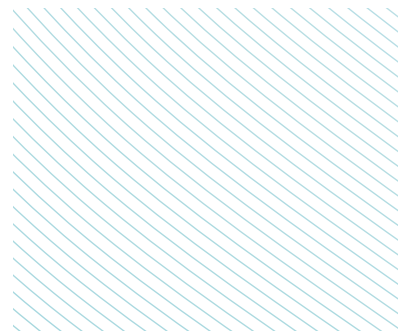




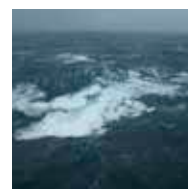
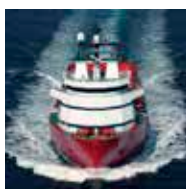
Norges
Rederiforbund
Norwegian
Shipowners'
Association



Blue Seas – Green Future

Environmental strategy
for the Norwegian Shipowners' Association

June 2014





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Our shared responsibility

The Norwegian Shipowners' Association has a proactive and ambitious zero-emissions vision. The objective is for Norwegian shipping and offshore contracting activities to produce no environmentally harmful emissions or discharges to the air or sea. The route to zero-emissions is a long and tough one, but no-one is better equipped for the voyage than the Norwegian shipping companies, and their vessels. As one of the world's most modern shipping nations, we are proud to take the lead as role models, not least by eliminating harmful emissions and discharges.

Along with the entirety of our maritime cluster, Norwegian shipping occupies a unique global position. We are recognised for our innovation and value-creation, which have helped make Norway one of the world's most advanced maritime nations. The Norwegian-controlled fleet of ships and rigs is modern, highly advanced and very diversified. The Norwegian maritime cluster is at the forefront in terms of developing and deploying technologies and concepts that contribute to lower emissions and a better environment.

The history of maritime Norway is a saga of generations of individuals and companies with determination, daring, competence and adaptability – and an ability to navigate

safely through difficult waters. This has made us a world-leader, not just at sea, but now also in and under the sea.

Shipping is a fully globalised industry. At any time, our members have ships and rigs on all the world's oceans. We are therefore dependent on the regulations that apply to us also applying internationally. Equitable ground rules are fundamental for healthy and fair competition. For this reason, the Norwegian Shipowners' Association engages proactively in all international forums which define shipping regulations. Our progressive environmental ambition is our commitment and guiding hand in our efforts to promote green shipping.

Norwegian shipping companies are committed to high quality shipping in all its aspects. It is important for us to support ambitious measures for ensuring progress in environmental protection and in shipping.

The responsibility to protect the environment is a common obligation for the entire society of which shipping is a part.

*The Board of the Norwegian Shipowners' Association
June 2014*





Our ambition and commitment

Today, transportation of goods by sea caters for around 90 per cent of the world's transportation needs, while shipping's contribution to global CO₂ emissions is only 2.7 per cent. This makes shipping the most energy-efficient means of transport. The Norwegian Shipowners' Association operates on the basis of a proactive and ambitious zero-emissions vision, meaning no harmful pollution of the air or sea. As a result, we must be constantly looking for improvements.

Our maritime competence is one of our most important renewable resources. Down the generations, Norwegian shipping companies have led the way in utilising the opportunities that the sea offers. Norwegian shipping companies have always been unafraid to look for and adopt new solutions. As a maritime nation, we share a history which is both fascinating and awe-inspiring. In the last 150 years, Norwegian shipping companies have controlled between 5 and 10 per cent of the world's total commercial tonnage, even though Norway has less than one 2,000th of the world's total population.

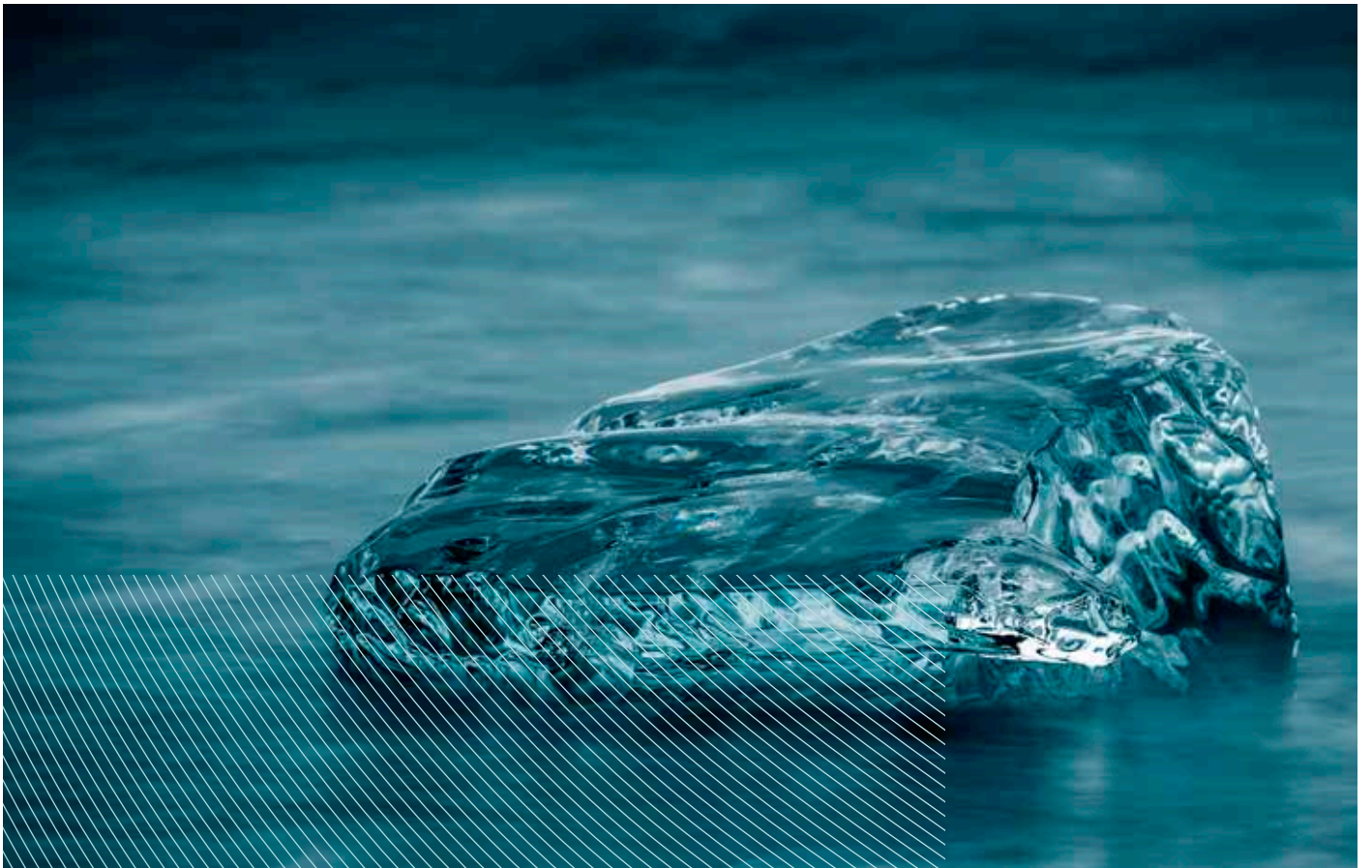
Norway's current maritime position is built on a foundation of competence, quality and a full-spectrum maritime cluster. We have a complete maritime environment, incorporating everything from shipping companies, shipyards, equipment suppliers, financial services, brokers, research institutions and highly competent maritime authorities. The interaction that goes on within this environment is crucial for securing the development of new green technologies and concepts for the future.

