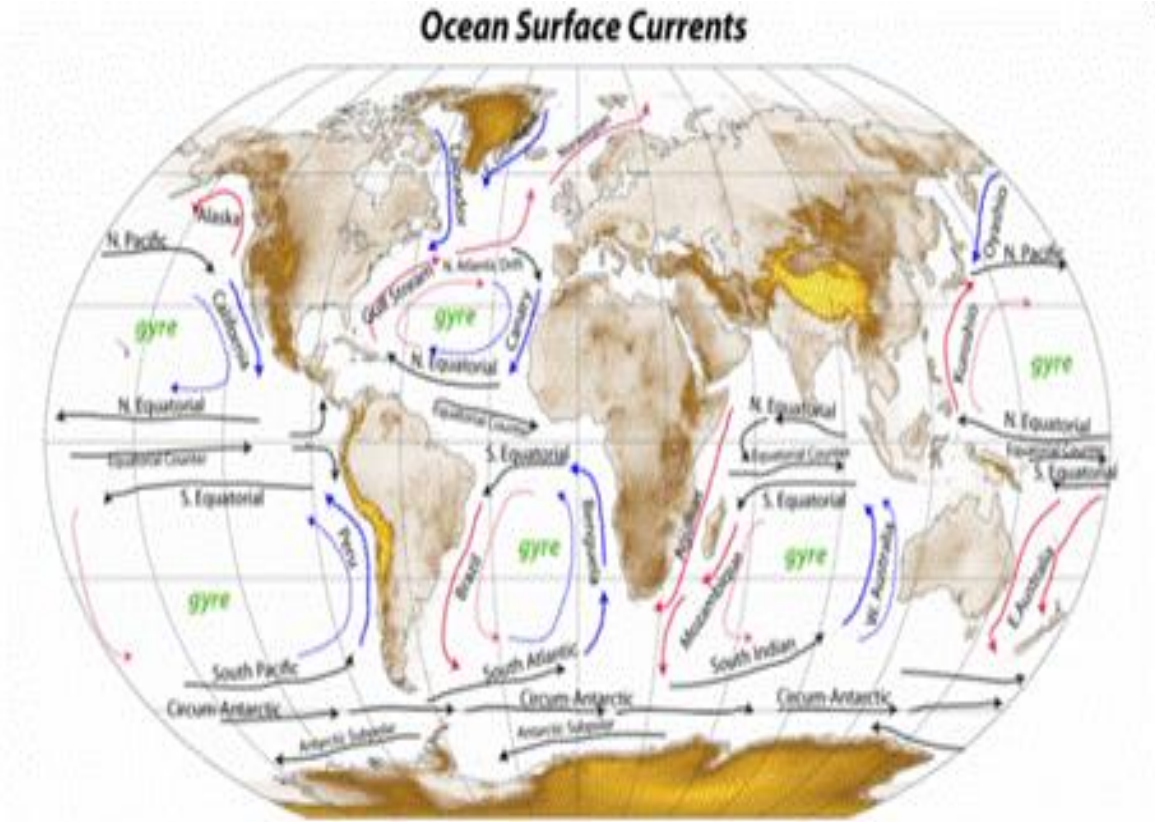
COMPLIANT EFFORTS

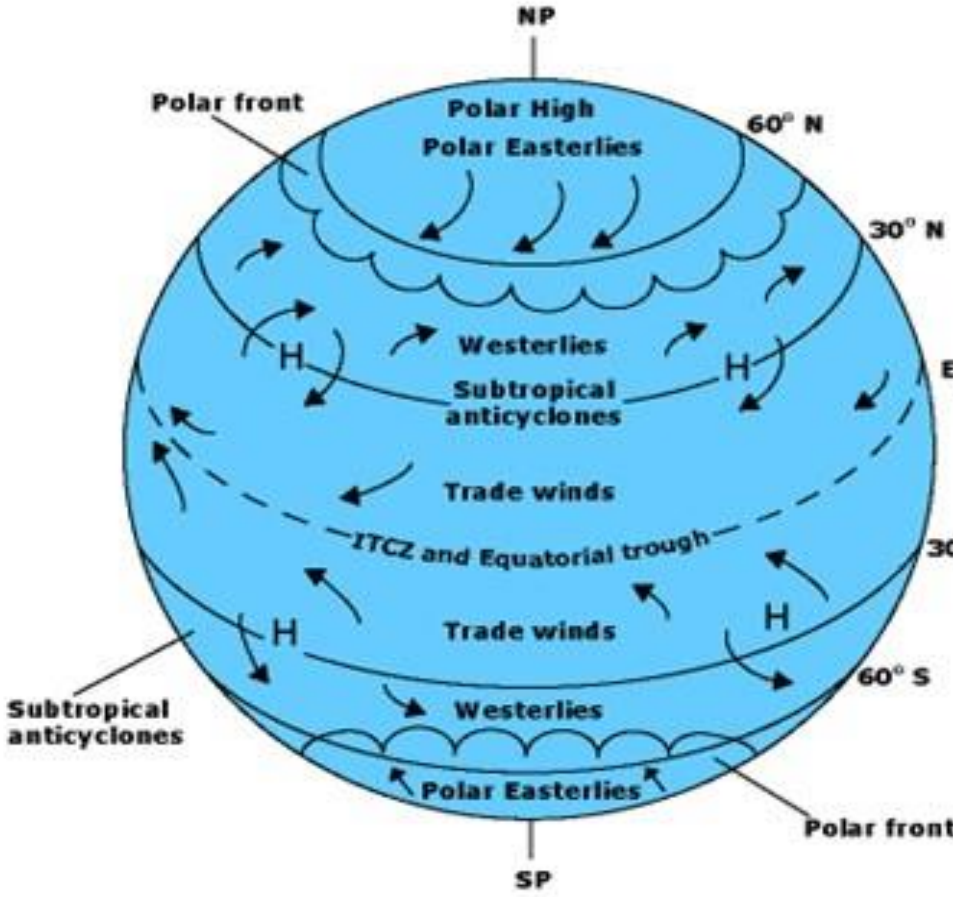
A. Operations
   a) requires you to follow both the rules and 'the ordinary practice of seamen’.
   b) Technology assisted / ICT enabled
B. Technical / Technology
   a) Digital - Soft-tech (Information and Communication Technology (ICT) ICT)refers to technology derived from outside of natural science disciplines and from outside of conventional science.
   b) Technical - Hard Technology - Hard technologies are tangible components that can be purchased and assembled into assistive-technology systems.
   c) Autonomous (Futuristic)

A) OPERATIONS ('the ordinary practice of seamen

COMPLIANT EFFORTS

- Voyage Optimization
  - ✓ Weather routing which includes using favourable winds, currents and tides is once again gaining acceptance as great savings in fuel consumptions which translates to lower emission by using favourable tides and currents especially for longer distances.





A) OPERATIONS

COMPLIANT EFFORTS

❑ Voyage Optimization

- ✓ Slow Steaming
- ✓ Ship-owners synergizing with Port Authorities in **deployment of** Smart port technologies and ports infrastructure development and improved performance
- ✓ Use of Shore powers when at the **Jetties / Terminals/ Quays** and this will reduce the use their generators and auxiliary engines while in Port.
- ✓ Creation of Layby berth where detained vessels can be moored where shore supplies could be used
- ✓ Effective use of Maritime Domain Awareness: Ensuring safe and secured anchorages to avoid vessels steaming around for fear of attacks by pirates.
- ✓ Incorporate a Ballast-Free System.
- ✓ Applying the Best Anti-Fouling Hull Paint.

