SHIP EMISSIONS TOOLKIT

GUIDE NO. 03 | Development of a national ship emissions reduction strategy

GloMEEP gef UNDP IMO IMarEST

Ship Emissions Toolkit

Guide No.3: Development of a national ship emissions reduction strategy

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The GloMEEP Project is a cooperative initiative of the Global Environment Facility (GEF), the United Nations Development Programme (UNDP) and the International Maritime Organization (IMO) to assist developing countries in the uptake and implementation of energy efficiency measures for shipping, with the aim of reducing greenhouse gas emissions and preventing air pollution from ships. For more information, please visit http://glomeep.imo.org.

The Institute of Marine Engineering, Science and Technology (IMarEST) is the first institute to bring together marine engineers, scientists and technologists into one international multi-disciplinary professional body. IMarEST is the largest marine organisation of its kind with a worldwide membership based in over 120 countries. For more information, please visit https://www.imarest.org.

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ADB	Asian Development Bank
AfDB	African Development Bank
AHEWG-TT	Ad Hoc Expert Working Group on Facilitation of Transfer of Technology for Ships
AIS	Automatic Identification System
CO_2	Carbon Dioxide
CH_4	Methane
DWT	Dead Weight Tonnes
EBRD	European Bank for Reconstruction and Development
ECA	Emission Control Area
EEDI	Energy Efficiency Design Index
EEOI	Energy Efficiency Operational Indicator
EIB	European Investment Bank
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GloMEEP	Global Maritime Energy Efficiency Partnerships Project
GWP	Global Warming Potential
HFC	Hydrofluorocarbon
HFO	Heavy Fuel Oil
IADB	Inter-American Development Bank
IAPP Certificate	International Air Pollution Prevention Certificate
IEE Certificate	International Energy Efficiency Certificate
IMarEST	Institute of Marine Engineering, Science and Technology
IMO	International Maritime Organization
INDC	Intended Nationally Determined Contribution
ITCP	Integrated Technical Cooperation Programme
LNG	Liquefied Natural Gas
LPCs	Lead Pilot Countries
LPIR	Legal, Policy and Institutional Reforms
LRTAP Convention	1979 Geneva Convention on Long-Range Transboundary Air Pollution
MARPOL Convention	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEPC	Marine Environment Protection Committee
MOU	Memorandum of Understanding

MTCCs	Maritime Technology Cooperation Centres
NAMA	Nationally Appropriate Mitigation Action
NDC	Nationally Determined Contribution
NGO	Non-governmental organisation
NMVOCs	Non-Methane Volatile Organic Compounds
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NSERS	National Ship Emissions Reduction Strategy
O_3	Ozone
ODS	Ozone-Depleting Substances
PM	Particulate Matter
PSC	Port State Control
SEEMP	Ship Energy Efficiency Management Plan
SIDS	Small Island Developing States
SO_2	Sulphur Dioxide
SO_3	Sulphur Trioxide
SO_4	Sulphate
SO_x	Sulphur Oxides
STCW	Standards Of Training, Certification & Watchkeeping
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UV	Ultraviolet
VAT	Value-Added Tax
VOCs	Volatile Organic Compounds
WMU	World Maritime University

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Preface

Maritime transport is essential to the global economy, providing the most cost-effective means of transporting bulk goods over great distances compared to road or rail. Over 80% of the volume of international trade in goods – including everything from food and fuel to construction materials, chemicals and household items – is carried by sea, with more than 90,000 commercial ships sailing the world's oceans, with a combined tonnage of 1.86 billion dead weight tonnes (UNCTAD, 2017). World trade and maritime transport are fundamental to sustaining economic growth and spreading prosperity throughout the world, thereby fulfilling a critical social as well as an economic function.

However, the sheer scale of the international shipping industry in comparison to other modes of transport means that overall emissions from ships remain a concern, having negative impacts on local port and coastal air quality and hence on human health, and contributing to regional acidification and global climate change. According to the Third IMO GHG Study 2014, maritime transport emits around 1 billion tonnes of carbon dioxide annually and is responsible for approximately 3% of global greenhouse gas emissions from fuel combustion. Shipping is forecast to grow as international trade grows. According to projections, by 2050, depending on future economic growth and energy developments, greenhouse gas emissions from shipping may increase by between 50% and 250%. Annually, international shipping is also responsible for approximately 13% and 12% of global nitrogen oxides (NO_x) and sulphur oxides (SO_x) emissions respectively.

For decades, IMO has exercised strong and decisive leadership in creating the legal and technical framework within which shipping has become progressively cleaner and safer, while continuing to provide the world with a cost-effective way to transport the goods and commodities that underpin the global economy and sustain global society. Efforts to reduce air emissions from ships took a major step forward in 1997, with the adoption of the 1997 Protocol to the International Convention for the Prevention of Pollution from Ships, known as MARPOL Annex VI, which currently regulates air emissions from 96.6% of the world's shipping tonnage. MARPOL Annex VI establishes limits on NOx emissions and requires the use of fuel with low sulphur content, thus protecting people's health and the environment by reducing ground-level ozone-producing pollution, which can cause smog and aggravate asthma.

IMO also adopted amendments to MARPOL Annex VI, which entered into force on 1 January 2013, and made technical and operational energy efficiency measures mandatory for all ships of 400 GT and above. In April 2018, the IMO adopted resolution MEPC.304(72), Initial IMO Strategy on reduction of GHG emissions from ships, that confirms IMO's commitment to reducing GHG emissions from international shipping and, as a matter of urgency, to phasing them out as soon as possible in this century. The Initial Strategy envisages for the first time a reduction in total GHG emissions from international shipping and calls for a reduction in total annual GHG emissions by at least 50% by 2050 compared to 2008, while, at the same time, pursuing efforts towards phasing them out.

Purpose of the Ship Emissions Toolkit

The *Ship Emissions Toolkit* provides a structured framework as well as decision support tools for evaluating emissions reduction opportunities in maritime transport. It offers guidance to countries seeking to develop and strengthen national policy and regulatory frameworks related to the prevention of air pollution and the reduction of greenhouse gas (GHG) emissions from ships.

This toolkit includes three practical guides. While these three individual guides are separate documents and can be used independently, they are complementary and in large parts based on each other:

Guide No.1 – Rapid assessment of ship emissions in the national context: offers guidance for conducting a rapid assessment and generating both quantitative and qualitative information about a country's maritime emissions status at the time of analysis.

Guide No.2 – Incorporation of MARPOL Annex VI into national law: provides useful information for policy makers and legislators in countries preparing for accession to the 1997 Protocol or for contracting Parties to the 1997 Protocol which have not yet developed the legal framework to implement the regulations in MARPOL Annex VI in the domestic legislation.

Guide No.3 – Development of a national ship emissions reduction strategy: supports countries in developing a national ship emissions reduction strategy that can guide potential policy and investments options.

Each guide provides links to tools that assist the user in collecting and analysing relevant information and data, and presents assessment techniques to support development of a national ship emissions reduction strategy and related implementation plans. Many of these tools include references to websites where more detailed manuals, guidelines, references, studies and presentations can be found.

The *Ship Emissions Toolkit* is drafted wider in the sense that it not only considers emissions from international shipping but also encourages the user to assess emissions from and identify emissions reduction opportunities for the domestic fleet. It may well be the case that domestic shipping represents the largest source of emissions in certain countries, and/or becomes the proving ground for low- or zero-carbon technologies that can subsequently be adopted by international shipping.

The objective of this toolkit is to support the development of a policy framework to guide near- and long-term emissions reductions in the shipping sector. By no means does this toolkit aim to promote any kind of unilateral or regional actions that conflict with the multilateral legislation mechanism under the framework of IMO. Instead, this toolkit provides guidance to interested countries seeking to take effective actions to achieve ship emissions reductions without promoting specific emissions reduction measures or technologies.

Furthermore, the toolkit recognises that ships and ports are intrinsically connected and as such also provides links to the *Port Emissions Toolkit* that has also been developed within the framework of the GloMEEP Project and aims to support countries in the quantification of emissions in ports and the development and implementation of a port emissions reduction strategy.

While the toolkit has been developed to support developing countries in particular (including through the Maritime Technology Cooperation Centres (MTCC) that have been established under the Global MTCC Network (GMN) Project, see document MEPC 73/13/3, and other technical cooperation activities implemented

by IMO under its Integrated Technical Cooperation Programme (ITCP), see document MEPC 73/13), it can provide guidance to any country seeking to improve the environmental performance of its maritime shipping sector with regard to emissions. It is intended primarily for use by staff of maritime administrations. However, it is expected to be useful to other government officials and policy makers, investors, developers, local community leaders and international development assistance agencies involved in activities designed to address emissions reductions from ships.

This toolkit has been used and tested by the 10 GloMEEP Lead Pilot Countries. Using the guides as a basis, each GloMEEP country has developed a rapid assessment and drafted a national ship emissions reduction strategy. Those GloMEEP countries that have not yet acceded to the 1997 Protocol or incorporated MARPOL Annex VI into national law have also undertaken a detailed legal assessment and drafted national legislation to domesticate MARPOL Annex VI.

In finalising development of this toolkit the GloMEEP countries' valuable feedback and questions have been incorporated as best as possible. Lessons learned and best practices that were identified over the course of the GloMEEP Project, have also been included.

The *Ship Emissions Toolkit* includes three individual practical guides as follows:

Guide No.1: Rapid assessment of ship emissions in the national context

This guide presents a framework for conducting a rapid assessment and generating information on a country's maritime shipping profile and environmental performance related to emissions from ships. It provides guidance on how to gather and analyse relevant information quickly; the data collection and analysis should not take more than four weeks.

The guide recommends the collection of both quantitative and qualitative information, and provides a rapid assessment template to help users arrive at an overview of a country's maritime emissions situation that can provide a foundation for the development and implementation of a national ship emissions reduction strategy. Developing a rapid assessment will help to answer the following questions:

1. Which maritime sectors currently play the most important role for the country and why?
2. Which sectors, if any, could play a more important role and thereby contribute more to the country's economy in the future? How could these sectors be promoted?
3. How is the country's maritime industry expected to develop by 2050 and what impact will those developments have on the country? Which opportunities do these developments bring?
4. Who are the most important stakeholders, why are they important and how could they contribute to the reduction of maritime emissions?
5. Which fleet component(s), or hybrid thereof, seem to be most relevant for the country and why?
6. What are the emissions of the most relevant fleet component(s) and how are they likely to develop? How could these developments be influenced and emissions be reduced?

Furthermore, the rapid assessment findings will be important in order to monitor and report progress in relation to the implementation and effectiveness of a national ship emissions reduction strategy.

Guide No.2: Incorporation of MARPOL Annex VI into national law

This guide is a useful tool for States interested in acceding to the 1997 Protocol or for contracting Parties to the 1997 Protocol which have not yet developed the legal framework to implement the regulations in MARPOL Annex VI, and in particular Chapter 4 on energy efficiency for ships, in the domestic legislation.

The guide recommends undertaking a detailed assessment of a country's existing policies, strategies, legislation and other measures that address emissions from ships. This legal and policy assessment will provide important information for the development of a national ship emissions reduction strategy.

If, as part of the strategy development process (see Guide No.3), it is identified that further action needs to be taken to implement and give full effect to MARPOL Annex VI, this guide outlines the steps States need to take at the national level in order to implement the provisions of MARPOL Annex VI and, in particular, the regulations on energy efficiency for ships, taking into account the particular legal system of the country.

The guide addresses the substantive provisions of MARPOL Annex VI, i.e. the provisions which require national action by an individual country in its capacity as a flag State and port State.