In recent times, nearly all significant maritime innovation has borne a clear Norwegian stamp, whether we are talking about the development of tankers, ro-ro vessels, reefers, LNG tanks, advanced shuttle tanker, or advanced supply or production vessels. For generations, the Norwegian maritime industry has displayed an ability and a willingness to restructure, innovate and actively target new solutions. We therefore believe that the Norwegian maritime industry is extremely well-equipped to take the lead in a proactive environmental initiative. Our point of departure is that the future will demonstrate that good environmental measures will also contribute to profitable shipping. To coin a phrase, "the good and the profitable go hand-in-hand".

The High North is one of regions that is most vulnerable to environmental changes. We are already witnessing changes to the planet and seeing new seas open up. In recent decades, Arctic sea ice has been drastically reduced. The result may be huge ecological disturbances. This is just one of the consequences of the Earth heating up. We aim to be a driving force in securing globally-binding safety and environmental commitments for this vulnerable area in our own backyard. Our fear is that the ice is withdrawing faster than the international negotiations in this area are advancing. The Norwegian Shipowners' Association is a driving force in securing a globally-binding safety and environmental commitment for the region.

It is easy to find motivation for a proactive environmental policy. When the first Norwegian seafarers sailed out for unknown coasts, they left behind them just their wake in the sea and their hopes in the air. Discharges of polluted ballast water and emissions of nitrogen oxides and CO₂ were a far-removed reality for them. The dramatic consequences of ecological and climate changes demand action. In 2050, there will be more than 9 billion people on Earth. Population growth will impose even greater demands for environmentally-friendly transport. Now that the maritime industry is to aim for the same goal, more than a millennium later, the Norwegian shipping companies will be leading the way. This is our ambition and our commitment.

Sturla Henriksen
CEO
June 2014



NORGES REDERIFORBUNDS MILJØVISJON:

Norwegian shipping and offshore contracting activities shall produce no environmentally harmful emissions or discharges to the air or sea

Blue Seas – Green Future

Wherever humans travel, we impact the environment around us. In recent decades, the consequences of human activity have been seriously felt in changes to the environment and the climate. On and in the sea, climate change has been especially visible. Melting ice and rising sea levels are signals that the planet is heating up. The Norwegian Shipowners' Association is working with our members so that, ultimately, Norwegian shipping and offshore contracting activities will produce no environmentally harmful emissions or discharges to the air or sea. This zero-emissions vision is the defining feature of our commitment to sustainable global shipping with no harmful consequences for life, health and the environment.

Norwegian shipping and offshore contracting activities shall produce no environmentally harmful emissions or discharges to the air or sea

As the largest and most important means of global, inter-continental transport, shipping has a major responsibility for ensuring sustainable development and a healthy environment – 90 per cent of the world's transportation of goods is by sea. The development of larger and more efficient vessels, technological improvements and innovation, and the optimisation of procedures onboard have already made shipping far greener than it was a decade or two ago. Stringent international requirements for the operation and running of ships will lead to further environmental gains in the years ahead. All the same, the Norwegian Shipowners' Association holds that emissions from shipping can and should be reduced more. This will be feasible both through the use of existing technology and through innovation and advances in technology.

Tomorrow's winners in an international market need to be focused on energy efficiency and green solutions. Several

of the Norwegian Shipowners' Association members are already international pioneers in eco-friendly shipping in their sectors. A series of groundbreaking concepts have been developed or are in development. This is one of the outcomes of the Norwegian maritime cluster's unique innovative force. Examples include the ongoing development of gas-powered energy-efficient low-emissions engines, new hull and propeller designs and the use of gas, batteries and fuel cells as power sources.

To give prominence to shipping's role in and contribution to the broader picture, the Norwegian Shipowners' Association is producing a coherent environmental strategy that describes how we are following up on our vision of zero harmful emissions. The strategy provides an account of how the sector will work in the years ahead to come up with sustainable solutions and underpin the green vision of a Norwegian shipping and offshore contracting industry that releases no environmentally harmful emissions to the sea or air. Today's new ships will be sailing for many years to come. This calls for a long-range approach in our efforts to strengthen the environmental profile of the maritime industry. The perspective for our strategy accordingly



extends to 2030, and this approach recognises that some challenges will be solved by that year, while others will need more time. For the Norwegian Shipowners' Association, a long-term plan for our environmental work is imperative.

The shipping industry's environmental efforts

Norwegian shipping companies have always been unafraid to look for and adopt new solutions. Norway's current maritime position is built on a foundation of competence, quality and a full-spectrum maritime cluster, in which the interaction between the participants and their focus on protecting the environment have been crucial in securing the development of new green technologies and future concepts.