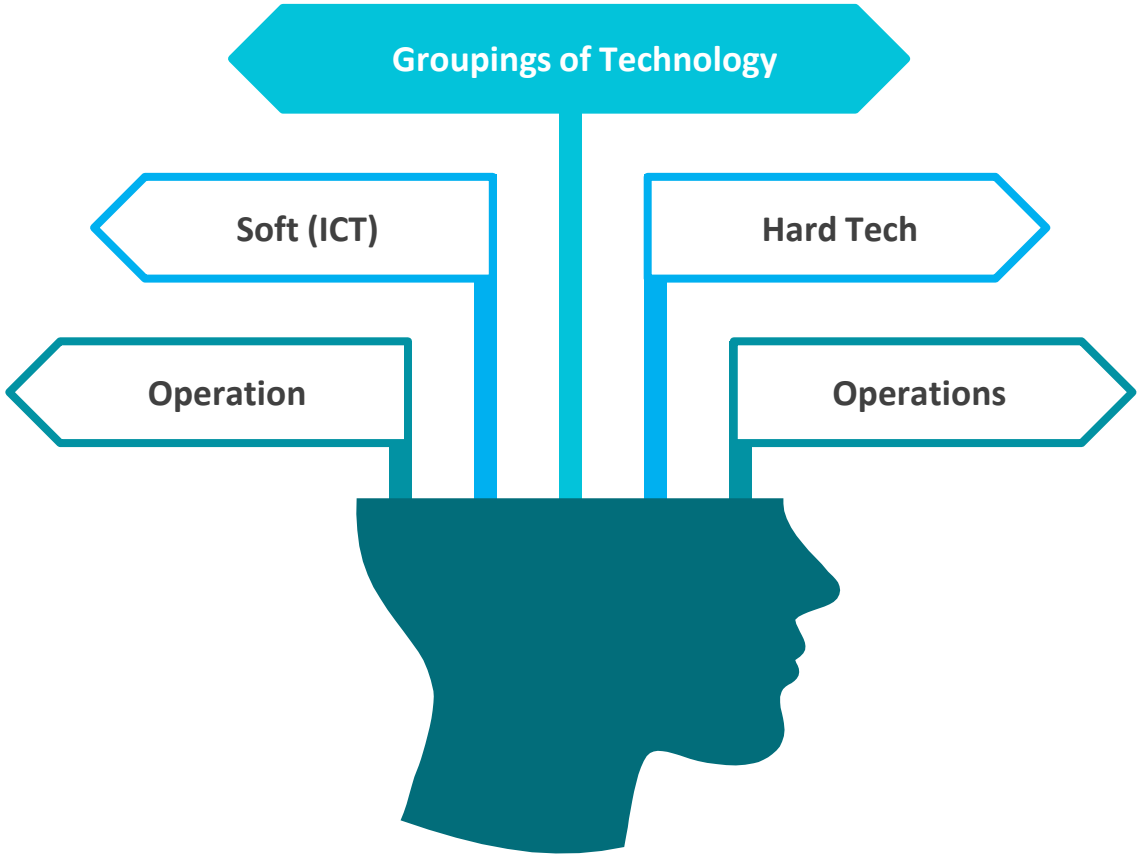
A) OPERATIONS (Technology assisted / ICT enabled)

COMPLIANT EFFORTS

- ❑ Voyage Optimization
- ❑ ICT systems automate and streamline the flow of information between the different parties in the maritime transport chain, improving their operations
- ❑ Efficient operations will translate to optimal usage of ships which translates to great savings in time and Fuel optimisation which consequently reduces the emissions into the atmosphere.
- ❑ Improvement in operations as end result of various level of Digitalization and ICT

Digitalization and new developments in the field of artificial intelligence, blockchain, IoT and automation are becoming increasingly relevant for maritime transport. They help streamline existing processes, create new business opportunities, and transform supply chains and trade geography

•B. Technical / Technology



COMPLIANT EFFORTS

B) TECHNICAL / TECHNOLOGY

a) Digital - Soft-tech (Information and Communication Technology (ICT) ICT)

- technology derived from outside of natural science disciplines and from outside of conventional science.
- Up-to-date data on all ships allows ports to plan accordingly. Consequently, the captain gets information regarding port availability and can optimise his route.
- This is in the use of digitalisation, to create new efficient ways of working and improve customer interfaces.

How ICT is helping shipping become safer and more financially and environmentally sustainable:

i. automate and streamline the flow of information between the different parties in the maritime transport chain, improving their operations.
ii. Real-time cargo tracking
iii. Predictive maintenance
iv. ICT adds value – internet connection enables it to do so
v. In essence, ICT creates the competitive advantage you need to sustain your business in a global market.

B) TECHNICAL / TECHNOLOGY

COMPLIANT EFFORTS

Technical - Hard Technology

- Compliance with regulations, conventions (e.g. issues using compliant fuels , Energy Efficiency Existing Ship Index (EEXI); and the operational carbon intensity reduction requirements, based on a new operational carbon intensity indicator (CII) may involve the introduction of some new equipment or the modification of existing.
- in the Maritime world, the aspect that contributes the greatest proportion in emission is the propulsion and exhaust systems hence the call for urgent and focused action/ solutions.

B) TECHNICAL / TECHNOLOGY

COMPLIANT EFFORTS

Technical - Hard Technology (Notable efforts):

- Modification and new equipment to be adaptable to new Fuel Mix including the use and implement an Exhaust Scrubber System/Sulphur Scrubber System in switching to Low-Sulphur Fuel. ...
    - The new fuel mix includes alternative fuels such as LNG, LPG, Methanol and hydrogen which are somehow playing greater roles in deep sea shipping
    - Use Speed Nozzles to Save Fuel. ...
- Building ships that are less heavy e.g. composite materials such as fibre-reinforced plastic (FRP) instead of steel, is one tactic that can help reduce a ship's weight and lower fuel consumption emissions. Using for example, should.
- Joining shore grid electricity (cold ironing) while alongside is once again becoming very popular (eg. Ports of Stockholm is investing in the environment by building onshore power connection facilities for cruise ships at two city centre quays.

C) TECHNICAL / TECHNOLOGY

COMPLIANT EFFORTS

C. Autonomous (Futuristics) The Journey thus far – how ship technology is becoming more sustainable.

- **Autonomous technologies can help** Improves Situational awareness and thus:
  - Reduction in Maritime incidents like groundings and collisions
  - **help avoid** environmentally disastrous **collisions, reducing emissions and the potential for spills**
  - reduce / eliminate emission (principally cutting down on fuel consumption) thus progressively moving the marine industry toward important sustainability targets.
- Last November, an autonomous, zero-emission ship developed by a Norwegian company set sail on its first journey through the Oslofjord inlet. After a successful voyage to Oslo, Norway, the ship is now undergoing a two-year trial with one goal in mind: to become the first certified crewless, all-electric container vessel of its kind, all while reducing CO2 emissions, improving safety conditions, and revolutionizing the world of shipping technology.

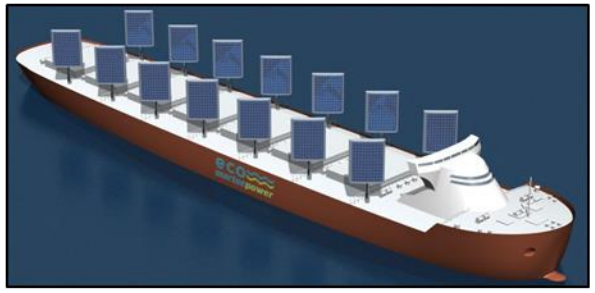
C) TECHNICAL / TECHNOLOGY

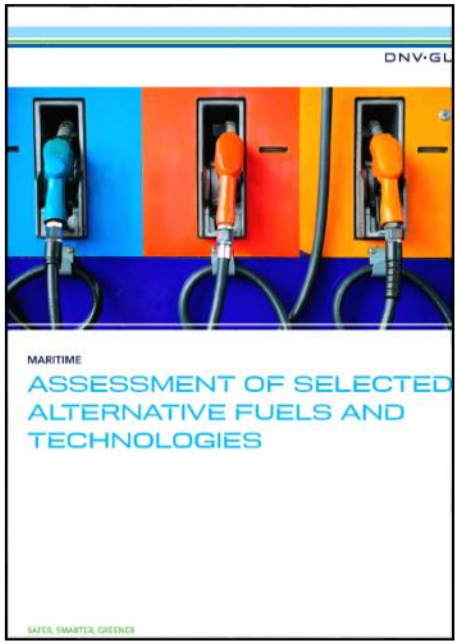
COMPLIANT EFFORTS

C. Autonomous (Futuristic)

- Autonomous ships are more navigationally efficient, which means less fuel waste.
- An important environmental dividend from autonomous technology will be a result of improved safety.
- Autonomous technology is presented as to having better situational awareness with capability to constantly monitor a vessel's position in relation to hazards including other ships – and ensuring it maintains a safe distance from these threats thus can help to prevent accidents and thereby protect the environment.
- Reduction (probable eliminate) the size of human crews, the industry could also reduce the onboard infrastructure and supplies required to support them. That could make these ships more lightweight, improved speed efficiency and with less fuel consumption.
- The aforementioned reduction in non-earning weights translates to more cargo-carrying weights for the same deadweight.
- Autonomous and automated navigation also benefit the environment by increasing voyage optimization and efficiency, in turn contributing to decarbonization.
- "The technology improves productivity and fuel efficiency by continuously reacting to small changes with small actions rather than intermittently responding to larger changes with more significant actions." This results in reduced emissions for the same cargo volume transported''….
  One Sea: Autonomous Shipping Has Clear Environmental Benefits (maritime-executive.com)