The guide also includes a brief review of the legal, policy and institutional arrangements in the 10 GloMEEP Lead Pilot Countries with regard to MARPOL Annex VI.

Guide No.3: Development of a national ship emissions reduction strategy

The findings generated by methodologically working through the rapid assessment guide (Guide No.1) and the legal guide (Guide No.2) can inform the process of developing a national ship emissions reduction strategy.

While MARPOL Annex VI and other international policies, regulations and strategies exist, they are by their nature often generic, in the sense that they are designed to apply as broadly as possible. They thus need to be operationalised within a national context, giving consideration to local, national and regional environmental, legal, institutional or other issues. Thus the purpose of a national ship emissions reduction strategy is two-fold; on the one hand it can support transposing and implementing international requirements in a national context and, on the other hand, it can support the achievement of international goals and targets through complementary national action.

For example, the development of a strategy could mobilise a broad range of national stakeholders to get involved in ship emissions reduction efforts, including those in shipping-related sectors that may not necessarily be covered by IMO Conventions, and thereby bring in new ideas, experience, capabilities and resources. Countries could also, through a targeted strategy, encourage and mobilise resources for research, development and deployment of low-emissions technologies and fuels at a national level, or from international donors. Through sharing research findings, best practices and lessons learned with the wider maritime community, countries could promote the global uptake of these technologies and fuels. These and other activities could facilitate the step change needed to significantly reduce ship emissions, achieve the IMO's aims and commitments, and thereby contribute to global air pollution and GHG mitigation efforts.

In addition, a national ship emissions reduction strategy could help countries realise benefits not directly associated with reducing ship emissions, such as reduced health care costs, job creation in new sectors, creation of new business and investment opportunities, decreased energy dependency, and so forth. The strategy development and implementation process also has the potential to strengthen national institutional and technical capacity and transfer knowledge to sectoral organisations. It can also support countries coordinate among sectors and institutions that currently work in isolation from each other, and allow decision makers to identify synergies among emissions reduction sectoral plans. Furthermore, sending a credible signal regarding future plans to reduce ship emissions can stimulate investment and international support for mitigation activities, promote technological innovation, and engage the private sector.

This guide therefore provides information on the crucial planning, development and implementation phases involved in the creation of such a strategy. The guide also includes a template with recommended elements a national ship emissions reduction strategy could include, as well as information suggested for inclusion in each part of the strategy.

Why a national strategy?

Ships produce a wide range of emissions causing different health and environmental issues. Key compounds that are emitted are carbon dioxide (CO_2), nitrogen oxides (NO_x), sulphur oxides (SO_x), particulate matter (PM), ozone depleting substances (ODSs) and volatile organic compounds (VOCs). In 2012, for example, international shipping accounted for 2.2% of global CO_2 emissions. Annually, international shipping is estimated to produce about 13% and 12% of global NO_x and SO_x emissions from anthropogenic sources. Due to anticipated growth in the world economy and associated transport demand most of these emissions are expected to increase in the coming decades, many of them significantly (Third IMO GHG Study 2014).

In light of the environmental and health risks posed by emissions from ships, IMO has adopted MARPOL Annex VI to reduce air pollution from ships and increase ships' energy efficiency. Furthermore, in April 2018, the IMO has adopted the Initial IMO Strategy on reduction of GHG emissions from ships which confirms IMO's commitment to reducing GHG emissions from international shipping and, as a matter of urgency, to phasing them out as soon as possible in this century.

While these, and other, international policies, regulations and strategies exist, they are by their nature often generic, in the sense that they are designed to apply as broadly as possible. They thus need to be operationalised within a national context, giving consideration to local, national and regional environmental, legal, institutional or other issues. Thus the purpose of a national ship emissions reduction strategy (NSERS) is two-fold; on the one hand it would help to transpose and implement international requirements in a national context and, on the other hand, it would support the achievement of international goals and targets through complementary national action.

For example, the development of an NSERS could mobilise a broad range of national stakeholders to get involved in ship emissions reduction efforts, including those in shipping-related sectors that may not necessarily be covered by IMO conventions, and thereby bring in new ideas, experience, capabilities and resources. In their NSERS, countries could also encourage and mobilise resources for research, development and deployment of low-emissions technologies and fuels at a national level, or from international donors. Through sharing research findings, best practices and lessons learned with the wider maritime community, countries could promote the global uptake of these technologies and fuels. These and other activities could facilitate the step change needed to significantly reduce ship emissions, achieve the IMO's aims and commitments, and thereby contribute to global air pollution and GHG mitigation efforts.

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[1] Adapted from WRI and UNDP (2015). *Designing and Preparing Intended Nationally Determined Contributions (INDCs),* Washington, DC and US EPA (2014), *Identifying and Evaluating Policy and Program Options,* Washington, DC.

1 Institutional needs

Development of an NSERS will require a significant degree of interministry/agency and cross-sector coordination. Responsibility for existing shipping legislation and policies are often spread over a range of ministries, agencies and implementing institutions (e.g. Ministry of Environment, Ministry of Transport, Ministry of Energy, environment protection agencies, port authorities) and affect a broad range of civil society stakeholders (e.g. shipping companies, industry associations, non-governmental organisations and interest groups).

A country's constitution and governance structures also matter. A centralised government system will require coordination and integration, both within and across ministries and agencies. In a federal system, legal and implementation responsibility may rest partly with the central government and partly with state governments or sub-national jurisdictions.

The establishment of a sound coordinating mechanism is critical to developing and implementing an NSERS and needs to be addressed early in the process.

In order to structure the process of developing and implementing the national strategy in consultation and cooperation with the relevant agencies and stakeholders, **it is suggested a Lead Agency be identified, a Task Force be established, a National Focal Point and National Project Coordinator be designated, and consultations with stakeholders be held.** This approach has been adopted to address other issues, such as the development of National Ballast Water Strategies, and has proven successful because it is an inclusive and cooperative process, bringing together the many key stakeholders and utilising their combined expertise to devise a national policy and strategy that best suits the country. The process instils ownership and thus ultimately strengthens implementation and compliance. It is also a tool for utilising the skill sets spread out over a number of institutions, sectors and civil society.

Another critical aspect for developing and in particular for implementing the NSERS is securing political will at the highest appropriate level. Without sufficient political will and government buy-in, it is likely that the development or implementation of the NSERS will be slowed down or even come to a stand-still once problems arise or other agencies prioritise work on other issues at the expense of the NSERS. **It is therefore crucial to mobilise political buy-in at the earliest stage possible and to continue securing it throughout the NSERS development and implementation process.**

1.1 Lead Agency

The Lead Agency has the principal responsibility for developing and implementing the NSERS. While there may be no single agency or government ministry which is the ideal agency for this function, it is recommended that an institution operating at a national level while interacting regionally as well as internationally be identified for this role. When selecting the most suitable agency for the country concerned, it is important to bear in mind the broad range of expertise required, including the specifics associated with the country's shipping industry and related emissions.

The Lead Agency could be appointed by the government to drive the process, or alternatively, the government could establish a Task Force to develop the NSERS, and which subsequently would recommend one of the Task Force members as the Lead Agency.

Where a Lead Agency for climate change has already been designated by the government, one option would be to expand its mandate specifically to include maritime emissions. However, because much of the regulatory framework on maritime emissions relates to transport and shipping, the Ministry of Transport, Ports Authority or a similar agency may be tasked with the development of a specific national strategy that fits within the overall climate change, energy or environment regulatory framework.

Further, it is recommended that the government identify a Focal Point from its Lead Agency that will be responsible for the overall coordination of the project nationally and for organising and chairing relevant meetings. Ideally, the Focal Point should be a senior government official who can speak on behalf of the Lead Agency.

Regardless of the ministry or agency chosen to be the Lead Agency, it is essential that it be assigned clear responsibility for overseeing and coordinating the development and implementation of the NSERS. Other responsibilities of the Lead Agency may include:

- convening meetings of the Task Force;
- mobilising and securing government buy-in and political will at the highest appropriate level from the start of developing the NSERS and throughout its implementation;
- integrating the national strategy into pertinent national policies and strategies and ensuring that necessary legislation is in place;
- delegating various aspects or components of the national strategy implementation to other institutions with particular competence in the field (e.g. the Port Authority or Environmental Ministry);
- devising and ensuring implementation of any necessary operational and administrative arrangements for all ships visiting the country's ports;
- ensuring ongoing liaison with, and cooperation of, all key stakeholders and ensuring they are fully conversant with the national strategy, appropriately trained and properly authorised to act on it, where required;
- monitoring and reviewing, on an on-going basis, how effectively the national strategy is being implemented and introducing changes, as necessary;
- updating the national strategy on the basis of experience gained in its implementation, research or technological developments and/or changes of international requirements or 'best practice'; and
- ensuring ongoing participation in relevant international, regional and national initiatives as well as maintaining contacts with potential donors, such as International Financial Institutions (IFIs) potentially interested in financing (parts of) the NSERS.

1.2 Task Force

A Task Force should be established for the purpose of advising and supporting the process of developing and implementing the NSERS. Other responsibilities of the Task Force are to:

- gather and analyse information, data and opinions related to the country's maritime profile and environmental performance related to emissions from ships; or to coordinate this activity (it is recommended the structure of the *Ship Emissions Toolkit, Guide No.1: Rapid assessment of ship emissions in the national context* be followed);
- consult and provide feedback on the development of the national strategy;
- support the implementation of the strategy;
- support the review and evaluation of the implementation of the strategy; and
- potentially continue to work together after the development of the national strategy to provide guidance, oversight and advice on matters relating to ship emissions.

The Task Force membership will be up to the country to decide, but ideally should include both government agencies and major national stakeholders, in particular those who would be key to the success of the strategy development and implementation process. It is recommended that the membership of the Task Force include:

- representative(s) from the Lead Agency;
- pertinent government agencies (e.g. ministries and agencies dealing with GHG emissions and air pollution, maritime administrations, port authority representatives, and so on) so that they can advise on the development of the national strategy and support strategy implementation activities;

- stakeholders from industry and the environmental community (e.g. representatives from shipowners, shipbuilders, classification societies, maritime training organisations, NGOs and academia) so that they have an opportunity to provide input and feedback, resulting in a more robust strategy and fostering greater acceptance of the strategy among stakeholders, thus promoting more effective strategy implementation.

Identification of stakeholders may have already been undertaken as part of *Ship Emissions Toolkit, Guide No.1: Rapid assessment of ship emissions in the national context.* Without precluding the participation of additional stakeholder groups, the following institutions and organisations are likely to be involved and interact during the development and implementation of the national strategy.

Table 1: *Suggested stakeholder groups to involve in the development of the NSERS*

Stakeholder (group)	Areas of expertise and responsibility
Maritime administrations (ministries) and coastguard agencies. Again, stakeholders are usually not government departments or agencies	Coordination and control of shipping, including maritime safety and environmental aspects. Flag and port State control. Implementation of shipping related conventions and legislation.
Ministry of Environment, Climate Change, and/or Energy	Overall coordination and management of climate change, air pollution and issues related to energy, including monitoring, mitigation and adaptation plans. Implementation of relevant international environmental and/or climate change conventions and regulations.
Shipping companies and associations	Expertise on and responsible for the procedures and activities on board ships. Business operations may be affected by the NSERS, so important to get their input and (ideally) buy-in.
Shipyards, shipbuilders, naval architects	Adaptation of ships and the building of new ships, according to the principles adopted internationally for reducing emissions from ships. Expertise on technical and design measures to reduce ships' emissions.
Universities and research institutes	Potential expertise on a range of issues, for example the monitoring, measurement and modelling of air pollution and GHG emissions, economic assessment of technology development and deployment in the maritime sector.
Environmental NGOs, recreational bodies and general public	Play a watchdog role and exert pressure on governments to implement policies to reduce air pollution and mitigate climate change. May assist in commissioning research towards this end.
Port authority or Port administration	Responsible for the elaboration and implementation of port air pollution management plans and provision of relevant infrastructure, e.g. onshore power supply.
Marine fuel suppliers/bunkering	Relevant if the NSERS covers elements relating to the provision of low-sulphur and/or low-carbon or zero-carbon fuels.
International technology developers and marine equipment suppliers	Provide equipment to reduce ships' emissions. Can help identify viable technical options in line with the NSERS.