In recent years, the Norwegian Shipowners' Association has convened around a set of principles prepared within the UN Global Compact. This is the UN's global network for companies and organisations committed to social responsibility and sustainable business practices. In

IMO (International Maritime Organization) established by the UN in March 1948. The IMO's mandate is to work for improved safety and the reduction of aquatic and atmospheric pollution, and anti-terrorism measures in the maritime sector. Achieving these goals involve a set of international conventions, regulations and guidelines for which the broadest possible endorsement is sought. Today, the IMO counts 170 nation states as members and 3 as associate members. In addition, 64 inter-governmental organisations and 78 non-governmental organisations have observer status.

signing up to the Compact we have endorsed three core principles for environmental protection:

- Support a precautionary approach to environmental challenges
- Undertake initiatives to promote greater environmental responsibility
- Encourage the development and diffusion of environmentally friendly technologies

Shipping is a fully globalised industry. Ships can be designed, financed, built, fitted out, flagged and manned everywhere in the world. All markets are exposed to keen international competition. It is therefore critical that shipping is regulated by international laws and regulations that are the same for all participants, regardless of the country that the vessel operates from or the flag it sails under. For this reason, we prioritise the efforts to influence an ambitious international regulatory framework. Our primary focus is to support global initiatives for better energy-efficiency and the reduction of emissions to the air and discharges to the sea through the IMO.

The EU is a key market for Norwegian shipping companies and participation in the EU's internal market is key in maintaining the industry's competitiveness. The EU has adopted an important role in setting the agenda for the international regulatory and policy developments that take place within the IMO. The policies and regulations that the EU adopts are therefore highly significant and this area has a high priority in the Norwegian Shipowners' Association's international efforts.

The fundamental approach of the Norwegian Shipowners' Association's environmental activity is to support global regulations that apply universally to all partici-



pants. We are critical of regulation based on regional initiatives since this entails a risk of detrimental distortion of competition and sidelines environmental efforts.

The Norwegian Shipowners' Association has been a driving force for international conventions for aspects such as ballast water management and responsible ship recycling. The task has been to ensure that the industry's positions are taken into account when the final regulations are adopted, and to ensure a development towards more environmentally-friendly maritime operations. One example of this is the Association's strong commitment to and support for shipping taking the lead, through the IMO, in the climate debate and imposing its own CO₂ regulation. This regulation has led to all ships having a plan on board for energy-efficiency and the lowest possible consumption of bunkers and, from 2013, to all new ships having to be built in accordance with low-emissions criteria. Through this decision, international shipping took a considerable initiative for reducing its own future emissions of greenhouse gases.

From land to sea

More than 70 per cent of the Earth's surface is covered by water, and maritime transport is by far the most important means of transportation that we have. Around 90 per cent of the world's intercontinental flows of goods and around 40 per cent of domestic freight is seaborne.

Over several decades there has been broad political agreement to switch more freight from road to rail and sea. Despite clear political goals, the trend has tended in the opposite direction. Freight transport by road has consolidated its position.

The Norwegian Shipowners' Association believes in a major national environmental initiative to better facilitate switching freight from road to sea. This applies in particular to bulk loads and larger quantities of containers and cargo that are not affected by time-critical factors. Norway has the national prerequisites for developing future environmentally-friendly and sustainable transport solutions based on short sea shipping. In addition to this, we have a maritime industry with long-standing experience of successfully performing difficult transport and logistics operations internationally. Our long coastline should be able to serve as an incubator for technical solutions which can then be exported and yield global ripple effects.

An increase in sea transport represents a solution to the challenges Norway faces in the transport sector. One ship in short sea service can take between 200 and 400 trailers off the road. Moving cargo from land to sea will help to reduce road wear and free up capacity on the roads. This will reduce harmful environmental pollution, reduce traffic accidents and reduce needless tailbacks.

Sea transport has few restrictions in terms of capacity utilisation and there are relatively low costs associated with developing infrastructure compared with other forms of transport. But sea transport is losing market shares to road freight.

Calculations show that transporting a container from Rotterdam to the goods terminal at Alnabru near Oslo by ship instead of road trailer will reduce emissions by the equivalent of 21 round trips by car between Oslo and Trondheim.¹

¹ Østlandsforskning, report OR.03.11 - Environmental comparison of ship and road transport using LCA (Life Cycle Analyses)



If we are to succeed in switching freight from road to sea, shipping's competitiveness relative to other forms of transport must be improved. This will mean establishing a much more coherent, strategic and planned approach to the infrastructure of sea transport than is currently the case. The ministries, specialist agencies and directorates must cooperate more intently to succeed in realising the potential of transport by sea. In addition, the entire system of fees and duties associated with transportation must be reviewed. User financing of maritime freight infrastructure must be substantially reduced to strengthen the competitiveness of sea transport relative to land transport. The future fees and duties system must support the policy objectives. We need good incentives for promoting green and climate-friendly transport. The introduction of a scrappage scheme for older vessels to encourage acquisition of a more modern and green fleet, and an eco-bonus for goods owners who opt for sea over road transport are examples of specific incentives.

The entire system for traffic flow at sea – including ports and the pilot system – must be targeted, streamlined and modernised. From being just goods terminals and transshipment points, a handful of ports should become national hubs, and drivers for commercial growth and regional development.

Eco-friendly measures must pay off

Maritime transport is international in nature, procyclical in respect of trends in world trade, capital-intensive and has a long investment horizon. The vessels tend to have a service life of 30 years or more. This means that vessels now being planned will be sailing right through to 2050. The shipping companies position themselves for the future through their order books of future newbuilds,

and the Norwegian companies are at the very forefront of employing innovative and eco-friendly design and technology.

Uncertainty concerning the requirements for ships and equipment in future global regulations complicates investment decisions for shipping companies that want to be early adopters and position themselves as focused on the environment and safety.