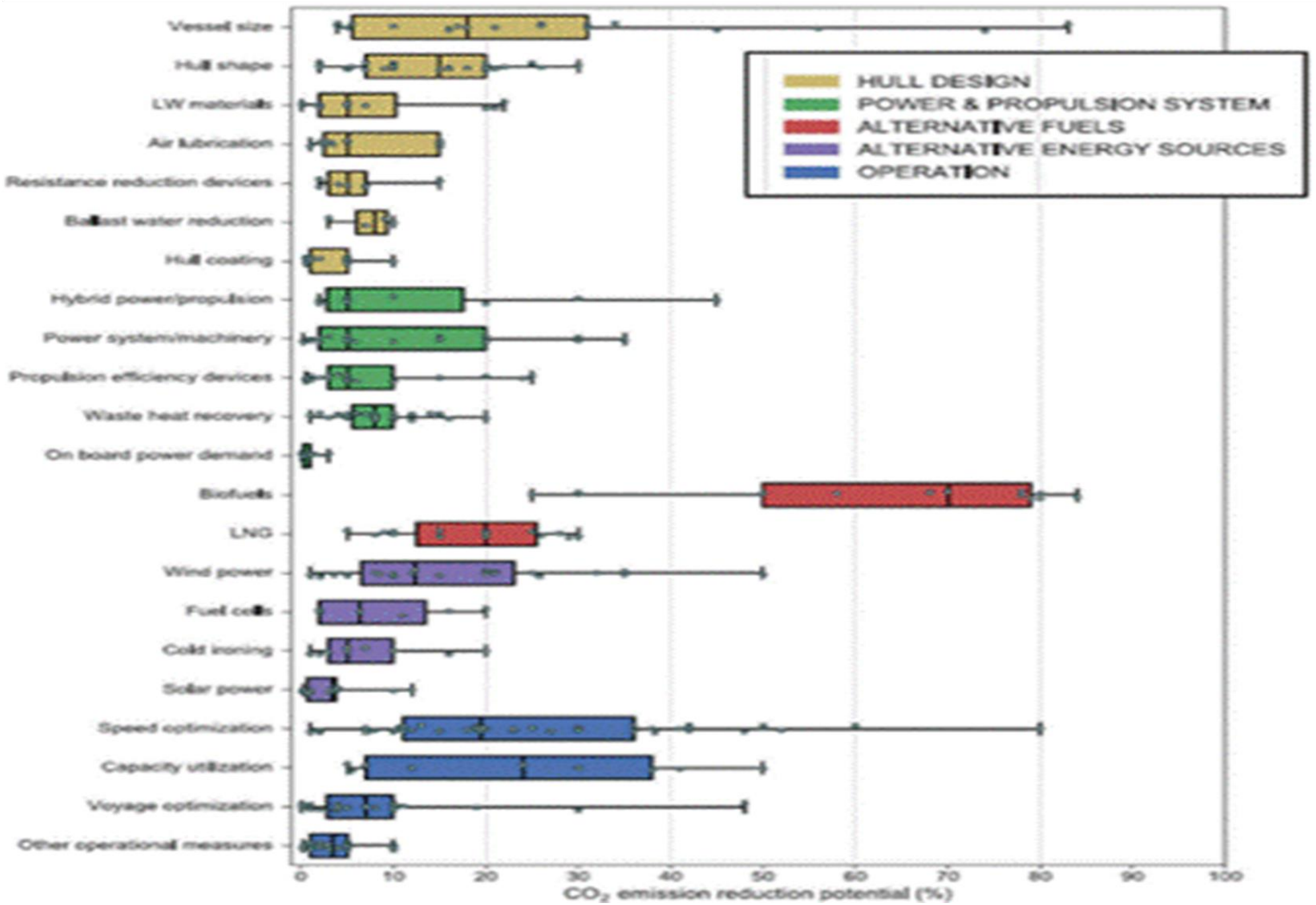
The “4th propulsion revolution”?

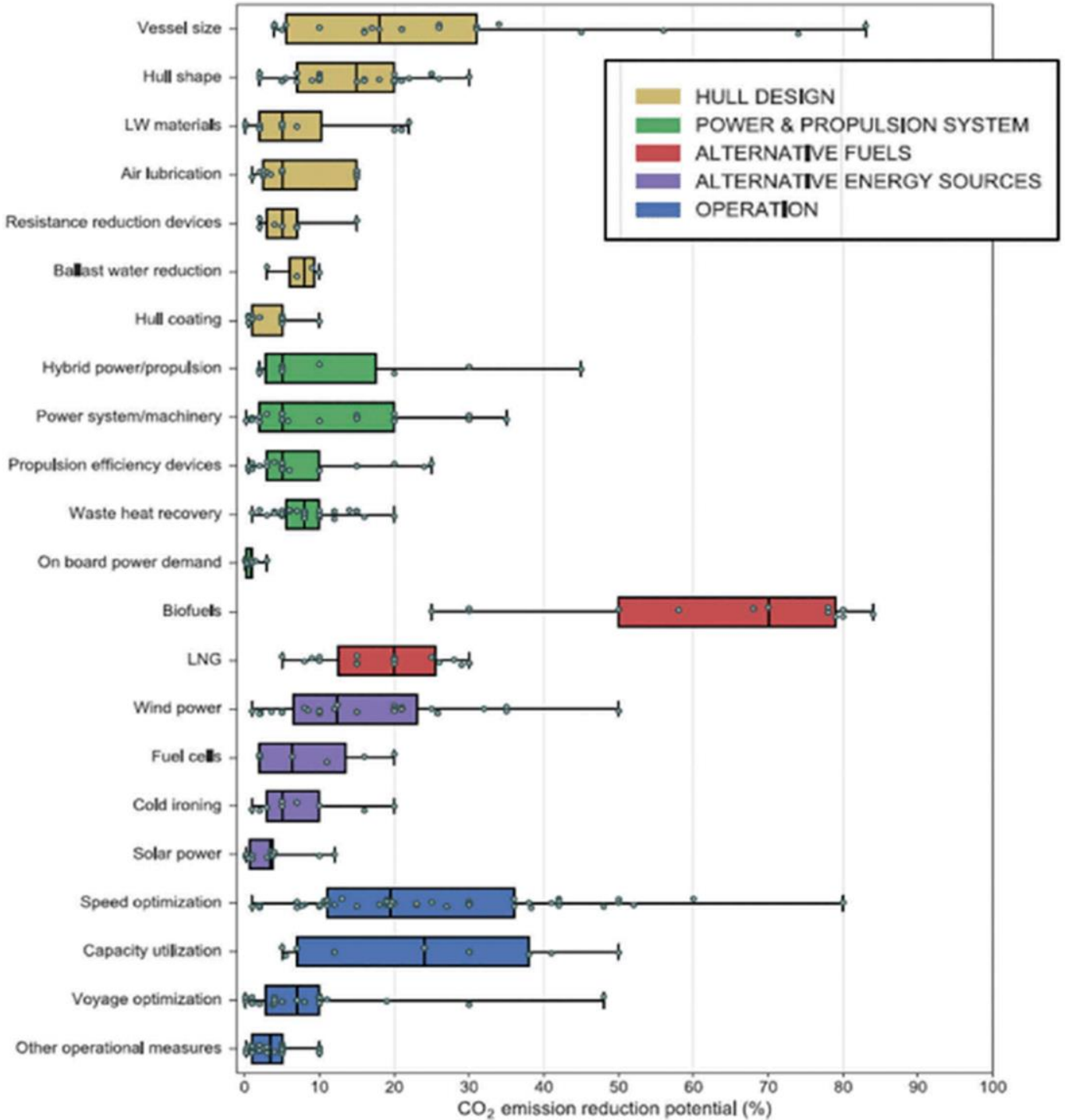




SUMMARY OF EFFORTS (ICT, HARD TECH, OPERATIONAL a nd etc) ADVANCEMENTS IN GREENER SHIPPING

- **Noted Approaches**





- Switching to Low-Sulfur Fuel. ...
- Slow Your Ship's Travel Time. ...
- Incorporate a Ballast-Free System. ...
- Use environmentally friendly fuels including Green Hydrogen, LNG as Marine Fuel. ...
- Implement an Exhaust Scrubber System/Sulfur Scrubber System. ...
- Use Speed Nozzles to Save Fuel. ...
- Apply the Best Anti-Fouling Hull Paint.
- Building ships that are less heavy is one tactic that can help reduce emissions. Using composite materials such as fibre-reinforced plastic (FRP) instead of steel, for example, should reduce a ship's weight and lower fuel consumption.
- Smart port technologies / WINDMILL for power generation around the ports