The Task Force should be established at the earliest possible stage of the development of the national strategy through a transparent process, in order to ensure ownership by participants and all relevant stakeholders, as well as to demonstrate transparency.

Where a Lead Agency already exists, the process of establishing a Task Force may be initiated by that agency. However, in the case where there is not yet a designated Lead Agency, one of the first and most important undertakings of the Task Force will be to provide recommendations to the government with respect to which entity should take on the role of Lead Agency. To support the work of the Task Force, it is recommended that a Project Coordinator be designated who will provide the day-to-day management of the strategy development and implementation process. The Project Coordinator could be a current employee of the Lead Agency.

Box 1:
Experience from the GloMEEP Project countries in managing the National Task Force (NTF)

Challenges faced by a number of GloMEEP countries with regard to the running of the NTF:

- Intermittent and poor leadership by the NTF.
- Lack of clarity on the role of the NTF – implementation of all GloMEEP Project activities (e.g. capacity building and training) vs development and implementation of a national emissions reduction strategy.
- Challenges in identifying and securing participation of the relevant stakeholders.
- Intermittent participation in NTF meetings and/or lack of continuity in terms of representation.
- Limited response from NTF members to requests from the Lead Agency for information.

Recommendations:

- Buy-in from key government ministries/agencies needs to be obtained at the outset of the process, preferably at ministerial level but at least at Head of Department (HOD) level, with specific officials then being formally assigned to be involved in the project/process and to report back to their superiors on a regular basis.
- NTF should have clear objectives and if these are altered (e.g. from supporting the implementation of the GloMEEP Project to overseeing the development of a national strategy), this should be agreed at high level.
- Lead Agency for the strategy development process does not necessarily need to be the transport or maritime ministry especially given that the key objective is the reduction of emissions from ships.
- Lead Agency needs to be in a position to "champion" the process, i.e. should have a clear understanding of the technicalities of the process and subject matter.
- NTF should be limited to a core group of the key authorities (transport, shipping, ports, environment, climate change and energy) depending on national structures in the country concerned. Other stakeholders outside of the government should be involved in the strategy development process through a series of workshops and other meetings as appropriate.
- In cases where external consultants (not from the Lead Agency) are used for drafting the strategy, the NTF must play a much stronger role in terms of facilitating access to relevant officials and information and in ensuring participation of stakeholders.

1.3 Internal Task Force communication and interaction

Effective communication and dissemination of relevant information within the Task Force is critical for enabling active participation of the various government entities and stakeholders involved. More specifically, everyone involved in the development and implementation of the NSERS should know:

- what their responsibilities are;
- why their work is relevant for the NSERS;
- when their input will be required;
- how the NSERS is evolving; and
- any other relevant updates.

Some entities within the Task Force are likely to require detailed information and frequent and regular updates, whereas others may only need to receive a general overview and periodic updates. Therefore, it might be useful to set up several communication channels according to the type of information and frequency needed.

Such communication channels may include, for example, (in)formal meetings, emails and newsletters. The Lead Agency may also have a dedicated internal communications person who could help identify existing communication channels that could be used or set up new ones. Which communication tool is used would depend on the purpose. For example, disseminating information on the progress of the development of the strategy could be done via emails or by regular updates on the website of the Lead Agency, while face-to-face meetings or teleconferences may be better for encouraging active interaction and feedback.

2 Developing a national ship emissions reduction strategy

A strategy is a course of action that seeks to link aims, opportunities and capabilities as indicated in the strategy triangle (below). Strategy development is not so much a detailed planning exercise, but rather a high-level process that seeks to link the "why" with the "how". More specifically, it brings a number of key elements together, for example, the question "where are we today" (based on knowledge gained from the rapid assessment exercise in *Ship Emissions Toolkit, Guide No.1: Rapid assessment of ship emissions in the national context*) with "where do we want to be and why".

The strategy triangle illustrates the three components that form part of a strategy. The development of the NSERS will require identifying each of the three components.

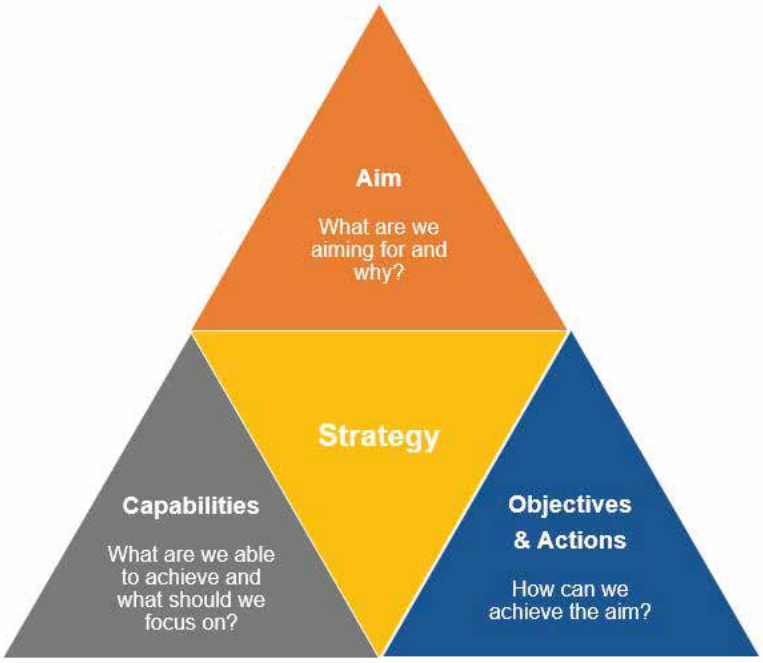


Figure 1: *The strategy triangle*

The first corner of the triangle is the aim, or goal, and the motivation behind it. That is, what is the strategy trying to achieve and why. The second corner of the strategy triangle is the identification of objectives to achieve the aims, including which actions could be taken. Whether these objectives and actions can be realised then becomes a question of the third corner, the available capabilities. In other words, "what are we able to achieve and what should we focus on?" Depending on the answer to these questions, the aim may need to be reformulated to match the available capabilities, which then has implications for the objectives and actions, and so on.

The aim, objectives, actions and capabilities of the NSERS should also be aligned with the broader national interest. The NSERS may, for example, support broader national strategies on air quality, climate change, economic development, increase in maritime trade, or development of national infrastructure (for more detail on defining the aim, see section 2.1.2).

2.1 Development of a national ship emissions reduction strategy

The following sections outline the suggested key steps in the process of developing an NSERS.

The guidance provided in this document is generic, as the national strategy will have to be tailored to different national circumstances and priorities as well as to the characteristics of the national shipping industry. The proposed components of the national strategy will thus not be equally applicable for all countries.

The proposed steps outlined below are written sequentially, but in practice, some of the steps may take place concurrently during the development process. Regardless, it is recommended that before developing the NSERS, a timeline be developed that sets out the different steps of the process and identifies an estimated date for finalising and adoption of the strategy.

2.1.1 Gathering information

When developing the NSERS, relevant information needs to be gathered in order to inform the development process. The starting point is an assessment of the current status of and expected future developments related to the national shipping industry, ship and port emissions, ship energy efficiency, legislative and policy regime requirements, and so forth. While it would be useful to have an in-depth understanding of all issues, a detailed assessment could take years, thereby delaying the development and implementation of the strategy. Instead it is suggested a rapid assessment be used, as outlined in *Ship Emissions Toolkit, Guide No.1: Rapid assessment of ship emissions in the national context.*

Much of the data required for undertaking a rapid assessment will already exist, but it may be spread over a wide range of reports, government ministries and stakeholders, may not be complete, may be inaccurate and may be out of date. Other data may not be available at all. If the rapid assessment identifies issues in terms of data availability or quality, these could be addressed in the NSERS, for example by commissioning studies, collecting data, and measuring or modelling fleet emissions and ship movements. Repeating the rapid assessment on a regular basis using more and/or improved data would result in more detailed and accurate outputs which could then feed into the revision of the national strategy.

Box 2:
Key information recommended for a Rapid Status Assessment

- Legislation and policies
- Relevant government ministries and other institutions
- Current port State control practices, compliance monitoring and enforcement regime
- Shipping's role in the national economy
- Key national maritime stakeholders
- Shipping fleet composition
- Fuel consumption and emissions of fleet components
- Possible emissions scenarios
- Existing and planned ports
- Existing bunkering facilities and expansion plans
- Shipbuilders and repair yards
- Marine equipment manufacturers and suppliers
- Maritime emissions experts, technical and training institutes
- Uptake and implementation of technical and operational measures
- Relevant technical cooperation and technology transfer mechanisms
- Potential sources of finance

For further information on the development of a rapid status assessment, please see *Ship Emissions Toolkit, Guide No.1: Rapid assessment of ship emissions in the national context.*

2.1.2 Defining the aim and scope

As described above, a strategy is a course of actions designed to achieve a long-term or overall aim. **After gathering relevant information through the rapid assessment, defining the aim and setting specific objectives is the next step in developing the NSERS and will be critical to the evaluation of its success.**

Defining the aim of the strategy requires an understanding of where the country currently stands in terms of its maritime industry and ship emissions and how these will likely develop in the future. Based on this understanding, one can then begin to explore the questions "where do we [the country] want to be and what are we aiming for and why?". The aim(s) could, for example, be to incorporate MARPOL Annex VI into national law, improve air quality in and around ports and harbours in order to improve the health of citizens living in the vicinity, or build a regionally or globally competitive ship retrofitting industry, or a combination of these or other aims.

Understanding the "why" of the strategy is important, as it provides the rationale for a course of action. For example, a country might want to promote the development of a ship retrofitting industry in order to stimulate local economies, improve fleet efficiency and create a competitive advantage. In this example, the "why" may be based on an analysis that a significant proportion of the fleet relevant to the country requires retrofitting to meet new air quality standards and that existing retrofitting capability is limited. Therefore, there is an opportunity to build or expand this capability for commercial and technological advantage. If there is not a good and compelling reason why an action should be undertaken, this implies that it is unlikely to be a good strategic course of action.

Defining the aim of the NSERS is closely linked with delineating its scope, i.e. what will the NSERS address and, equally important, what will it not focus on. This assessment will include decisions on the geographical scope: is the strategy a purely national strategy, part of a regional initiative or will it be implemented with the support of international donors?

Furthermore, the technical scope should be defined. One way to do this is to consider the following questions:

- Will the strategy focus on ship emissions?
  - Which fleet component(s) will be considered? The following options could, for example, be considered (for more information, see *Ship Emissions Toolkit, Guide No.1: Rapid assessment of ship emissions in the national context)*:
    - Registered fleet
    - Domestic fleet
    - Fleet servicing the country's international transport demand
    - Fleet passing through the country's territorial waters
    - Fleet owned by national shipowners
    - Or a hybrid thereof?
  - Which ships will be considered, e.g. only those above a certain size, those of a certain vessel type, or those below a certain age threshold?
  - Will the strategy address ship energy efficiency, CO_2 emissions, all GHG emissions and/or air pollutant emissions?
- Will the NSERS focus on port emissions?
    - Which ports, e.g. only those above a certain capacity threshold?
    - Will NSERS address energy efficiency in ports, CO_2 emissions, all GHG emissions and/or air pollutant emissions?