A report entitled “Future scenarios for Deep Sea shipping towards 2030”² of May 2013 prepared by DNV for the Norwegian Shipowners' Association, examines dilemmas and relevant trends for international shipping. Key findings of this report are that the price of bunkers will increase considerably as a consequence of stricter emissions requirements. But long implementation times of several decades for international conventions make the shipping companies' decisions difficult when it comes to being innovative frontrunners and adopting new, green technologies. New requirements and standards are to be introduced in a number of areas and there are examples of these having changed during their implementation (which was the case with ballast water). Political pressure for regional regulation can stymie adopted decisions and create difficulties. Technological solutions available at a given point in time may not necessarily match subsequently developed requirements for solutions, and developments are always in progress.

The driver for the shipping companies will be increased demand in the market for eco-friendly shipping if it pays to invest in green technology and equipment.

² The DNV report: Future scenarios for Deep Sea shipping towards 2030

New eco-friendly and energy-efficient ships consume significantly less bunkers than old types of ships. The newest ro-ro vessels consume around 40 per cent less fuel than an equivalent vessel designed in the late 1970s. For comparison, a car carrier from the 1980s has a cargo capacity of 3,000 cars and consumes around 30 tons of bunkers a day, while an equivalent modern car carrier using new technology will have a capacity of 8,000 cars and consume just under 45 tons a day. Similar savings are also to be seen in other types of ships, such as in the offshore fleet.

The market in 20-30 years will probably be far more environmentally aware than the present one and impose more stringent requirements on the environmental aspects of products. Future markets will have sustainable solutions and greener ships, because customers will wish to associate themselves more with environmental responsibility and sustainability than they do now. Eco-friendly measures must pay off. Great responsibility rests with the authorities in all countries, as well as companies under substantial public ownership for leading the way in demanding eco-friendly shipping.

The High North

The High North is an object of increasing focus for many parties due to its significance for energy, the environment and security on a global scale. The trend we are now seeing in the form of very serious melting of the Arctic ice is cause for concern. This development makes particular demands on the authorities and all other stakeholders in the High North. Increased activity in the High North is creating great opportunities, but also entails a special responsibility for contributing to sustainable development.

The Arctic areas are particularly challenging in terms of more extreme weather, ice conditions, the dark and great distances. This means that we need to develop ambitious environmental regulations and define strict requirements for safety and emergency preparedness. The Norwegian Shipowners' Association therefore stresses the importance of preparing globally binding agreements to reduce emissions of greenhouse gases and exhaust particles that may accelerate Polar ice melt.

Maritime activities taking place in the High North must be undertaken in a sustainable manner and grounded in a transparent attitude towards the environment, safety and emergency preparedness. Three development areas are of special interest for maritime activities: (i) offshore energy extraction, (ii) intra-regional transport and (iii) polar transit. Common to all three is that these operations take place under extremely challenging conditions, which place great demands on operational expertise, technology and quality at all stages of the value chain.

The Norwegian maritime industry is a world-leader in technology and innovation and has long traditions in the Polar regions. We already have very wide-ranging experience and competence in participating in the types of activities that will arise in the High North. A number of shipping companies have under construction, or already in service, specialised ships and rigs adapted to working in extreme climatic conditions. Safe handling and transportation of oil and gas products are also activities which Norwegian shipping companies have considerable experience of.

The main challenge relating to industrial activities in the High North is that nature in the Arctic is vulnerable to external influences and is slow to recover from encroachments and accidents. The High North is not uniform in the composition of its eco-systems, and there are large seasonal variations. This means that vulnerability assessments cannot be performed universally, but must be tied to specific activities, seasons and areas. The high concentrations of birds, fish and mammals mean that the consequences of external encroachment in the High North are considered to be large. In order to safeguard sustainable development in the region, it is therefore crucial that industrial activity here adheres to the highest standards with respect to health, safety and the environment.

The sea areas in the farthest North have been difficult to access because of the thick multi-year ice, but climate change is now altering the situation. The changes we are seeing in the northernmost sea areas are most clearly manifest in the reduction in the sea ice. Ice melt in the Arctic is dramatic and extremely serious, even though it must be stressed that, for the foreseeable future, these sea areas will be covered by ice in the winter season.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association will work to ensure that the Norwegian authorities conduct a proactive policy to secure sustainable and eco-friendly utilisation of the petroleum resources in the High North.
- The Norwegian Shipowners' Association shall work nationally and internationally to ensure that industrial activities in the High North adhere to the highest standards for health, safety and the environment in order to reduce the likelihood of accidents and harmful discharges and emissions and to protect vulnerable natural resources that are slow to recover.
- The Norwegian Shipowners' Association will co-operate with the Norwegian authorities to promote global progress to ensure that IMO regulations/ the Polar Code shall apply to everyone and set out the technical and operations frameworks for high-quality shipping in the High North.
- The Norwegian Shipowners' Association will be proactive in boosting knowledge about the High North among the knowledge institutions and relevant industrial concerns for the benefit of people, the environment and equipment.
- The Norwegian Shipowners' Association will contribute to effective response procedures for preventive and damage-limiting preparedness in the High North.

While the Norwegian Shipowners' Association seeks to contribute to reducing greenhouse gas emissions in order to halt temperature increases, we also see that the melting ice is creating new opportunities for Norway as a maritime nation. Literally, a whole new ocean is opening up. Sea routes from Europe to Asia can be shortened by as much as 40 per cent. This in turn may yield major emissions reductions.

Because the ice is melting so quickly, it is crucial to put into place a binding common regulatory regime for maritime activity in the High North. The IMO, the UN's shipping organisation, is working on a Polar Code aimed at complementing existing environmental and security regulations for shipping in Polar regions. The Norwegian Shipowners' Association will cooperate with the Norwegian authorities to promote global progress to ensure that IMO regulations/the Polar Code shall apply to all ships and set out the technical and operations frameworks for high-quality shipping in the High North.