Some Smart Ship Technologies to make shipping Gre
en with eventual delivery of the Ultimate Green Ship

Below are new technologies and initiatives which if used individually or together would create the improved **Green Ship of the Future.**

They are as follows:

1. "No Ballast Ships" - **No Ballast System**: This concept is a step higher than reliance on compliance with IMO Ballast water convention by having A no ballast ship or similar system can drastically reduce this problem.
2. **Propulsion System (Engine and auxiliary engine):** What is the fuel of the future of the Shipping industry? LNG, Diesel, DFDE, TFDE aimed at efficient engine performance with reduction of air pollution
4. **Sulphur Scrubber System**: as at date we have somehow accepted the fact that conventional fuel will still play a major role in the energy mix an hence all the effort to remove to ALARP the worrisome constituent sulphur or SOx emission from the exhaust. 98% of sulphur can taken off by the installation of an exhaust gas scrubber system wherein the sulphur along with other harmful particles are washed out from the exhaust gas.
5. **improved fuel oil consumption by up to 4% and increased speed by the use of Advanced Rudder and Propeller System**:
6. **Speed Nozzle** generally used in small supply vessels and tugs to provide power to the ships.

Some Smart Ship Technologies to make shipping Gre
en with eventual delivery of the Ultimate Green Ship

7. **Applying Hull Paint correctly**: could lead to in 3-8% of fuel savings.
8. **More Efficient Waste Heat Recovery System**: This can reduce the fuel consumption of the ship drastically up to 14% of the total consumption.
9. **Exhaust Gas Recirculation**:
10. **Water in Fuel**: This is aimed at reduction of the temperature inside the cylinder liner by the addition of water in fuel just before its injection into the combustion chamber can reduce the temperature inside the cylinder liner. An efficient system for this can result in NOx reduction of up to 30-35%.
11. **Improved Pump and Cooling Water System**:
12. **Sail and Kite Propulsion System**: Sail and Kite propulsion system when used along with the conventional propulsion system can reduce the fuel as well as NOx, SOx and CO2 emissions by 35%. Read more about these green propulsions system here.
13. **Fuel and Solar Cell Propulsion**: The fuel cell propulsion utilizes power from a combination of fuel cells, solar cells and battery systems. This helps in reduction of GHG emission to a great extent.
14. **Sandwich Plate System (SPS)**: Here two lighter metals plates are bonded and thus the use of steel with its heavier weight and other related stiffeners are eliminated hence lighter weight and less prone to corrosion. This technology is positive in green ship recycling an improved service performance. .

Some Smart Ship Technologies to make shipping Gre
en with eventual delivery of the Ultimate Green Ship

Others:

Artificial Intelligence – Digital Cargo And Bay Arrangement Optimization

- classify and differentiate containers and goods on the basis of their timeframe of delivery This can e*n*sure that goods with an urgent requirement are given priority over other items
- Proper distribution of cargoes between many vessels passing through a port helps in reducing terminal traffic
- With digital cargo optimization, the empty space in a ship can be reduced from between 35-40% to below 15 – 20 %.
- order of arrangement very important in improving efficiency.

IoT on Vessels

- Enables users to controls everyday objects with the help of their phone or a consolidated control system such as a remote.
- This eliminates physical presence by providing remote control to the vessel operator or passengers
- Invariable application in emergency, the master or captain of the vessel would have remote access to the cabins that could prove decisive.
- Can mean reduction of crew

Some Smart Ship Technologies to make shipping Gre
en with eventual delivery of the Ultimate Green Ship

Others:

Digital Route Management of Ships

- Voyage optimisation
- .Considering the long periods that ships remain at sea, and the possibility that ocean conditions can vary drastically over the matter of a few hours, it is important that real-time data is available for ship operators to use.
- by allowing computational software to handle the routing, an accurate path can be developed that factors in several variables.

Smart Manoeuvring Control / Autonomous Control

- Integrating smart technology such as AI and machine learning into the manoeuvring systems would enable vessels to stay accurately on course
- reduces the chances of human error, and also allows real-time route information to be implemented immediately.

Smart Propulsion Systems

- This enabled the pitch, angle, rack, and speed to be controlled to exceedingly high tolerance values.

Some Smart Ship Technologies to make shipping Gre
en with eventual delivery of the Ultimate Green Ship

Others:

Integrated Control Systems

- Integrated control systems provide a unique solution to monitoring the various systems and components that make up massive vessels.
- These systems use smart technology that connects the parts of the ship to a central server. This can include propulsion, manoeuvring controls and communication that are managed by individual units.
- Smart Defence Technology

To ensure the highest level of standard in running military operations, all such actions taken by the smart technology should preferably be routed through an individual who can verify and activate the suggestions forwarded by the software.

Blockchain technology

- It is the next giant step in the aspects of payments by providing a quick, secure and transparent way of collecting payments from any place in the world.
- It is also being used in the ecology and sustainability sector.
- If implemented properly, the industry will be able to take benefit of advantages such as high data quality, process integrity, configurable smart contracts, lower transaction costs, empowered network, ecosystem simplification and many more.
- On-going more research on its application in the industry.

Some Smart Ship Technologies to make shipping Gre
en with eventual delivery of the Ultimate Green Ship

Others:

Augmented Reality (Virtual Reality - VR)

- This is revolutionising almost all industries today
- AR is presently being used mainly for seafarers training and has been implemented by a couple of maritime training institutes. It is helping students to learn from several real-life experiences which would have been otherwise not possible.
- AR is also being used for efficient maintenance and inspections of vessels. Using tools such as AR wearables and remote guidance software, repair and maintenance are being carried using visual images and without the physical presence of a technician at the site.
- is also being used in the shipbuilding and design process, simulating virtual models which can help resolve several issues at the early stage of designing before implementation.

Some Smart Ship Technologies to make shipping Gre
en with eventual delivery of the Ultimate Green Ship

Others:

Robotics / Drones / 3D Printing

- Just like in other industries, advanced robotics are influencing operations in the maritime industry as well.
- Robots are already being used for maintenance, security and inspections of vessels.
- Companies such as Hyundai Merchant Marine HMM have already started replacing human labourers with robots in risky environments, for e.g. in hull cleaning work on its vessels.
- several companies have already started using robots for remote inspections of vessels especially during times of travel restrictions.
- Even drones are now being used extensively for tasks such as delivering goods to vessels, security and surveillance, and remote inspections.
- Implementation of 3D Printing is also being carried out especially to resolve the issue of timely availability of spare parts onboard ships.
- more advanced robotic technologies will soon be dominating various aspects of the maritime industry.

Wayforward

- Set Your SMART Goals (e.g. MSC Shipping)
  - Carbon intensity (EEOI) reduced to 13.61 g/mt-nm by 2023
  - Carbon intensity (EEOI) reduced 70% by 2045 from 2008 baseline
  - First net zero carbon emissions capable ship in service by 2030
- Involvement and sponsorship of R&D for best, affordable and less complicated technologies
  - Complete net decarbonisation in 2050
- Training and re-retraining of crew for familiarity with the best fitted systems. In the recent paper to be presented at MEPC by Netherlands on the report of its study in 2021 its Human Environment and Transport Inspectorate (ILT) carried out 19 Exhaust Gas Cleaning Systems (EGCS) besides certification and documentation deficiencies another major issue was lack of familiarization with the EGCS. Crew demonstrated little knowledge of the EGCS installation on board and thus poor operational and maintenance knowledge.
- Supporting of Maritime Training Institute (MTIs)
- Transition – it is a moving train!! Nobody expects magic. Plan and have your Roadmap
- It is a programme / project not open-ended or secured retirement plan
  - RACI chart
  - Project Champions
- Deal as synonymous with sustainable future,
- Massive Infrastructure development

APPLAUDED EFFORT

MSC ..... Kudo

MSC ..... Kudo

As a leading company whose business both impacts and is impacted by the climate, we have a key role to play in accelerating the energy transition as we decarbonise our operations. Climate action – including adaptation to evolving adverse weather patterns – is therefore a strategic imperative for MSC.

MSC is in a unique position to contribute to the decarbonisation of global supply chains. With the scale and breadth of our operations comes a responsibility to show leadership, by pioneering innovative, sustainable and scalable solutions. By adopting an end-to-end perspective we aim to reduce emissions across our global operations.