For more information on the development of strategies to address emissions in ports, please refer to the *Port Emissions Toolkit*[2] that has been developed under the auspice of the GloMEEP Project.

[2] *Port Emissions Toolkit* includes two guides as follows:
Guide No.1: Assessment of port emissions; and
Guide No.2: Development of port emissions reduction strategies

2.1.3 Identifying objectives and actions

Once the aim of the NSERS has been established in line with other relevant national policies, it needs to be further elaborated through the identification of a set of objectives and actions.

Objectives provide a more granular level of detail and define the specific outcomes that are needed to achieve the aim, answering the question "What needs to be achieved to get from where we are now to where we want to be?"

Objectives should be so-called SMART objectives:

- **S**pecific
- **M**easurable
- **A**ssignable
- **R**ealistic
- **T**ime-dependent

Whether an objective is achievable should also be assessed against the funding available (or within a budget that can be reasonably mobilised). As the strategy is developed, a regular review of the objectives to assess whether they are still valid and realistic will help to keep the strategy focused and ultimately successful.

With the objectives set, actions should be identified. The completion of actions will deliver the wider ranging objectives. In some cases, an action may only address one objective, while in other cases they will help to achieve multiple objectives.

Figure 2 illustrates the possible hierarchy between policy at the highest level and individual actions at the most granular level.

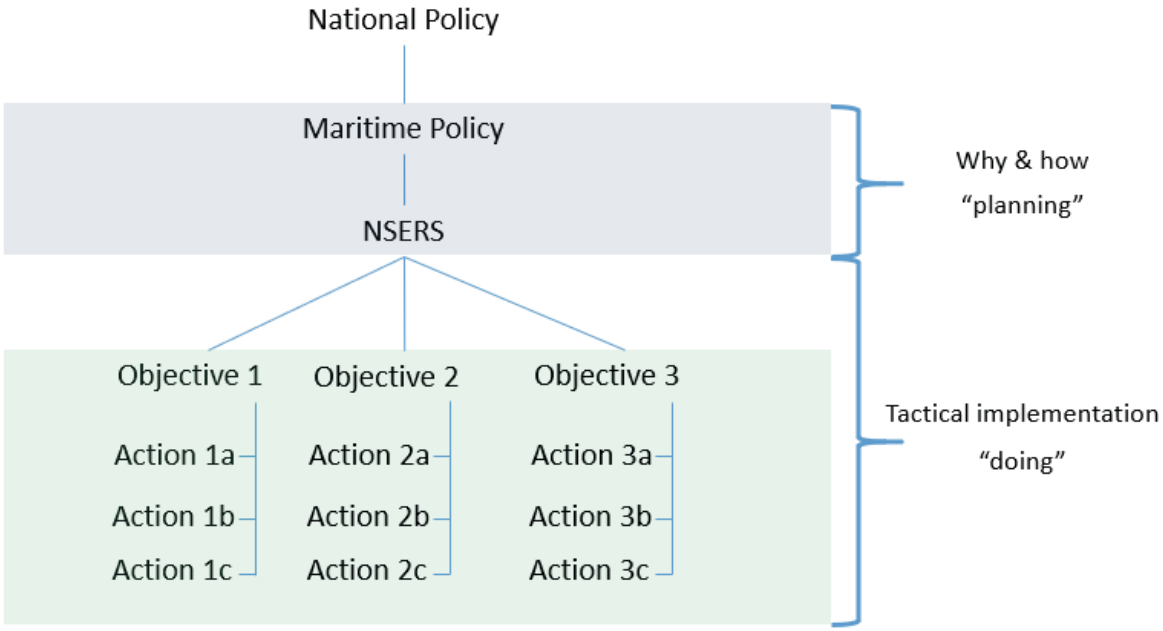


Figure 2: *The strategy hierarchy*

At this point in the development of the strategy, it may be useful to review what has been undertaken in other countries to reduce emissions from ships. Annex 2 of this document outlines several examples of existing national strategies or policies addressing maritime emissions. **When considering actions for the NSERS, however, it is important to do so against the background of the national maritime circumstances identified in the rapid assessment.** This is because actions which make sense in one country might not in another. For example, a country with busy ports might want to focus on the provision of on-shore power to reduce air pollution and GHG emissions in the port area, whereas this might not be the approach of a country with a large registered fleet but little port activity.

Depending on the aim of the strategy, it may also be helpful to identify suitable technologies, design strategies and operational solutions for the reduction of emissions. Given the range of options available, careful consideration needs to be given to ensure the most appropriate ones are selected. In the case of technologies, this can be achieved by, for example, analysing their applicability to certain ship types and operating profiles, their suitability for retrofitting, current market uptake, performance and costs. An overview of the most common options available is provided in Annex 3. Further information can also be found in the GloMEEP Energy Efficiency Technologies Information Portal[3] and Appraisal Tool.[4]

The table below provides examples of possible objectives and actions based on hypothetical findings from the rapid assessment.

Table 2: *Ideas for objectives and actions based on rapid assessment findings*

Example finding from rapid assessment	Possible objectives	Examples of actions
Country has not ratified and/or incorporated MARPOL Annex VI into national law	Ratification and/or incorporation of MARPOL Annex VI into national law	• Please refer to *Ship Emissions Toolkit, Guide No.2 Incorporation of MARPOL Annex VI into national law for actions*
Many nationals work on board ships	Offer training to seafarers on MARPOL Annex VI regulations and how to implement them on board	• Develop MARPOL Annex VI training package • Train [X] seafarers by [date]
Country is active in steel manufacturing	Promote the manufacture of lightweight steel for shipbuilding	• Identify steel R&D activities • Identify lightweight steel manufacturing capacity for shipbuilding • Identify opportunities to promote lightweight steel manufacturing
Country has a number of marine engine manufacturers and technology providers	Promote the development of highly energy efficient engines and/or low emissions technologies	• Identify existing R&D incentive schemes • Issue a public tender for national R&D funding • Include technical and/or operational efficiency or low emissions targets in the award criteria of government tenders for maritime services
Country has large flag registry	Promote increase in energy efficiency/ decrease in ship emissions among the registered fleet	• Establish draft for "green" discount scheme (providing a registry discount for ships demonstrating enhanced energy efficiency or using emissions abatement technology or low-carbon or zero-carbon fuels) • Undertake a stakeholder review of draft scheme • Introduce "green" discount scheme

Country has many or busy ports	Reduce emissions from ships in port	• Explore potential for:
		  • supply of alternative fuels
		  • introduction of differentiated port dues
		  • onshore power supply
		  • at-berth fuel switch requirements to low-sulphur fuels
		  • speed limits in ports
		• Improve information exchange between ports and ships so that ships can sail at optimal speed (virtual arrival)
		• Give preferential treatment to harbour crafts equipped with engines meeting stringent emissions standards
		• Strengthen Port State Control inspection regime for visiting ships, relating to compliance with MARPOL Annex VI

[3] *https://glomeep.imo.org/resources/energy-efficiency-techologies-information-portal/*

[4] *http://glomeep.imo.org/resources/appraisal-tool/*

Example finding from rapid assessment	Possible objectives	Examples of actions
Significant ship traffic within country's coastal waters	Reduce emissions in country's coastal waters	• Assess potential to introduce speed limits in country's coastal waters • Identify regional availability of low-sulphur fuels and evaluate potential to impose a fuel sulphur cap
Country has many or large shipbuilders and/ or repair yards	Increase the construction and/or servicing of low emissions ships; increase capability to retrofit technologies to reduce emissions from ships	• Conduct techno-economic evaluation of low emissions shipping opportunities • Introduce economic/fiscal incentives for low emissions shipbuilding or retrofit industries
Lack of data related to one or more areas of the rapid assessment	Implement or expand a system to collect and analyse data	• Implement data monitoring or measurement activities • Analyse new data

In the interest of making the strategy as realistic and achievable as possible, some objectives or actions may have to be prioritised, while others may need to be postponed to a future date. In order to set priorities, it may be useful to assess objectives and actions based on a number of criteria and prioritise or rank them accordingly. Objectives and actions could, for example, be evaluated in terms of their expected impact on achieving the aim of the strategy and ease of implementation (or resources and efforts required), as shown in Figure 3. This may help identify objectives or actions on which to focus first (e.g. those with a high or medium impact that can be easily implemented), which ones to postpone to a later date (e.g. high impact/difficult to implement) and which ones not to pursue further (e.g. those with a low impact).

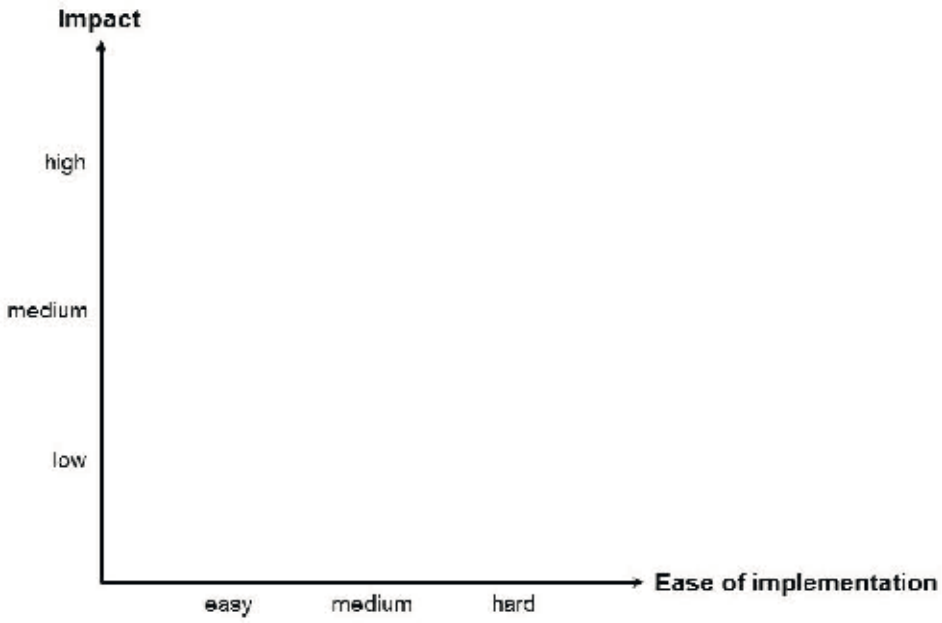


Figure 3: *Prioritisation matrix*

For other examples of criteria, see Box 3.

Box 3:
Criteria for selecting objectives and actions

The choice of objectives and actions should be based on national priorities and criteria. Possible criteria include:

Emissions reduction potential

- Facilitate transformational impacts (i.e. long-term, significant changes) that enable a shift to a low emissions economy over the long term.
- Achieve significant emissions reductions relative to a baseline scenario.
- Target high-emitting or fast-growing maritime sectors (based on the rapid assessment).
- Eliminate key barriers to emissions reductions.

Feasibility

- Be aligned with national economic and development priorities and objectives.
- Be feasible to implement and enforce, given current and anticipated political, legal and regulatory context.
- Have stakeholder support.