Ship recycling

Since 1999, the Norwegian Shipowners' Association, in cooperation with the Norwegian authorities, has been a driving force for the establishment of internationally binding regulations through a special convention under the IMO. The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (HKC) was adopted in May 2009. The convention is a milestone in the efforts to improve conditions at recycling yards. It imposes requirements on the ship, the yard, the flag state and the national authorities, and it is important that these requirements are defined through the IMO. Once the convention comes into force, ships registered in signatory countries may only be recycled at facilities in countries that have ratified

the convention, that meet its requirements and that have been certified by the ship's home country authorities on this basis.

The Norwegian Shipowners' Association is committed to the recycling of ships taking place in a responsible manner without risk to life, health and the environment. This entails a clear responsibility for both the authorities and the industry to change an unacceptable practice. In order to contribute to higher environmental standards, the Norwegian Shipowners' Association has recommended its members not to scrap ships in Bangladesh. But simply availing oneself of these services outside of Bangladesh is not synonymous with environmentally-friendly ship recycling.

The Hong Kong Convention

The Hong Kong Convention (HKC) was adopted by the IMO in 2009 and deals with risks relating to environmental, occupational health and safety concerns in the recycling of ships. The convention also points towards a future need for a transition from hazardous substances to less hazardous substances in the building and maintenance of ships, without this being detrimental to the ships' overall safety or operational efficiency. The convention will come into force once it has been ratified by 15 countries which together represent 40 per cent of the world's gross tonnage and 3 per cent of global recycling capacity. The Hong Kong Convention will apply to all ships of more than 500 gross tonnes registered in flag states that have adopted the convention. It also applies to all ship-breaking yards in states that have signed the convention.



The Norwegian Shipowners' Association assumes that its members take the necessary precautions to avoid their ships being scrapped under environmentally harmful conditions. Members are expected to assume full responsibility for the proper recycling of their ships. This also applies to ships sold to third parties prior to recycling. The Norwegian Shipowners' Association recommends its members to recycle their ships in accordance with the Hong Kong Convention, even though this has not yet come into force. This entails a requirement for documented plans to protect the environment and the safety of employees.

Criticism of the convention has been directed at its failure to outlaw beaching. The Norwegian Shipowners' Association is of the opinion that if beaching were to be prohibited, this would impact the majority of all activity within ship-breaking to the extent that the largest ship recycling countries would be unable to sign the convention. The largest flag states would then not sign either since that would place their shipping companies and ships in a very difficult situation by excluding around 80 per cent of total global capacity for recycling services.

Grieg Green

Grieg Green adheres to the Hong Kong Convention and only uses recycling yards in China, Turkey and Europe which meet the requirements of the convention and Grieg Green's internal guidelines. The portfolio of approved yards is kept constantly up to date through regular inspections and visits. In China, beaching is prohibited and ships must therefore be recycled at the quayside and/or in drydocks. Grieg Green has a payment model which, through a transparent process, entails the company purchasing the ship from the shipping company and simultaneously selling it on to one of the approved recycling yards. Throughout the entire process, Grieg Green is present at the yard to monitor progress and assist in follow-up and execution in compliance with international laws and regulations. Before recycling takes place, a Ship Recycling Plan is prepared in partnership with the yard, which describes for each ship specifically how the process shall proceed. Grieg Green also prepares weekly reports so that the shipping company can follow the approximately three-month long process from beginning to end. At the end of the process, a summary final report is prepared in accordance with the Hong Kong Convention guidelines.

The Norwegian Shipowners' Association's position:

The Norwegian Shipowners' Association considers that its members have an independent responsibility to ensure proper recycling of their ships. This also applies to ships sold to third parties prior to recycling.

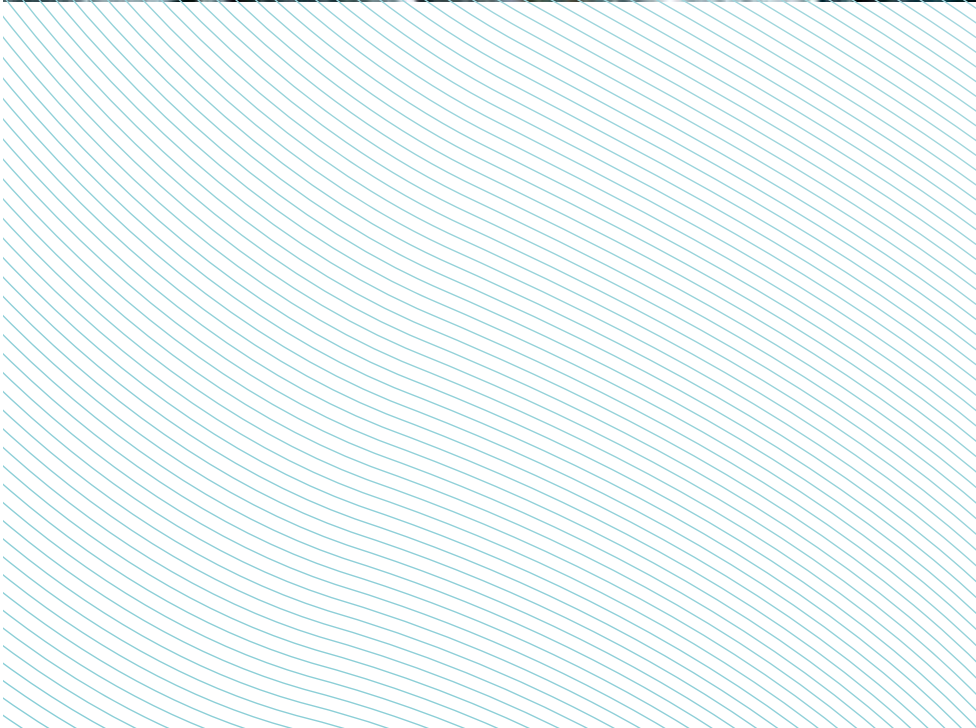
- The Norwegian Shipowners' Association urges its members to comply with the Hong Kong Convention, despite this not yet having come into force.
- The Norwegian Shipowners' Association urges its members to choose recycling facilities that comply with the Hong Kong Convention.
- The Norwegian Shipowners' Association strongly advises its members against recycling their ships in Bangladesh, unless closely monitored and undertaken as part of projects aimed at improving standards in line with the Hong Kong Convention.