Taking leadership to drive the decarbonisation of shipping demands concrete action to promote the wider adoption of low- and zero-carbon fuels. We collaborate with industry peers as well as engage through multi-stakeholder platforms across the maritime ecosystem, capitalising on the interdependencies between our shipping and other sectors providing fuels, distribution systems and infrastructure.

The Race to save the world is on – be a partaker and not an onlooker

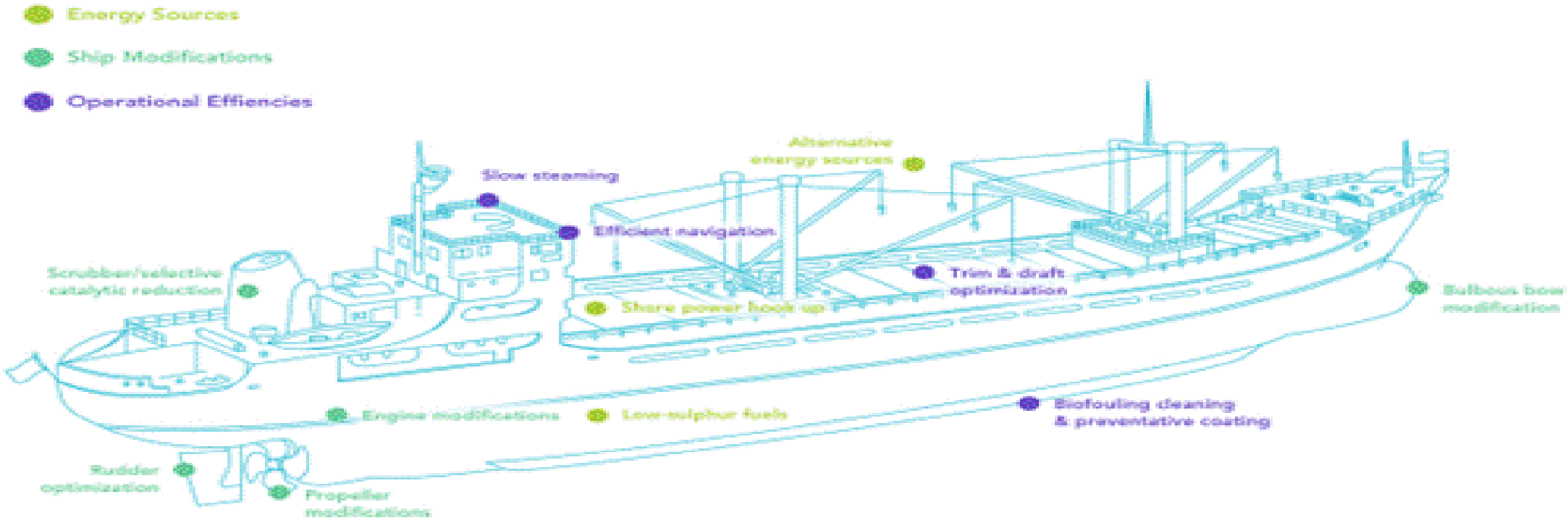
CLEAR SEAS GROUPINGS

Practical Measures
To reduce air pollution from marine shipping, vessel owners and operators are implementing practical measures including alternative energy sources, modifications to ship components and operational efficiencies.

Measures to Reduce Air Pollution from Ships

CLEAR SEAS GROUPINGS

Practical Measures to Reduce Air Pollution from Ships



Learn more at clearseas.org/air-pollution

ClearSeas

CLEAR SEAS GROUPINGS

- ✓ Ship Modification:
  - ✓ Exhaust Cleaning
  - ✓ Engine modification:

Internal engine modifications – adding water, recirculating exhaust gas, cooling water temperatures, or modifying overlap timing or intake valve closing – can reduce NOx emissions by nearly 100%.

Gas-fuelled engines can use LNG or methanol as fuel to reduce NOx emissions by up to 90% and SOx and particulate matter by 95% to 100% when compared to HFO.

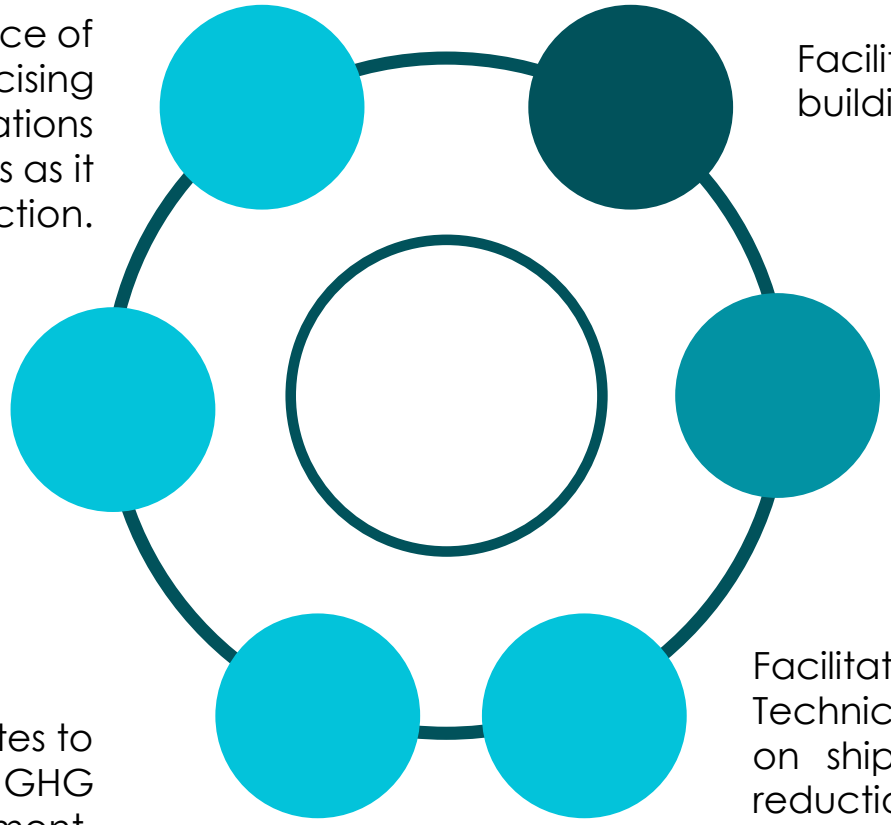
  - ✓ Efficient Design
- ✓ Energy Sources
  - ✓ Shore Power
  - ✓ Low-sulphur Fuels
  - ✓ Alternative Energy Sources
- ✓ Operational Efficiencies
  - ✓ Slow Steaming
  - ✓ Vessel Cleaning and Coating
  - ✓ Trim and Draft Optimization
  - ✓ Efficient Navigation

The Role of Abuja MoU in Reducing GHG Emission

Periodically evaluate the performance of member states in respect of exercising their rights and meeting their obligations under mandatory IMO instruments as it concerns GHG emission reduction.

Ensure that members keep a register of fuel oil suppliers.

Encourage member states to develop technologies for GHG emission ataement.



Facilitate sensitization and capacity building on GHG emission reduction.