Benefits and costs

- Deliver multiple benefits, including emissions reductions and various economic, social and environmental benefits (such as reduced fuel costs, improved air quality, improved public health and reduced health care costs, job creation in new sectors, increased stakeholder participation in policy-making processes, creation of new business or investment opportunities, decreased energy dependency, etc.).
- Deliver a positive economic return (e.g. through financial savings from reduced fuel costs, job growth through new industries, productivity gains that increase GDP and create jobs, reduced health care costs from air pollution).
- Be cost-effective in reducing ship emissions and achieving other benefits for a given amount of resources (e.g. as determined through marginal abatement cost curves (MACC)).
- Leverage private sector investment in low emissions development/technologies.

Other

- Have been shown to be effective in other jurisdictions.
- Be measurable, in order to enable monitoring and evaluation of their performance over time.
- Be expected to have a fair distribution of costs and benefits across society, for example, across different geographic regions, income groups, or industry sectors.
- Be expected to expand and entrench support from domestic constituencies and lock in low emissions technologies and behaviour.

2.1.4 Identifying and creating linkages with other national and international strategies

It is unlikely that the NSERS will be, or indeed could feasibly be, a stand-alone strategy. In most cases, the NSERS will be intrinsically linked with other national policies and strategies, including, for example, those dealing with energy, health, environmental protection, trade, industry and labour.

In developing the NSERS, it will be important to identify other national policies and strategies that share common aims and where appropriate, to make the necessary linkages. Similarly, the NSERS objectives and actions may come under other, non-maritime national programmes or strategies. Integrating and aligning the NSERS objectives or actions with other policy and strategic objectives will help avoid duplication as well as identify areas where the NSERS can be implemented through an expansion of existing programmes. This will further strengthen the effectiveness of the NSERS by ensuring a more efficient use of existing resources, greater operational efficiencies, and therefore greater overall success.

If there are many areas of overlap, it may be worth considering integrating the NSERS into a broader non-maritime strategy (e.g. a national strategy on climate change or air quality), rather than developing a stand-alone NSERS.

In the example below (Figure 4), the NSERS is assumed to share common elements with (and support) the national trade strategy. Through collaboration with the team developing and implementing the trade strategy, the NSERS Objective 3 is identified as supporting the Trade Objective 1 and, in this example, NSERS Actions 3a and 3c are complementary to Trade Actions 1a and 1c.

Similarly, it will be important to identify policies and strategies that may conflict with the overall aim of NSERS or present barriers to implementation. For example, port development policies may lead to an increase in total emissions, even if maritime energy efficiency improvements are achieved, because of the increase in overall fuel use.

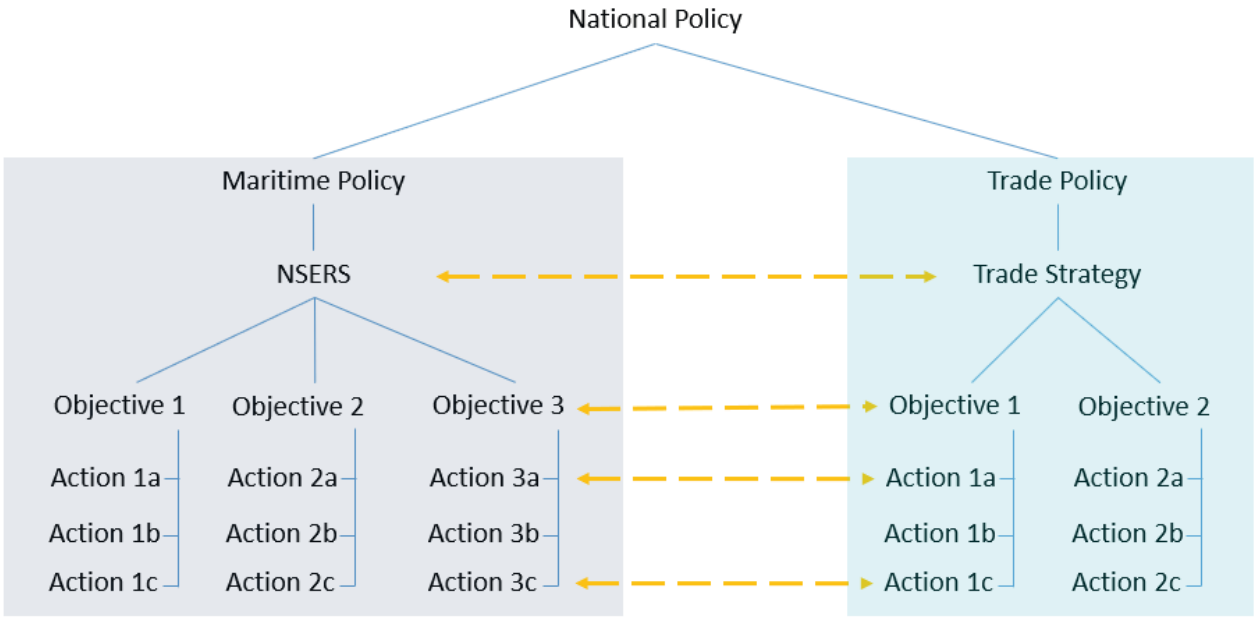


Figure 4: *Example showing linkages between NSERS and the national trade policy and strategy*

Particular attention should be given to the potential to link (or include) NSERS into national United Nations Framework Convention on Climate Change (UNFCCC) strategies and programmes, including the country's Nationally Determined Contribution (NDC), Technology Transfer programmes, and so forth. Such inclusion or linkages could provide a very effective means of delivering the strategy in line with other national climate change programmes.

In addition to identifying commonalities and creating linkages with other national strategies, the same could be done for regional and international strategies or programmes. Regional or international collaboration and coordination may facilitate the transfer of best practice between countries and make joint studies possible, thus saving time and resources in the development and implementation of strategies. Furthermore, it could help to raise the profile and priority of the NSERS at the national level and leverage resources.

There are a number of ways in which such regional or international collaboration could be fostered, including through representation as observers or representatives on the strategy task forces of other countries in the region, and establishment of regional fora for policy coordination and exchange of information.

2.1.5 Allocating responsibilities

Once actions have been identified, responsibility for achieving each action should be assigned to a lead department or organisation best positioned to implement the action. When determining who should be responsible for implementing a certain action, it may be useful to consider the following questions:

- Which department has the legislative mandate?
- Which department has the relevant expertise and experience?
- Whose support is required?
- Have the expertise, experience, skills and availability of each Task Force member, stakeholders, and so forth, been taken into account before allocating responsibilities for actions?

In addition to responsibilities, the relevant level of authority and "sign-off" capability needs to be assigned the responsibility for delivering objectives and actions.

It is recommended the responsibilities to undertake and complete objectives and actions within set timeframes (see below) be formalised within performance agreements or terms and conditions.

Box 4:
Linkages to other policies and strategies in GloMEEP countries

In most GloMEEP countries, a number of other policies and strategies were in place which had overlapping objectives (broader in some cases, and more specific in others). These included:

- National development plans;
- National GHG emissions reduction plans, including Nationally Determined Contributions (NDCs);
- Maritime transport policy;
- Fuel reduction/energy saving measures in the shipping industry (including speed reduction, more frequent hull cleaning);
- Use of low-sulphur, low-carbon/zero-carbon;
- Energy efficiency policies/ programmes in other sectors;
- Green Port/Shipping initiatives; and
- Shift to shore-based power supply.

Recommendations:

- Specific initiatives should be linked to or integrated with national policies or strategies at higher levels – in particular national development plans or policies or strategies addressing climate change and air pollution. This would make it easier to get support and approval from other ministries and stakeholders.
- There also needs to be consistency across relevant policies and strategies, so that they do not work against each other.
- Emission reductions achieved in the maritime sector (domestic fleet) could be incorporated into NDCs.

2.1.6 Setting timeframes for implementation

A national timeframe should be determined for the achievement of each objective and action. While at this stage this can only be an estimate which may have to be adjusted, the timelines should be set as carefully as possible and in conjunction with the implementing organisation to ensure that the objectives and actions fit within the overall timeframe to achieve the strategy's aim, and to help estimate how many resources will be required to deliver the objectives and actions.

Reviewing previous projects or strategies may provide insight into realistic timeframes. It may also be helpful to consult with those who have the relevant technical knowledge or expertise in order to make realistic estimates. However careful the planning, unforeseen events can always occur, which is why it may be wise to build in extra time.

2.1.7 Resources and sources of funding

Identifying resource requirements

A range of resources are typically required to implement a strategy. These may include, inter alia: human resources, facilities, equipment, services and materials. To determine the resource inputs required to deliver each objective and related action, ask the following questions:

- How many people are required?
- What type of skills or expertise do they need to possess?
- Are particular facilities, equipment, services, or materials necessary?
- Are there any other special requirements?

A resource requirements matrix, as presented below, can assist in identifying and recording estimates of the various costs of the strategy.

Table 3: *Resource requirements matrix*

	Human resources: knowledge and skills; time required	Facilities: types; space required	Equipment: types required	Services, materials: types (e.g. travel expenses, training); quantity	Special resources: unique skills; data; etc.	Total resource cost
Objective 1						
Action 1.1						
Action 1.2						
Action 1.3						
…						

Scale of financial resources required

In order to implement the NSERS, there will be a requirement for sufficient financial resources. The financing requirements for a successful NSERS will broadly fall into two categories:

1. Funding to administer (the development of) the NSERS and programme of work: this level of funding will mainly cover administrative costs and will largely be determined by the administrative set-up decided upon by the country. These costs will include staffing, office and supplies; there may also be travel and travel-related subsistence costs or costs related to consultations of stakeholders and the public.

2. Funding required to deliver strategic objectives and actions: substantial levels of funding may be required to implement the practical delivery of the strategic objectives and actions. The levels of funding required are likely to increase with the ambition of the NSERS. For example, it is envisaged that funding in the range of $1 million to $5 million would be required for the adoption of retrofit technologies per ship, whereas larger scale schemes, such as the development of new shipbuilding facilities or development of low-carbon or zero-carbon fuel infrastructure, would require investment in the order of $100 million.

Sources of funding

There are a wide range of private, public and institutional funding options potentially available for the implementation of the NSERS.

Private investors will typically be technology investors, private equity and venture capital organisations. Public investment can be provided by national and local governments.

Institutional investment can be supplied through International Financial Institutions (IFIs) such as the European Bank of Reconstruction and Development (EBRD), the European Investment Bank (EIB), the Asian Development Bank (ADB), African Development Bank (AfDB) and Inter-American Development Bank (IDB), a number of which have previously financed ship newbuilds and retrofits, as well as port/harbour and other infrastructure development.

In addition, the UN has established a number of mechanisms and organisations focused on providing financial support for climate change mitigation and adaptation, including:

- Green Climate Fund (GCF) is the largest entity under the financial mechanism of the UNFCCC and invests in low-emission, climate-resilient development through mitigation and adaptation projects and programmes in developing countries.
- Global Environment Facility (GEF) is an independent international financial entity established to help defray the costs of making projects environmentally friendly and reduce global environmental threats in developing countries and countries transitioning to a market economy.
- Adaptation Fund finances projects and programmes that help vulnerable communities in developing countries adapt to climate change. Initiatives are based on country needs, views and priorities.

- Least Developed Countries Fund (LDCF) was established to support a work programme to assist least developed countries carry out, inter alia, the preparation and implementation of national adaptation programmes of action (NAPAs).
- Special Climate Change Fund (SCCF) was established to finance projects relating to: adaptation; technology transfer and capacity building; energy, transport, industry, agriculture, forestry and waste management; and economic diversification. Unlike the LDCF, the SCCF is open to all developing countries, prioritising most vulnerable countries in Africa, Asia and SIDS.

Further support may exist in the form of arrangements for bilateral support by development agencies of specific donor countries or by organisations such as the European Commission. Support mechanisms for developing a low-emissions shipping sector can also be provided through government tax incentives and discounted lending arrangements.