The Norwegian Sh

- Norwegian shipping and offshore contracting activities shall produce no environmentally harmful emissions or discharges to the air or sea.
 - *Green and energy-efficient shipping is a key part of the solution to regional and international transportation and climate challenges.*
 - *Sea transport is already the most energy-efficient option compared with road, rail and air.*
 - *Around 90 per cent of global intercontinental freight is transported by sea, while shipping's contribution to global CO₂ emissions is only 2.7 per cent.*
 - *Shipping must be regulated by global provisions to protect people and the environment. The provisions must be adopted through the International Maritime Organization (IMO) and apply equally to everyone – local and regional regulations must be avoided.*
- The Norwegian Shipowners' Association believes that shipping has a global responsibility for helping safeguard sustainable development and healthy environment.
 - *New solutions will offer opportunities to further reduce harmful emissions from shipping.*
 - *Norwegian shipping companies are at the forefront of using existing environmental technology.*
 - *Through the full-spectrum maritime cluster that Norway has, our ambition is to have the best innovation and technological performance. To succeed in this, we need to strengthen our national focus on research, development and innovation.*
- The Norwegian Shipowners' Association maintains that one of the most important regional environmental measures that shipping can contribute is to take away from the roads and onto the sea a larger share of goods and passenger transport, especially large bulk loads and larger quantities of containers and cargo that are not affected by time-critical factors. In order to succeed in switching goods from land to sea, the following are important:

ipowners' Association's key positions

- A coherent, strategic and planned approach to both logistics flows and the infrastructure of sea transport.
- A restructuring of the entire system of fees and duties associated with transportation which strengthens the competitiveness of shipping relative to land transport.
- Good incentives for promoting green and climate-friendly transport. For example, the introduction of a scrappage scheme for older vessels to stimulate a more modern and green fleet. Another incentive might be an eco-bonus scheme that rewards goods owners who choose to send their goods by sea.
- The entire system for traffic flow at sea – including the pilot system – must be targeted, streamlined and modernised.
- Research and investigation into goods transport by sea must take place in parallel with the implementation of measures to strengthen shipping.
- The Norwegian Shipowners' Association will work to ensure that the Norwegian authorities conduct a proactive policy to secure sustainable and eco-friendly development of the resources in the High North.
 - The Norwegian Shipowners' Association will be a driving force to ensure that IMO regulations/the Polar Code shall apply to all ships and set out the technical and operational frameworks for high-quality shipping in the High North.
 - The Norwegian authorities must pursue an active policy to ensure effective and responsible resource utilisation of the petroleum reserves in the North.
 - Activities taking place in the High North must be grounded in a transparent and responsible attitude towards the environment, safety and emergency preparedness.
 - The areas in the North are particularly challenging in terms of more extreme weather and greater distances. This means that we need to impose different, stricter requirements for safety and emergency response, and develop realistic but ambitious environmental requirements.
- Transarctic sailing routes should be established, with traffic monitoring.
- Effective electronic information exchange and monitoring systems across sectors and national borders in the circumpolar region are essential.
- The Norwegian Shipowners' Association will make the safety of people and the environment focal for its efforts relating to ship recycling.
 - The shipping companies have full responsibility for ensuring that their ships are properly recycled. This also applies to ships sold to third parties prior to recycling.
 - The Norwegian Shipowners' Association urges its members to comply with the Hong Kong Convention, despite this not yet having come into force.
 - The Norwegian Shipowners' Association urges its members to choose recycling facilities that comply with the Hong Kong Convention.
 - The Norwegian Shipowners' Association strongly advises its members against recycling their ships in Bangladesh, unless closely monitored and undertaken as part of projects aimed at improving standards in line with the Hong Kong Convention.
- Shipping companies with head offices in Norway and Norwegian seafarers provide the foundation for innovation and the development of beneficial environmental solutions for the maritime industry. This is predicated on competitive conditions for shipping companies, their owners and seafarers:
 - Competitive shipping company taxation that safeguards continued presence in Norway.
 - Competitive taxation of shipowners that safeguards proactive private owners and healthy entrepreneurialism. The present tax on shipowners is not competitive.
 - A competitive register of shipping/flags for maintaining our position and identity as a maritime superpower.
 - A competitive net wage scheme for seafarers.
 - The Norwegian Shipowners' Association maintains that tomorrow's winners will be focused on energy efficiency and green solutions.



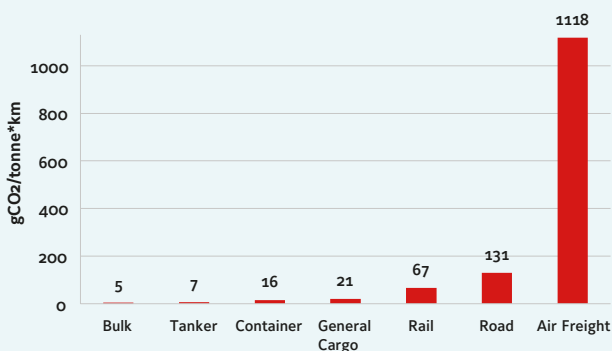
Climate

Climate change is one of the greatest challenges we face. As a key industrial sector, shipping has a responsibility to help ensure sustainable growth and reduce greenhouse gas emissions. Around 90 per cent of inter-continental goods are handled by shipping. We will assume our responsibility by stimulating and encouraging the development of larger and more efficient vessels, of technological improvements and innovations and by optimising onboard procedures. In addition, we will continue to work for ambitious international requirements for environmental improvements and energy-efficiency in compliance with the IMO decision of summer 2011, which laid down global provisions concerning future emissions of greenhouse gases from international shipping.

The Norwegian Shipowners' Association wishes to help solve the world's climate challenges and supports measures in keeping with the environmental vision of combating climate change and encouraging green shipping. The Association also maintains that emissions from shipping can and should be reduced further. This will only be possible by deploying the available environmental technology that exists on the market and through innovation and technological advances.

Shipping is energy-efficient. A container ship can carry a load of 1 kg approx. 120 km for an emission of 1 kg CO₂. A diesel-powered train can carry the load 60 km for the same emission, a lorry 20 km and a Boeing 747 just over 1 km.