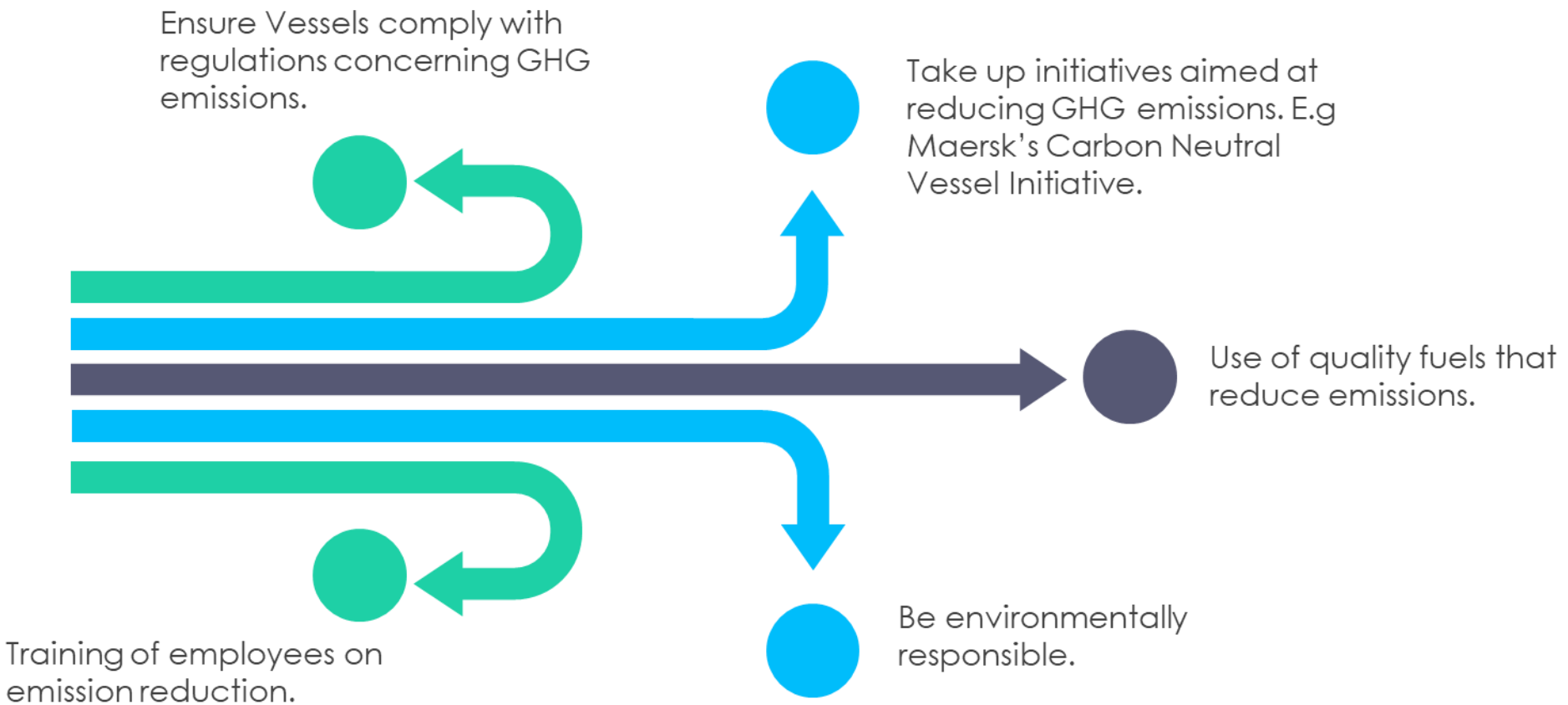
Encourage member states to develop and implement national policies aimed at GHG emission reduction.

Facilitate International Technical Cooperation on ship GHG emission reduction.

SHIPOWNERS / PERSPEVTIVE

The Race to save the world is on – be a partaker and not an onlooker

The Role of Ship Owners in Reducing GHG Emission



The Role of Ship Owners in Reducing GHG Emission

In discussing Vessel's compliance, it is important to deal with two aspects which depends on the acquisition process.
Ship acquisition is basically through contracting for New-building and / or Purchase of existing vessel (2nd hand tonnage).
Two approaches towards Ship Acquisition:

1. Modification of existing vessels (retrofitting): This involves the use existing (if complaint) or novel technologies for adaptation to meeting the requirement. Example in the use of scrubber units in processing non complaint fuel in ensuring that the exhaust gas from the engines scrub up Sulphur (to 0.5%) and other detrimental constituents to acceptable limits. Exhaust Gas Cleaning Systems (EGCS) is most popular of such
2. Construction and commissioning of new vessels that are compliant through (Shipbuilding Contract)

The main Contract for the construction of newbuild is the Shipbuilding Contract (SBC) to which guarantee and warrantees are highlighted.
Shipowners should look at the followings:

- Commissioning and installation of approved and complaint equipment
- Using of Shipyards with outstanding Environmental Certification,
- Using of lighted Materials for ship construction
- establishment of environmental policy initiatives

The Role of Ship Owners in Reducing GHG Emission

- ✓ Shipping design and compliance (SDC)
- ✓ Involvement in R&D for best and less complicated technologies
- ✓ Training and re-retraining on crew for familiarity with the best fitted systems. In the recent paper to be presented at MEPC by Netherlands on the report of its study in 2021 its Human Environment and Transport Inspectorate (ILT) carried out 19 Exhaust Gas Cleaning Systems (EGCS) besides certification and documentation deficiencies another major issue was lack of familiarization with the EGCS. Crew demonstrated little knowledge of the EGCS installation on board and thus poor operational and maintenance knowledge.

Operational:

Generally, ship-owners need to synergize with Port Authorities in their ports infrastructure development and improved performance in the following areas:

- ✓ Voyage optimisation: Optimized voyage planning is an essential tool for fuel savings. Maersk has developed the Voyage Efficiency System (VES) to identify the most fuel-efficient route and pursue a just-in-time steady running strategy.
- ✓ Use of Shore powers when at the Jetties / Terminals/ Quays and this will reduce the use their generators and auxiliary engines while in Port.
- ✓ Creation of Layby berth where detained vessels can be moored where shore supplies could be used
- ✓ Ensuring safe and secured anchorages to avoid vessels steaming around for fear of attacks by pirates.
- ✓ Slow Your Ship's Travel Time. ...
- ✓ Incorporate a Ballast-Free System.

WHY SHIPOWNERS SHOULD OPENLY ACCEPT GREEN SHIPPING

- As part of CSR
- Love of the Environment
- Competitive edge
  - Enjoying incentives where available
  - Greener fuels may eventually be cheaper
  - Current situation in Russian has somehow shown us that there will always be issues with countries that are major producers of Fosil Oil
  - Freed from over dependences on politically volatile suppliers and associated pressure groups
- Ensure compliance hence free from the consequence of non compliance
  - Unnecessary delays
  - Detentions (Flag, Port and Coastal States)
  - Fines

Maritime Organization
(Administration)

MARAD

MARAD
Maritime Administration

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The Race to save the world is on – be a partaker and not an onlooker

The Role of Maritime Administration in Reducing GHG Emission 001

Maritime Administration (MARADS):
This is the institutional body that is concerned with the enactment and enforcement of domesticated International and local regulations with which Ships and shipping firms must comply in their construction, maintenance, equipment and operations. MARADs regulates the Maritime spheres and related management and operation.

Different MARAD has different scope of responsibilities depending on the establishing Act and thus the expectations with respect to their influence on greener shipping may vary

- Effective Enforcement (Port State and Flag States) of applicable Conventions, Protocols, Guidelines and Codes.
  - ✓ Covert and Overt inspections
- Conduct Sensitization aimed at creating and improving Stakeholders to appreciate the dire consequences of the prosecution of deafulters (heavy polluters), noting the natural tendency of most people towards regulations which is resistance and slow appreciation especially where coast is involved.
- to support any initiatives, by both shipping companies and the wider shipping sector, that help develop smart and innovative ideas for digital shipping,"
- Tax incentives (dues) or rebates fro tonnage calculations
- Prompt inspections and thus avoiding unnecessary delays and consequent increased Port Turnaround Time

The Role of Maritime Administration in Reducing GHG Emission

Maritime Administration (MARADS):

- Training and re-retraining on officers (Port and Flag State Inspectors). Recall the earlier mentioned inspection report Netherland's Human Environment and Transport Inspectorate (ILT). The success of the study was becos the inspectors were knowledgeable about the Exhaust Gas Cleaning Systems (EGCS). Inspection is beyond ticking the checklist but more of show, demonstrate and tell aimed to expose poor operational and maintenance knowledge and skills of seafarers.
- Efficient and effective enforcement regime: through:
  - ✓ Proficiency of Port and Flag State Inspectors.
  - ✓ Strict observance of compliance including records review - The prohibition on the carriage of non-compliant fuel oil for combustion purposes for propulsion or operation on board a ship, also known as "the carriage ban", was adopted by resolution MEPC.305(73), and is laid down in regulation 14.1 of MARPOL Annex VI.