Much of the existing focus for climate finance is in traditional areas of energy efficiency, urban transport and clean cities, with funding being made broadly available for both climate mitigation and adaptation purposes. However, there are opportunities for accessing large-scale funding for large infrastructure projects, such as new ports and harbours and new ship building capabilities. Further focus is expected to be given to the maritime sector in relation to climate finance with activities such as the GloMEEP Project acting as a catalyst for this form of finance. IMO's Integrated Technical Cooperation Programme (ITCP) may also support countries with technical support for the development of (specific parts of) their NSERS.

Blended finance may also be a practical option for large-scale financial support. Blending involves support from different IFIs or by the use of public and private finance which can be commercially attractive, with a higher level of governance being provided through the involvement of public lending organisations (often development banks, such as EBRD and ADB, or institutional investors).

It is recommended that discussions with key finance stakeholders on the funding requirements and potential sources of funding be initiated early on in the NSERS development process and that national government departments, such as the Ministry of Finance, or Treasury, be involved in these discussions.

3 Implementation of a national ship emissions reduction strategy

3.1 Implementation plan

Once the aim, objectives and actions are identified, responsibilities allocated, timeframes set and resource requirements as well as potential funding sources identified, the various elements of the NSERS can be assembled into an implementation plan. Table 4 provides a possible outline.

Table 4: *Implementation plan*

	Responsible agency/actor	Timeframe	Total resource cost	Funding source(s)
Objective 1				
Action 1.1				
Action 1.2				
Action 1.3				
…				

The NSERS is expected to cover a significant range of activities which will require careful and consistent management. **It is recommended that the management of the strategy implementation be considered at an early stage.** Project management structures will most likely already exist within the Lead Agency. Alternatively, the NSERS project management could also be outsourced to a third-party commercial entity. Furthermore, established project management methodologies and tools could be used, as well as international standards such as ISO 9000 and ISO 14001.

Box 5:
Potential barriers to the implementation of a national strategy

Although in the majority of GloMEEP countries, formal endorsement and adoption of the strategy have yet to be concluded – and therefore implementation is still pending – a number of potential barriers to implementation were identified. These included:

- Weak regulatory authority;
- Lack of support from other ministries and stakeholders and lack of agreement on goals and objectives;
- Multiplicity of ministries involved makes coordination a challenge;
- No incentives for involvement of stakeholders and even a lack of interest in the issue;
- Lack of clarity on responsibilities and commitments during implementation;
- Lack of information;
- Competing policy priorities;
- Lack of an adequate budget;
- Non-availability or high cost of appropriate technology;
- Lack of trained personnel in relevant ministries and agencies (e.g. to implement port State control);
- Inability to agree on appropriate objectives and a monitoring and evaluation strategy;
- Limitations on the ability of stakeholders to adopt specific measures recommended in the strategy – for example, the economic climate places constraints on ability of especially medium and small shipowners to invest in new equipment.

Recommendations:

A phased approach to implementation of the NSERS would allow a number of the challenges to be addressed in the initial phase. This should be followed by a National Workshop during which progress is evaluated and the strategy revisited prior to a second phase.

The timeframes required for vessels to be compliant should take economic and other constraints into account.

Objectives should include environmental, administrative (institutional) and financial parameters and should cover short-, medium- and longer-term periods.

Annual meetings of the NTF should be used as a platform for reporting on progress and evaluation of the success of implementation. Any blockages can then be addressed. A more thorough evaluation should be undertaken at the mid-point of the implementation period and objectives adjusted as necessary.

3.2 Reviewing and approving the NSERS

Once the draft strategy is at a reasonably advanced stage, it should be reviewed in terms of whether it is 'fit for purpose'. This means that it is clear about the aim to be achieved and how to achieve it. To do this effectively, the strategy must support the direction and vision of the government's overall policy and it must be easily understandable and accessible to the people who will need to work with it and implement it.

The following checklist can be used as a basis for determining whether the strategy is fit for purpose:

- Is the strategy clear about what aim it is intended to achieve and how it supports the national government in its overall policy direction?
- Does the strategy take account of the wider agenda of government policy for shipping and the environment, especially with respect to climate change and air pollution?
- Does the strategy make clear links to other relevant strategies and policies so that it 'fits' with the overall direction of the government and avoids giving out contradictory messages?
- Are the objectives and actions clear? If met, will they lead to the overall achievement of the strategy's aim?
- Is it easy to understand what needs to be done to implement the strategy?
- Does the strategy make clear reference to and fit within the appropriate legislative requirements?
- Is the strategy clear and concise? Is it written in a style that is simple and direct and avoids longwinded language or becomes difficult to follow?

- Is it clear who is responsible for implementing the strategy?
- Has the strategy been shaped by the involvement and consultation of a range of stakeholders?
- Does the strategy draw on a relevant evidence base to support assertions?

It is recommended plans for early evaluation and endorsement be made, a regular dialogue with the endorsing agency be set up and briefings on progress be provided in order to ensure buy-in and support from the endorsing agency. Mobilising political buy-in from the outset of the development of the NSERS and continuing to secure it throughout its development and implementation process will be important to enable continuous progress to be made, particularly in light of potential problems arising or competing priorities.

The review stage also provides an opportunity to request final feedback from stakeholders involved in the development and implementation of the NSERS. In order to ensure a rapid turn-around, it is recommended that a timeline be given to each of the stakeholder groups by which to provide any final comments.

Once the NSERS has been through the review process and is considered 'fit for purpose', the document will require formal endorsement and approval/adoption at the highest appropriate political and administrative level, in line with national government protocols.

3.3 External communication

A communications strategy to raise awareness within the maritime community and the general public of the work being undertaken nationally to reduce emissions from ships may be helpful in obtaining wider support for the NSERS and should be considered an essential part of the implementation plan.

Elements to consider when developing a communications strategy are summarised below:

- Objectives: ensure the communications strategy is aligned with the overall objectives of the NSERS
- Audiences: identify the audience(s) you would like to reach and understand their interests
- Messages: ensure these are consistent and focus on relevant elements for different audiences
- Tools and activities: identify the most appropriate tools and activities for communicating key messages to your target audience(s)
- Resources and timescales: ensure that the communications strategy is consistent with the available resources and is achievable within the required timescale
- Feedback: assess the effectiveness of the communications strategy. If possible, get an independent third party to do this work. If necessary, amend the communications strategy to strengthen areas which did not work well[5]

3.4 Monitoring and evaluation

The development and implementation of the NSERS is an iterative process rather than a one-off activity and should be monitored, evaluated and revised on a regular basis to ensure the relevance of the NSERS in the face of changing national and international circumstances.

- It is recommended that the progress made in delivering the set objectives and actions, as well as in achieving the overall aim of the strategy, be monitored and evaluated. The criteria that were used to select objectives and actions (see section 2.1.3) could, for example, be used for the evaluation of the strategy. In order to improve the effectiveness of NSERS, it will be important to identify what has worked, what has not and to analyse why. Based on this information, an assessment and decision can be made on whether the strategy needs to be revised to address any gaps, newly emerging issues or changes in national or international circumstances.

[5] ODI (2005). Planning Tools: How to write a communications strategy, *https://www.odi.org/publications/5186-communications-strategy-planning*; Overseas Development Institute.

The frequency for periodic reviews should be agreed prior to publication of the strategy (for example, every year). Furthermore, the most appropriate organisation or individual to carry out this process should be considered; this could be an organisation or individual closely involved and thus intimately familiar with the NSERS or an organisation or individual outside of the process, including third-party auditors, and thus providing a more neutral and objective perspective.

Annex 1
Strategy development template

The template below lists the recommended Table of Contents for a national ship emissions reduction strategy (NSERS). In addition, there is a description of the information suggested for inclusion in each section which is to be removed when the strategy is written.

Template for the national ship emissions reduction strategy (NSERS)
Executive Summary Short summary of the issues and approach taken in developing the NSERS
1 Institutional needs
1.1 Lead Agency Description of the Lead Agency: • Name of organisation(s). • Lead Agency structure and organisation. • Fixed period or rotation (i.e. will the Lead Agency remain with the same organisation or is it expected/required that this role is "rotated"). • Core resourcing requirements from the Lead Agency. Description of the responsibilities of the Lead Agency: • What are the Terms of Reference for the Lead Agency? • Description of roles and responsibilities of the Lead Agency. • Description of any specific Terms and Conditions associated with the structure and operation of the Lead Agency. • Governance structure and rules/obligations of the Lead Agency. • Decision-making process. • Reporting requirements. • Accountability requirements. • List of Lead Agency deliverables (yr 1/2/3 etc.).
1.2 Task Force Description of the Task Force Membership: • Nominated Representative(s) from the Lead Agency. • Identification and nomination of representatives from pertinent government agencies and stakeholders (e.g. ministries and agencies dealing with GHG emissions and/or air pollution, maritime administrations, port authority representatives, and so on) so that they can advise on the development of the national strategy and support strategy implementation activities. • Identification and nomination of relevant stakeholders from industry and the environmental community (e.g. representatives from shipowners, shipbuilders, maritime training organisations, NGOs and academia) so that they have an opportunity to stay abreast of, provide feedback on and support the strategy development process and planned implementation activities.

Template for the national ship emissions reduction strategy (NSERS)

1.2 Task Force *(Cont.)*

Description of the responsibilities of the Task Force:

- What are the Terms of Reference for the Task Force?
- Description of roles and responsibilities of the Task Force.
- Description of any specific Terms and Conditions associated with the structure and operation of the Task Force.
- Governance structure and rules/obligations of the Task Force.
- Decision-making process.
- Reporting requirements.
- Accountability requirements.
- List of Task Force deliverables (yr 1/2/3 etc.).

Identification of Focal Point and description of the role, responsibilities and tenure.

Identification of Project Coordinator and description of the role, responsibilities and tenure.

1.3 Internal Task Force communication and interaction

- Identification of who needs what information and how often.
- Description of mechanisms to be used to disseminate information and updates within the Task Force.
- Description of how to enable interaction with relevant actors.
- Description of how feedback is received and processed.

2 Developing a national ship emissions reduction strategy

2.1 Development of a national ship emissions reduction strategy

2.1.1 Gathering information

Information and statistics on the current status of and expected future developments related to the national shipping industry, ship and port emissions, ship energy efficiency, legislative and policy regime requirements, and so forth.

For more guidance please refer to *Ship Emissions Toolkit, Guide No.1: Rapid assessment of ship emissions in the national context.*

2.1.2 Defining the aim and scope

Aim:

- State the strategy's aim: "where do we [the country] want to be and what are we aiming for and why?"

Scope:

- State the strategy's scope: "what will the strategy address (ship emissions, port emissions, energy efficiency, CO_2 or GHG emissions, air pollutants) and at what geographical level (national/regional)?

2.1.3 Identifying objectives and actions

Objectives:

- List the objectives that will need to be achieved in order to reach the overall aim of the strategy.
- Identify which objectives, if any, should be prioritised over others, using, for example, the prioritisation matrix shown in Figure 3 or some of the criteria listed in Box 3.
- Describe the review process to assess whether the objectives are still valid and realistic.

Actions:

- For each objective, identify the actions which need to be accomplished to collectively deliver the set objective.
- Identify which actions, if any, should be prioritised over others, using, for example, the matrix shown in Figure 3 or some of the criteria listed in Box 3.