CO₂ emissions during transport



SOURCE – DET NORSKE VERITAS

Emissions of CO₂

Emissions of CO₂ are the most important cause of global warming and climate change. Other important gases which cause climate change include methane, nitrous oxide and fluorinated gases. It seems clear that fuel for powering ships will continue to be based on fossil energy sources for many years. However, regulations will lead to fuel becoming increasingly cleaner and more expensive³ and we will see a marked increase in the use of low-sulphur heavy fuel oil, marine diesel oil, marine gas oil, biogas and liquid natural gas, together with the development of cleaning technologies.

Work is being done internationally, regionally and nationally to restrict emissions of greenhouse gases.

³ PWC 04/2011 – Reducing CO₂ emissions from international shipping



Shipping was the first to produce binding global emissions regulations across an entire industrial sector. This was effected through the IMO decision of 2011 to regulate greenhouse gas emissions from international shipping.

The IMO decision means that new vessels from 2013 onwards must be built to comply with an *Energy Efficiency Design Index* (EEDI) which sets an emissions limit for transportation activities performed by ship (CO₂ per tonne/nautical mile). All ships must also have a *Ship Energy Efficiency Management Plan* (SEEMP). The SEEMP has been developed by the industry itself. It entails the ship, having a written plan, giving an account of the technical and operation measures the vessel must follow in order to operate at the highest level of energy efficiency.

The Norwegian Shipowners' Association considers that the EEDI and SEEMP are not in themselves sufficient for achieving the desired emissions reductions and the Association therefore asserts that the IMO decision

Shipping is an energy-efficient means of transport with a large potential for further emissions reductions. The world's ocean-going fleet consists of more than 100,000 vessels and in 2008 the IMO estimated⁴ that the fleet then accounted for 2.7 per cent of anthropogenic CO₂ emissions. This is similar to what the industrial nation of Germany produces. Norwegian-controlled ships represent around 5 per cent of emissions from shipping, corresponding to just over 50 million tonnes.

⁴ Second IMO GHG Study 2009

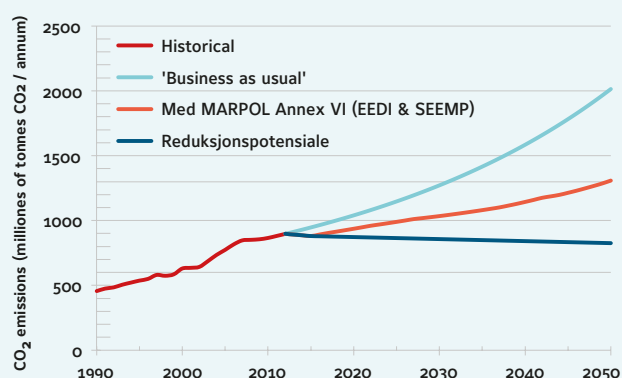
must be followed up by a market-based mechanism, which puts a price on emissions above the limits established by global regulations. The Norwegian Shipowners' Association maintains that a tax-based system is the market mechanism that most effectively ensures that the objective of an emissions reduction from shipping is achieved. The tax should be held in an international fund which makes subsidies available for research and development in climate initiatives within shipping.

A regulation has been adopted to reduce the sulphur content of bunkers on a worldwide basis from 2025 at the latest. This decision will probably lead to a considerable increase in the price of bunkers and this will be the dominant cost driver for shipping companies up to the year 2030.

At the same time, it is reckoned that the development of different bunkers types and qualities will intensify and it will be relevant to monitor the refineries' ability and capacity to produce the required bunkers quality. The pressure for a total ban on heavy fuel oil is increasing, the need for further reductions in CO₂ emissions persists and the pressure for emissions reduction from the public and politicians is expected to mount. In addition, the use of gas, both natural gas and biogas, will probably expand in a number of segments and come to represent a significant share of the bunkers consumption of shipping. In this respect, the export of shale gas from the USA will be a market factor, while different types of biofuels will probably be developed and introduced for maritime use. The drivers behind this development will continue to be persistent demand from the international community to reduce all types of emissions, both aquatic and atmospheric.



CO₂ emissions from International shipping between 1990 and 2050



THE FIGURE SHOWS THE HISTORICAL CO₂ EMISSIONS FROM SHIPPING (GREEN) WITH A PROJECTION OF WHAT EMISSIONS WOULD BE IF WE CONTINUE AS AT PRESENT (BLUE), HOW THE EMISSIONS ARE AFFECTED BY THE MARPOL RESOLUTIONS IN 2011 (RED) AND THE DIFFICULTIES WE STILL CONTINUE TO FACE IF THE SAME EMISSIONS AS IN 2007, 870 MILLION TONNES, ARE TO BE ACHIEVED (VIOLET). SOURCE – DET NORSKE VERITAS

In order to support the IMO's work, in the autumn of 2012, the EU decided to establish a Monitoring, Reporting and Verification system (MRV) for CO₂ emissions from shipping. This measure will assist in raising awareness and knowledge of the extent of CO₂ emissions. Such a system will also supply up-to-date data as a basis for a pricing mechanism for emissions above the emissions ceilings adopted in future.

For several years now, the Norwegian Shipowners' Association has expressed its view that there is a need for more information about CO₂ emissions from shipping, in order to be able to choose the most appropriate means of global regulation. To underpin shipping's position as the greenest means of transport, it is important for the system not to be exclusively based on bunkers consumption, but also to document the transport work

performed or distance sailed for such consumption. CO₂ emissions are linked to bunkers consumption, where 1 tonne of bunkers consumed produces in excess of 3 tonnes of CO₂ emissions, slightly depending on the bunkers quality. If only bunkers consumption is taken as the basis, without a more thorough explanation of the reason behind the bunkers consumption, shipping alone will emerge with higher CO₂ emissions as the market and world trade pick up. It will discredit shipping as a means of transport if the emissions figures are not accompanied by details of how much load is transported over a specified distance as a result of this consumption.