The Role of Maritime Administration in Reducing GHG Emission

FINAL WORDs for MARADs

I will advised MARADs with the following propositions from " Green shipping practices in the shipping industry: Conceptualization, adoption, and implications Kee-Hung Lai et al "

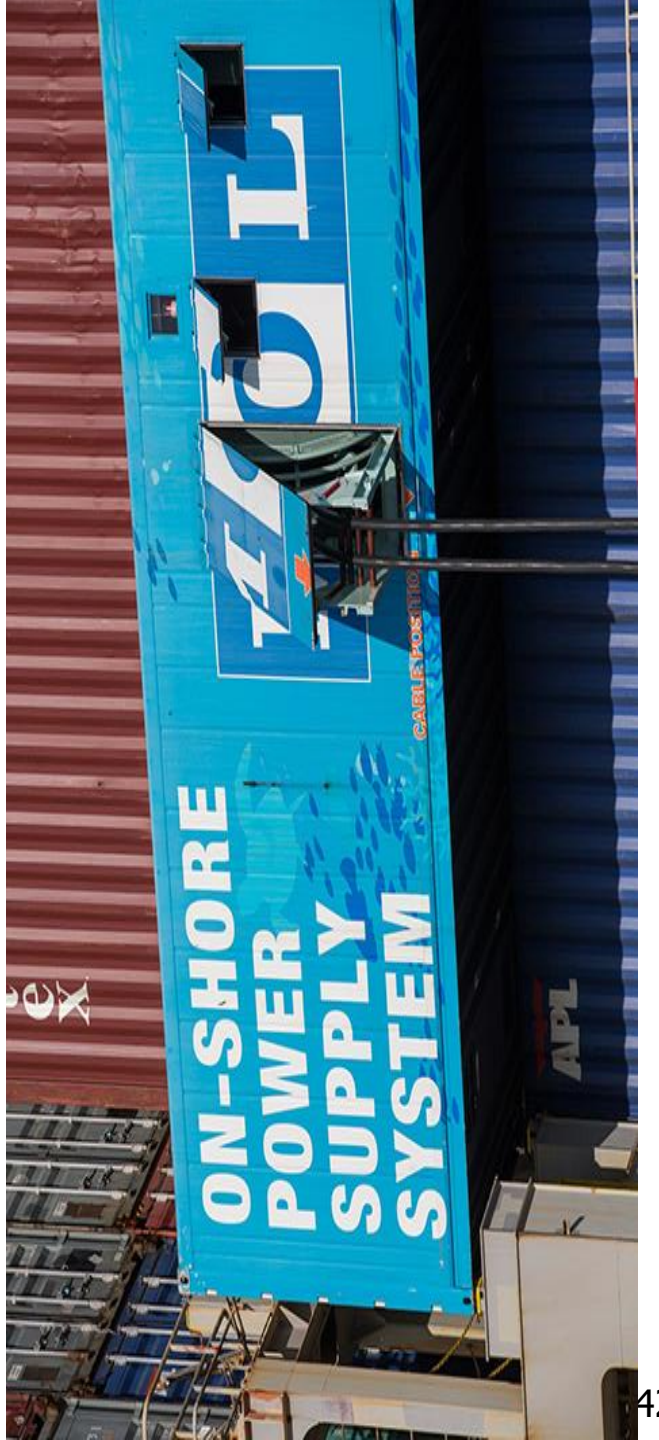
- ✓ Proposition 1. Shipping firms tend to adopt GSPs when they encounter strongly enforced regulatory environmental requirements
- ✓ Proposition 2. Shipping firms tend to adopt GSPs when exposed to industrial institutionalized norms on environmental protection.
- ✓ Proposition 3. Shipping firms tend to adopt GSPs in the face of strong environmental requests from customers.
- ✓ Proposition 4 Shipping firms adopting GSPs will attain both environmental and productivity per

SYNERGY WITH Ports AUTHORITY

Other Strategies for GHG Emission Abatement

- Supplying vessels electricity from the grids line NORWAY. Atmospheric emission from ships at ports can decrease as much as 98% when shore power supply is provided to ships that call at the port.
  - A real life case study in Shenzhen Port showed that after installation of shore power at the port, there was a reduction of 40,000 Tonnes of CO2.
  - The study by Olumide Oyewole in Apapa port showed that shore power could have reduced the CO2 emissions by 12,509 Tonnes
- Improved Turnaround Time through more efficient operations
- Encouraging Port State Inspections – ridding of non-complaint vessels
- Compliant tug boats and mooring boats with acceptable green machineries
- Towing vessels in and not using self machinery – LIKE VIGIN DID WITH Planes
- The Los Angeles Harbor Commission has launched the Vessel Speed Reduction (VSR) Program, under which vessels reduce speed to a voluntary 12-knot speed limit within 20 nautical miles of Point Fermin. Maersk is participating in the Ports of Los Angeles/Long Beach Vessel Speed Reduction Program.

Other Strategies for GHG Emission Abatement



SYNERGY WITH Ports AUTHORITY

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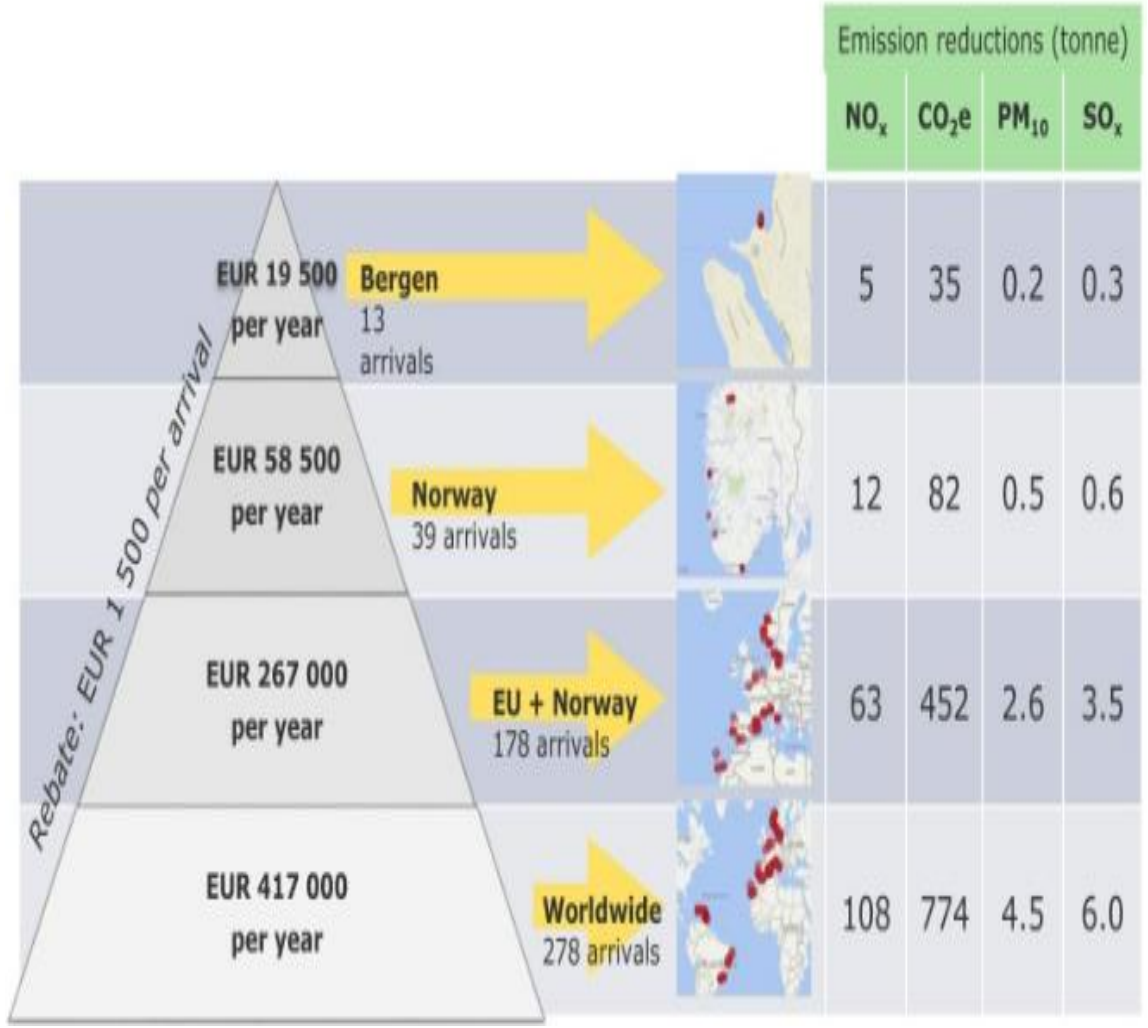
Financial Incentives by Ports

Other Strategies for GHG Emission Abatement



Financial incentives is a popular method ports are utilizing for emission control and this forms about 48% of the emission control methods being utilized globally.