Template for the national ship emissions reduction strategy (NSERS)

2.1.4 Identifying and creating linkages with other national and international strategies

- Identify national entities (government and private) that may have policies or strategies in place which could interact with the NSERS.
- Identify and list national policies and strategies which may be complementary or in conflict with the aim and scope of the NSERS.
- Identify supporting and complementary objectives and actions and, where possible, harmonise strategic aims, objectives and actions on a cross-functional basis (e.g. between different government bodies).
- Similarly, identify contradictory objectives and actions and, where possible, find opportunities to reconcile these with the NSERS objectives and actions.
- Identify opportunities to link or include NSERS into national UNFCCC strategies and programmes, including NDCs, Technology Transfer programmes etc.
- Identify commonalities and contradictions of the NSERS with regional and international policies and strategies and identify opportunities to align these with each other.

2.1.5 Allocating responsibilities

Indicate which entities will be responsible for delivery of which objectives and actions.

2.1.6 Setting timeframes for implementation

- For each objective and action, provide the timeframe and date by which they need to be delivered and justify why they need to be delivered by the set date.
- Describe how the delivery of objectives and actions will be monitored. If deadlines slip, how will the cause(s) be identified and what steps will be taken to ensure that a more realistic timeframe is set for completion.

2.1.7 Resources and sources of funding

Describe the resource inputs required to deliver each objective and related action, for example by using the resource requirements matrix presented in Table 3 and by considering the following questions:

- How many people are required?
- What type of expertise, experience, or skills do they need to possess?
- What is their availability?
- Are particular facilities, equipment, services or materials necessary?
- Are there any other special requirements not yet covered?

Scale of financial resources required

- Provide an estimate of the funding required:
  - to run and administer the NSERS and programme of work.
  - to deliver strategic objectives and actions.

Sources of funding

- List possible sources of finance to implement the NSERS, its objectives and actions. For example, these could come from:
  - Private investors, including technology investors, private equity and venture capital organisations.
  - Public investors, including governments and local government organisations.
  - Multilateral Development Banks, e.g. EBRD, EIB, ADB, IDB, AfDB.
  - Climate Finance Funds and Initiatives, including:
    - Green Climate Fund (GCF)
    - Global Environment Facility (GEF)
    - Adaptation Fund
    - Least Developed Countries Fund
    - Special Climate Change Fund
  - Blended finance, i.e. combining public and private finance.

Template for the national ship emissions reduction strategy (NSERS)

3 Implementation of a national ship emissions reduction strategy

3.1 Implementation plan

Assemble the various elements of the NSERS into an implementation plan, for example as outlined in Table 4**.**

Outline how the strategy implementation will be managed.

3.2 Reviewing and approving the NSERs

- Review the draft strategy to see if it is 'fit for purpose', i.e. if it is clear about the aim to be achieved and how to achieve it (see checklist included in section 3.2 of this guide).
- Request final feedback from stakeholders involved in the development and implementation of the NSERS.
- Make plans for early evaluation and endorsement, set up a regular dialogue with the endorsing agency and provide briefings on progress in order to ensure buy-in and support from the endorsing agency.
- Once the NSERS has been through the review process and is considered 'fit for purpose', the document will require formal endorsement and approval/adoption at the highest appropriate political and administrative level, in line with national government protocols.

Please note that these are recommended procedural steps for the review and approval of the NSERS rather than text that should be included in the NSERS itself.

3.3 External communication

- List the objectives of the external communications strategy, ensuring they are aligned with the overall objectives of the NSERS.
- List the audience(s) you would like to reach and briefly describe their interests.
- List the messages you would like to convey and ensure these are consistent and focus on relevant elements for different audiences.
- List the tools and activities for communicating key messages to your target audience(s).
- Define when, how and by whom the communications strategy will be reviewed and how its effectiveness will be assessed.

3.4 Monitoring and evaluation

- Describe how the progress of NSERS will be monitored and at which intervals.
- List which criteria to evaluate the NSERS against, including performance indicators.
- Determine who will be responsible for monitoring progress and evaluating effectiveness.

Annex 2
Examples of national maritime emissions reduction policies and strategies

In many countries, the reduction of emissions from ships is covered under policies, strategies or legislation related to environmental management, climate, trade, transport or shipping. Some examples of countries with specific maritime policies or strategies in place to address ship emissions are provided in Table 5.

Table 5: *Examples of countries or regions with national policies and/or strategies to reduce emissions from ships*

Country or region	Strategy summary
People's Republic of China	China designated the Pearl River and Yangtze River Deltas, and Bohai-rim waters as domestic ECAs (DECAs) in 2015 and announced a gradual implementation of the requirements concerning emissions of air pollutants from ships. Since 1 January 2017 ships have been required to burn fuel with a sulphur content not exceeding 0.50% while berthed at eleven key ports within the DECAs. Since 1 January 2018 the 0.50% sulphur cap also applies to ships berthing at other ports in the three DECAs whilst from 1 January 2019, ships will be required to burn fuel with a sulphur content not exceeding 0.50% at all times while operating within the DECAs. To comply with the sulphur requirements, ships can choose alternative measures equivalent to the aforementioned control measures, such as use of shore power and clean energy, and treatment of exhaust gas. An assessment on the effect of the aforementioned control measures will be conducted before 31 December 2019 to decide whether to: a) Introduce the requirement of 0.1% m/m sulphur content in the DECAs. b) Extend the geographical scope of DECAs. c) Introduce other control measures.
European Union	The European Commission's 2011 White Paper on transport suggests that the EU's CO_2 emissions from maritime transport should be cut by at least 40% from 2005 levels by 2050, and if feasible by 50%. However, international shipping is not covered by the EU's current emissions reduction targets. In 2013, the Commission set out a strategy for progressively integrating maritime emissions into the EU's policy for reducing its domestic greenhouse gas emissions. The strategy consists of three consecutive steps: Monitoring, reporting and verification of CO_2 emissions from large ships using EU ports • Greenhouse gas reduction targets for the maritime transport sector • Further measures, including market-based measures, in the medium to long term. *Source:* *https://ec.europa.eu/clima/policies/transport/shipping_en*

Country or region	Strategy summary
European Union	*Clean Power for Transport: A European alternative fuels strategy,* January 2013 sets out a comprehensive alternative fuel strategy and the road to implementation covering all modes of transport. It aims at establishing a long-term policy framework to guide technological development and investments in the deployment of these fuels and give confidence to consumers. An accompanying legislative proposal provides a general direction for the development of alternative fuels in the Single European Transport Area. Member States have the flexibility to develop policy frameworks for the market development of alternative fuels in their national context. The proposal also sets binding targets for the necessary infrastructure build-up, including common technical specifications. For electric recharging points, the proposal provides a single connector solution ensuring interoperability across the EU and certainty for the market. *Source:* *European Commission (2013). Communication From the Commission to the European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions Clean Power for Transport: A European alternative fuels strategy COM (2013) 17 final.*
Finland	Finland has adopted a Maritime Transport Strategy (2014–2022) to ensure that maritime transport and the country's maritime industries can operate effectively and that the competitiveness of the national economy as well as environmental and safety issues are taken extensively into account. A vision for maritime transport and a related action programme have been developed in collaboration with the maritime transport sector and with users of the sector's services. Finland's Maritime Transport Strategy includes the following measures: • Strengthen competitiveness of ports by providing incentives to develop their service functions, by improving operating preconditions through reducing the administrative load and by enabling greater logistical efficiency through enhancing the usability of information. • Improve financing opportunities for vessel investments in order that sufficient vessels can be modernised and replaced, and investigate opportunities for new financing arrangements. Take into account the opportunities offered by the European Investment Bank and the Nordic Investment Bank. • Focus on education, research and development in support of environmentally friendly, low emission and safe shipping. • Seek increase in Finnish Cleantech project start-ups and in their financing and marketing. • Advance development and take up of alternative fuel solutions, and implement LNG Action Plan for Shipping 2013–2017. • Adopt pro-active and resolute approach in influencing the handling of environmental and safety matters within the IMO, the EU and HELCOM. • Primarily seek international environmental regulation of maritime transport through the IMO. • Work within IMO towards low emissions and safe shipping by ensuring enabling environment is created where new technologies which increase energy efficiency can be adopted worldwide. • Secure safety and convenience of maritime transport and minimise its environmental effects through national and cross-border cooperation. • Further develop shipping company operations and the maritime cluster; strengthen bilateral international cooperation. *Source:* *Maritime Transport Strategy for Finland 2014–2022, Ministry of Transport and Communications 2014 (available on Ministry website).*
Japan	The Japanese government, in particular the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), has established several measures for enhancing national maritime energy efficiency for environmental protection and sound shipping as follows: • "Act on the Rational Use of Energy" requires a shipping (passenger and cargo) company, the combined fleet of which constitutes 20,000 GT and more and are not engaged in domestic voyages, to take two different energy saving measures. One is to submit energy saving plan including reduction target to MLIT, and the other is to report a total energy consumption on an annual basis. MLIT has promoted development of innovative technology for reducing GHG emissions such as dual-fuel engine (LNG and heavy fuel oil), fuel cell ship, Eco Ship (electric propulsion system) and air lubrication system. *Source:* *Maritime Bureau of Ministry of Land, Infrastructure, Transport and Tourism (MLIT).*

Country or region	Strategy summary
Liberia	The Liberian Registry (LISCR), in partnership with a specialty ship finance firm, offers an environmental retrofit finance programme designed to reduce global CO_2 emissions, enhance fleet efficiency and competitiveness, and promote a greener Liberian fleet. The Liberian Registry is also offering special tonnage tax discounts for ships participating in this green initiative. Each ship will be entitled to a 50% annual tonnage tax discount in the first year, and up to a 25% discount in both the second and third years. The finance firm provides the financing needed for each project, and assumes responsibility for technology performance and fuel volatility risk. It also provides technical supervision retrofits and continuous monitoring. Owners and operators remit to the company a proportion of the amount they save on fuel costs, or from the additional-negotiated hire. The retrofit projects require no upfront capital by owners and, since the payments are always limited to a share of the savings, there is an ongoing net benefit to customers. The Liberian Registry participates in the Green Award programme, under which eligible shipowners are offered a 3% tonnage tax discount annually to all Liberian-flag vessels that are certified. The discount will apply continually as long as the vessel remains in the Green Award programme. Green Award is a global, independent, not-for-profit quality assurance organisation which certifies ship managers and vessels that go beyond industry standards in terms of safety, quality and environmental performance. The Green Award scheme brings together ship managers who are willing to improve the safety and environmental performance of their vessels, and ports or private companies in the maritime sector which are willing to support vessels that go beyond international conventions and legislation in terms of ship lay-out and equipment, quality of operations and management. *Source:* *http://www.liscr.com/eco-upgrade* *http://www.liscr.com/sites/default/files/Green%20Award%20Insert.07.06.2016.pdf*
Norway	Through the Gothenburg Protocol, Norway has undertaken to limit NO_x emissions to a maximum of 156,000 tonnes per year from 2010. Shipping has a great potential for reducing its NO_x emissions, by cleaner fuel or installation of treatment systems. On 1 January 2007 a tax on emissions of NO_x was introduced by the Norwegian government as an incentive to reduce NO_x emissions. The tax applies to the offshore and shipping industry as well as large-scale land-based industry. In 2013 the tax was 17.01 NOK/kg NO_x emitted. Shortly after the introduction of the NO_x tax, the Norwegian NO_x Fund was initiated in 2008. The fund is based on an industry/authority agreement, including tax relief and quantitative NO_x reduction commitments. Enterprises may apply for financial support for installation of NO_x reducing measures (going beyond existing regulations), receiving up to 80% coverage of their investment. Examples of technologies supported include LNG, selective catalyst reduction (SCR) systems, battery-driven/hybrid ships, low NO_x engines, engine replacements, exhaust gas recirculation (EGR) and various fuel-saving technologies. The fund also provides financial support for the infrastructure of LNG bunkering and arrangements for shore power.
Panama	As of 1 January 2016, the Panama Registry is implementing a special three (3) year discount in the registration fee for vessels already registered or vessels to be registered in the National Merchant Marine, provided evidence of the implementation of corporate social responsibility programmes focused on the reduction of air and sea pollution from shipping is provided. This discount will apply regardless the tonnages or age of the vessels and it could be renewed. In addition, the Panama Canal has launched the Green Connection Award, a new initiative to recognise customers who demonstrate excellent environmental stewardship and to encourage others to implement technologies and standards to help reduce GHG emissions. Panama Canal customers that meet and exceed environmental standards set by the IMO and/or other globally recognised standards are considered for the Award. The Panama Canal evaluates eligible candidates based on specific environmental factors, such as the EEDI, Environmental Ship Index, amount of nitrous oxides they emit due to engine performance, vessels powered by LNG and the amount of CO_2 emissions they reduce by using the Panama Canal compared to alternate routes. *Source:* *Panama Maritime Authority, Merchant Marine Circular MMC-298 Economic Incentives for Panamanian Vessels: https://www.segumar.com/wp-content/uploads/2018/01/MMC-298-ECONOMIC-INCENTIVES-FOR-PANAMANIAN-VESSELS-JANUARY-2018.pdf*