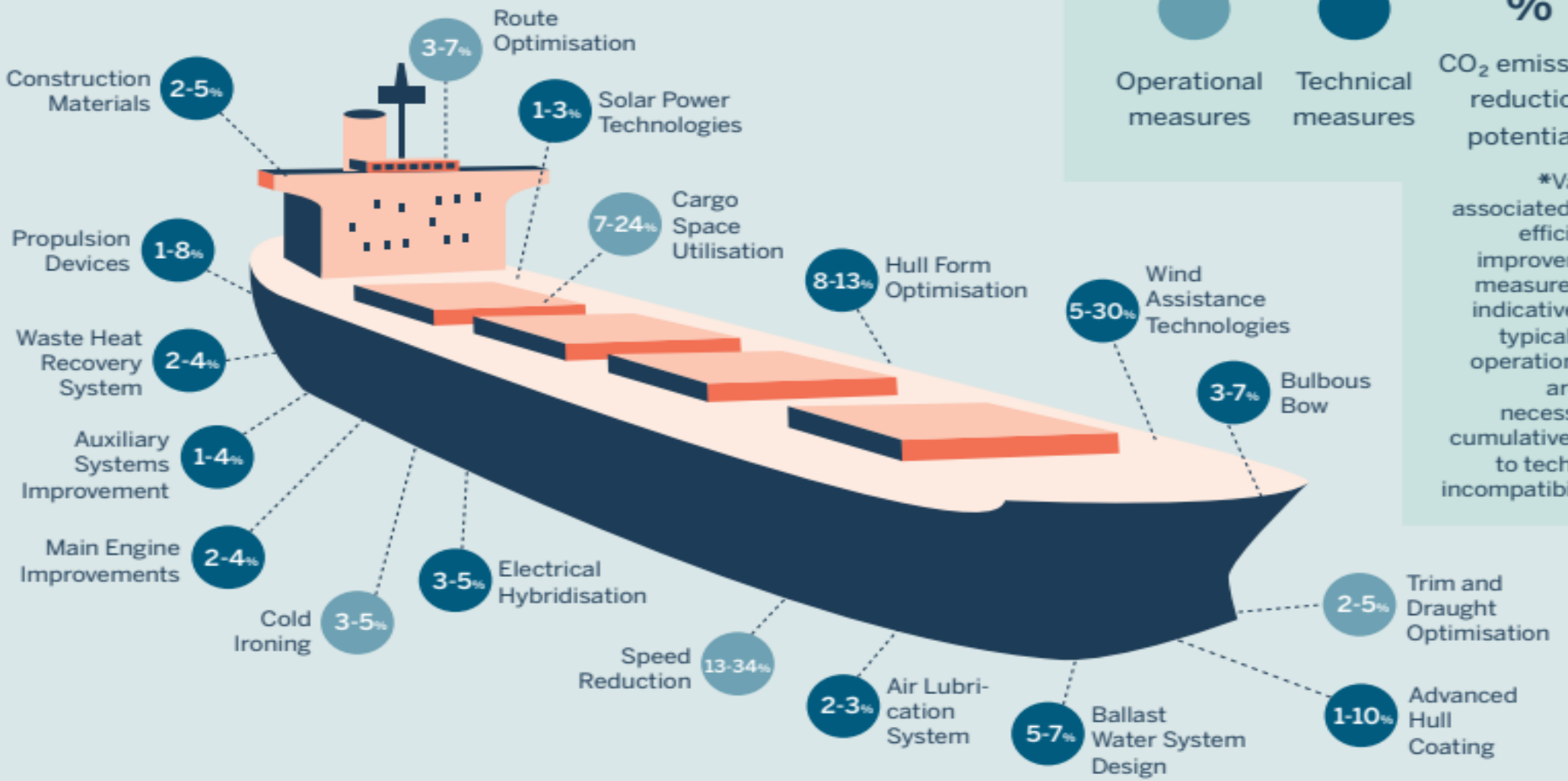
DNV GL (2018) did a study where an assessment of the incentive system was done for a total of 278 port calls from various ports globally using an estimated rebate of €1,500 for every vessel being powered by clean fuel which call at these ports. The results of this study showed that this incentive system led to the reduction of 774 Tonnes CO2 from the 278 port calls.

Source: Christodoulou et al. (2019)
DNV GL (2018)

Other Strategies for GHG Emission Abatement

Efficiency measures

Some of the needed emissions reductions can be achieved immediately using technical and operational energy efficiency measures.



AREA OF SYNERGY BETWEEN SHIPOWENERS AND MARADs

✓ SHIP DESIGN AND COMPLIANCE (SDC):

This aims at reducing the life-cycle environmental damage due to shipping activities by complying to regulatory requirements. Examples include; equipment design to avoid the use of polluting materials; reuse, recycling and recovering of materials among others. These measures take cognizance of the environmental impact of shipping operations right from ship construction, hence, the need for both Maritime Administrations or Organizations and Ship-owners to collaborate towards effective ship survey inspections and compliance.

THE ENVIABLE OUTCOME

The noted positivity in tilting towards greener fuels include:

- varying degree of reduction and eventual elimination of waste generation, waste generation and reduction during operations, resource conservation in handling and distributing cargoes. Lai et al. (2011Lai et al.)
- reduction of negative impact on the environment and Humans / Aquatic lifeforms
- Shipping design and compliance (SDC) and Voyage optimisation
- Related Policy making
- Effective enforcement

ETERNAL GLORY
(2022- ∞)

Summary

As we battle to save the environment, we expect all our stakeholders which generally cover all identified parties in our Maritime cluster (including Shipowners and MARADs) to act now (in action and not words) with substantiable initiatives in the following areas:

i. ***Energy source*** *(Shore Power, low sulphur fuel, alternative fuel source - compliant MDO, LNG, Methanol, Liquid Hydrogen and etc*

ii. ***Ship Modifications*** *including Exhaust cleaning (scrubber mix), internal engine modifications for various kinds of compliant fuel mix, efficient design (Energy Efficiency Design Index, Ship Energy Efficiency Management Plan and etc*

iii. ***Operational Efficiencies*** *(slow steaming, general voyage optimization, Slow Steaming, Vessel Cleaning and Coating, Trim and Draft Optimization, Efficient Navigation and etc*

Conclusion

FOOD FOR THOUGHT

Ladies and Gentlemen, after today, LET US ARISE TO:

Improve knowledge and awareness, acting responsibly, collaborating with our stakeholders, developing ***Sustainability Roadmap*** with effort to address the global challenges of today and be ready for emerging trends noting that often resolution of one issues creates another and/or expanded knowledge revealing hidden issues.

Sustainability should be embedded in our businesses and forms integral part of our due diligence and shape our thoughts and guide us in all we do. Finally, we should Align with the UN Sustainable Development Goals and the UN Global Compact's Ten Principles and develop Sustainability ***Priorities***

Conclusion

- ✓ The above submissions show the need for all hands to be on deck, especially in the shipping sector, towards enthroning shipping practices which encourages sustainable use of the oceans.
- ✓ The noted positivity in tilting towards greener fuels include (1) waste generation and reduction during operations (2) resource conservation in handling and distributing cargoes. Lai et al. (2011Lai et al.) (3) Reduction of negative impact on the environment and (4) Humans / Aquatic lifeforms

- ✓ The drive for ensuring reduction of GHG emission from ships is the responsibility of all maritime stakeholders and we all have to put hands on deck to ensure that we save our planet to guarantee sustainability and for the benefit of posterity.

Comparison of the different solutions guaranteeing compliance

Option	Pros	Cons	Issues/questions
Low Sulphur diesel	– Simple, technical mature, low CAPEX – Reduce SO_x and PM – Global availability – Competence is proven	– Expensive fuel – Issues with fuel switch – IMO Tier III after 2016 need SCR or EGR	– Global availability – Fuel quality – Future higher prices?
HFO + Scrubber	– Low cost fuel (HFO) – Lower CAPEX than LNG – Easier conversions – Process is mature – Global availability	– Space req. installation – Waste disposal, consumables (closed/hybrid) – Maintenance, complexity – IMO Tier III after 2016 need SCR or EGR	– Flag approval – Reliability/corrosion – Load dependence – Compatibility with SCR redundancy
LNG	– Low cost of natural gas – technical mature – Reduce SO_x, PM, NO_x, CO_2 – Favourable CAPEX for smaller vessel than scrubber – Environmental profile	– Engine, tank and system costs – Space for LNG tank – Range on gas could be limited – Lack of LNG bunkering infrastructure – Risk and safety challenges – IMO, international and national regulations are in progress	– Flag approval – LNG pricing – Global LNG bunker availability – LNG fuel quality standards – GHG (methane slip/emissions)

Announcement: Special training for Port Authorities: **The Role of Port Authorities in the Effectiveness of Port State Control Regime**

The Role of Port Authorities in the Effectiveness of Port State Control Regime

BY:
Capt. Sunday Umoren
Secretary General (Abuja MoU).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