Country or region	Strategy summary
Singapore	The Maritime Singapore Green Initiative seeks to reduce the environmental impact of shipping and related activities and to promote clean and green shipping in Singapore. In 2011, the Maritime and Port Authority of Singapore (MPA) pledged to invest up to S$100 million over 5 years in the Maritime Singapore Green Initiative. In 2016, following industry support, the Initiative was further enhanced and extended until 31 December 2019. It is a comprehensive initiative comprising five programmes: 1 *Green Ship Programme*: encourages Singapore-flagged ships to reduce CO_2 and SO_x emissions by lowering the initial registration fees and providing a rebate on annual tonnage tax. 2 *Green Port Programme:* encourages ocean-going ships calling at the Port of Singapore to reduce the emissions of pollutants. Qualifying ocean-going ships that use type-approved abatement/scrubber technology, burn clean fuels or LNG during an entire port stay within Singapore Port Limits are granted 25% reduction in port dues. 3 *Green Technology Programme*: helps local maritime companies develop and adopt green technologies through co-funding costs. Singapore-registered companies engaged in maritime-related businesses such as terminal operations, ship operations and harbour craft operations qualify for the GTP. Companies can apply for grants of up to 50% of qualifying costs to co-fund the development and adoption of green technological solutions with at least 5% reduction in emissions. For qualifying projects that can achieve more than 20% reduction in emissions levels, the grant limit under GTP will be increased from S$2 to S$3 million. 4 *Green Awareness Programme:* encourages the maritime industry to explore all possible avenues to promote sustainable shipping. The programme hosts regular workshops and forums aimed at sharing industry best practices for sustainable shipping. Organisations hailing from every corner of the maritime industry come together to demonstrate a common commitment to protect the environment through the Maritime Singapore Green Pledge. 5 *Green Energy Programme:* provides support for the adoption of alternative/cleaner marine fuels in the Port of Singapore. In 2016, MPA initiated a co-funding initiative to assist SGX-listed maritime companies in Singapore with their sustainability reports using world standards, e.g. the Sustainability Reporting Guidelines of the Global Reporting Initiative. MPA will co-fund 50% of the qualifying costs, up to a cap of S$50,000 per company, for reports submitted before 31 December 2018. Beyond voluntary initiatives of the Maritime and Port Authority of Singapore, the Singapore Government has also put in place legislation – the Energy Conservation Act – which mandates energy management practices for large energy users. With effect from 1 January 2014, companies from all sectors, including transport, that consume more than 15 GWh of energy per year must appoint energy managers, report energy use and GHG emissions, and submit plans for energy efficiency improvements to reduce their energy consumption and carbon emissions. *Source: https://www.mpa.gov.sg/web/portal/home/maritime-singapore/green-efforts/maritime-singapore-green-initiative*
United Kingdom	The UK is developing policies to address, in a holistic way, the reduction of both greenhouse gas emissions and air quality pollutants from the maritime sector, through a domestic 'Clean Maritime Plan'. The UK is establishing a strategic advisory body – the Clean Maritime Council – to advise on the development of these policies. This body will bring government together with leading experts from national industry and academia. It will help identify barriers to the growth of zero emission shipping, and solutions to these challenges. A key part of the UK's approach will be improving the national evidence base, to produce a comprehensive body of data on emissions from all ships operating in UK waters. In addition, the UK is exploring the introduction of domestic policy for the reduction of maritime air quality pollutants specifically. A number of areas are under consideration, including commitments from ports to create Air Quality Strategies and the introduction of further domestic legislation to reduce emissions in UK waters.

Annex 3
Emissions reduction measures

MARPOL Annex VI includes mandatory requirements to reduce the emissions of certain air pollutants from ships and increase their energy efficiency. Contrary to other legislation, e.g. the Ballast Water Management Convention, MARPOL Annex VI is technology-neutral which means that shipowners can decide which technologies or solutions to use in order to comply with the required emissions level.

In particular with regards to energy efficiency improvements, there are a variety of technologies, design strategies and operational solutions to choose from. These vary depending on their applicability to certain ship types, their fuel saving potential and (for technologies) their suitability for retrofitting.

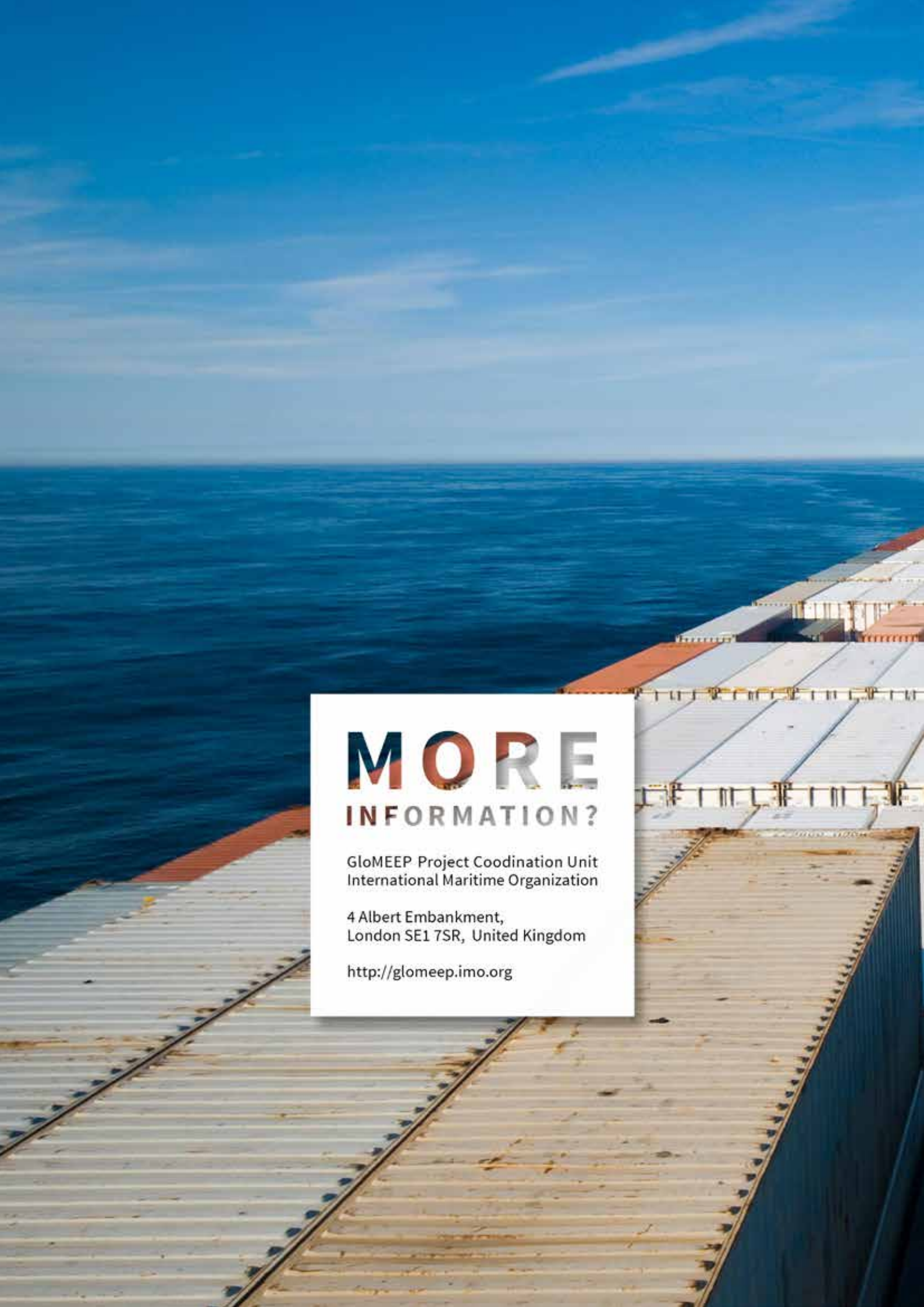
Given the range of options available, careful consideration needs to be given to ensure the most appropriate technologies are adopted. This can be achieved by analysing the technology's maturity level, market uptake, performance, efficiency improvements and costs of each technology.

Establishing the performance of a technology in terms of fuel savings is particularly challenging (especially for technologies with low market uptake) as it depends on a number of factors, such as ship type, environmental conditions, operating mode, and so forth.

Table 6: *Range and type of energy efficiency and GHG reducing technologies*

Design based technologies	Hydrodynamic technologies
• Aft waterline extension • Skeg shape/trailing edge optimisation • Optimisation of hull openings • Shaft line arrangement • Bulbous bow • Lightweight construction • Air lubrication • Design speed reduction – smaller engine • Design speed reduction – engine de-rating • Superstructure aerodynamics	• Propeller modifications • Propeller/rudder integration • Pre-/post-swirl devices • Contra-rotating propellers • Other hull streamlining
Machinery technologies	**Low- or zero-carbon fuel or energy sources**
• Common rail • Diesel electric drive • Combined Diesel/electric & Diesel mechanical drive (CODED) • Hybrid shaft generator • Engine tuning • Low loss power distribution • Variable speed electric power generation • Power take off/shaft generator • Speed control of pumps and fans • Waste heat recovery • Energy saving lighting • Efficient boiler	• Hydrogen • Ammonia • Biofuels • Batteries • Solar power • Wind propulsion

Maintenance strategies	Operational
• Propeller condition based maintenance • Regular/interval based propeller maintenance • Advanced propeller coating and paints • Hull cleaning • Hull surface coating – biocidal • Hull surface coating – foul release	• Weather routing • Autopilot upgrade/adjustments • General speed reduction • Advanced fuel consumption and power generation monitoring • Trim/draft optimisation • Speed reduction due to port efficiency • Raising crew awareness & energy efficiency training • Efficient voyage execution – Voyage planning & DWT utilisation • Optimisation of ballast voyages
SO_x reduction options	**NO_x reduction options**
• Switching to low-sulphur fuels • Exhaust gas cleaning systems (scrubbers) • Liquefied Natural Gas (LNG) • Biofuels • Onshore power supply • Low- or zero-carbon fuel or energy sources (listed above)	• Internal engine modifications • Direct water injection • Humid air motor • Water-in-fuel emulsion • Selective catalytic reduction • Exhaust gas recirculation • LNG • Onshore power supply



MORE INFORMATION?

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