The Norwegian Shipowners' Association believes that an MRV system, which maps CO₂ emissions from international shipping for transport work performed, will facilitate implementation of the most appropriate system based on up-to-date empirical data. The Norwegian Shipowners' Association accordingly supports the EU's ongoing efforts in this area. In extension of the EU's MRV initiative, the Norwegian Shipowners' Association wishes to facilitate this type of reporting among its own members, by collecting and publishing annual CO₂ emissions in the form of an annual statistical report. On a national scale, a number of the Association's members already perform such monitoring, measuring and reporting of CO₂ emissions on their own initiative, but also through participation in the FRAM project.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association will work with national and international authorities to develop and make room for a global market-based mechanism through the IMO to help reduce greenhouse gas emissions.
- The Norwegian Shipowners' Association will seek to establish a CO₂ Fund, on the model of the NO_x Fund, capable of supporting measures to reduce emissions of greenhouse gases.
- The Norwegian Shipowners' Association shall be a leader and constructive representative of shipping in international work to establish a system for Monitoring, Reporting and Verification (MRV) as support and background for a global, market-based instrument for the pricing of CO₂ emissions.
- The Norwegian Shipowners' Association shall contribute to openness surrounding shipping's CO₂ emissions by publishing aggregated figures for the members' annual total bunkers consumption as part of regular environmental reporting.

The FRAM project:

In February 2009, the Torvald Klaveness, Wilh. Wilhelmsen, Höegh Autoliners, BW Gas and Grieg Star shipping companies established a working group, named WG5, to focus on environmental issues. Solvang ASA joined the partnership in 2011. The object of WG5 is to contribute to the Norwegian Shipowners' Association's environmental vision of "no environmentally harmful emissions or discharges to the air or sea" by establishing green projects and initiatives. One of the projects, initiated in March 2012, is FRAM. This is a co-project between the WG5 group, the WWF, Det Norske Veritas and the Norwegian Shipowners' Association, focusing on measures to reduce CO₂ emissions from Norwegian-owned, Norwegian-controlled and Norwegian-operated fleets, and working on

energy efficiency among Norwegian-controlled ships in international shipping.

The project has two purposes:

- To establish a common system for collecting, verifying, storing and reporting greenhouse gas emissions data from the Norwegian fleet.
- To establish a forum for goal-oriented work on energy efficiency at individual shipping company level and in partnership between the companies.





Clean Air

Politicians and environmental organisations around the world have a keen focus on atmospheric pollution from shipping, especially in densely populated and urban areas. The Norwegian Shipowners' Association is seeking continually to restrict atmospheric emissions from ships. We would like to see ambitious global regulations that apply to shipping anywhere and everywhere in the world.

The International Convention for the Prevention of Pollution from Ships, MARPOL 73/78, is intended to prevent and reduce pollution from shipping – both from day-to-day operations and resulting from accidents. The material rules are set out in six Annexes. These concern oil pollution (I), noxious liquid substances (II), harmful substances in packaged form (III), sewage (IV), garbage (V) and air pollution (VI). The rules are at times very detailed and supplemented by appendices. To ratify the MARPOL Convention, states only need to accept Annexes I and II. The other Annexes are voluntary, but can also be ratified. All six MARPOL Annexes are in force. Ships must fulfil all the requirements which the coastal state has made binding.

Atmospheric pollution is the emission of foreign matter into the air in such quantities that human health and well-being is affected, or that the climate, animals, plants and other features of the environment are harmed. Atmospheric pollution from shipping includes sulphur oxides (SO_x), nitrogen oxides (NO_x), and particulate matter (PM). These are chemicals which contribute to precipitation, eutrophication (increased growth in phytoplankton) and poor air quality.

Reducing emissions of atmospheric pollutants will require strict new international requirements to come into force in the next few years. Through technical and operational improvements and a substantial transition

to the use of low-sulphur fuel, the coming years will see a major reduction in the emission of sulphur and nitrogen gases from ships. For example, advanced cleaning technologies in the shape of catalytic converters which reduce NO_x emissions and scrubbers which reduce SO_x emissions will be important technologies for meeting future emissions requirements and contribute to cleaner air.

Emissions of sulphur oxides – SO_x

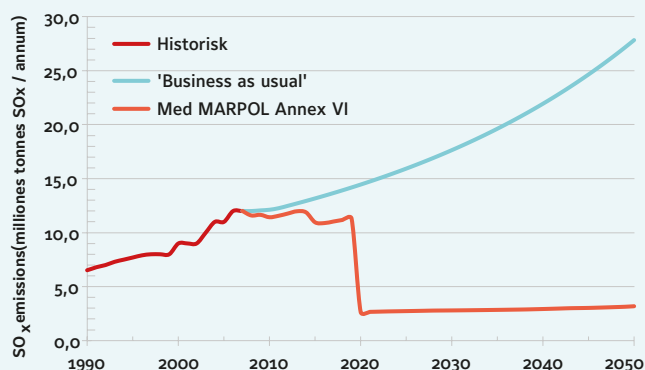
The sulphur oxides (SO_x) are compounds containing sulphur and oxygen. When hydrocarbons such as coal, oil and gasoline containing sulphur are combusted, sulphur dioxide is created as a by-product. Sulphur emissions cause acid rain and in high concentrations are harmful to humans – especially asthma sufferers. In recent years, strict international requirements for the reduction of sulphur emissions from ships have been adopted, and the Norwegian Shipowners' Association has been an active driving force in achieving these.

Pollution from ships is regulated internationally through the IMO's MARPOL convention: International Convention for the Prevention of Pollution From Ships*. The provisions in MARPOL apply to all vessels over 400 GRT, all fixed and mobile platforms and floating and submersible installations. In 2008, the IMO adopted stricter rules for limiting emissions of SO_x, NO_x and PM. These were incorporated into the MARPOL Conven-

tion's Annex concerning atmospheric pollution, MARPOL Annex VI.

In the new emissions regulations, the legal limit for sulphur content in bunkers was reduced to 3.5 per cent as of 1 January 2012. The limit will be further reduced to 0.5 per cent from 1 January 2020, but, depending on an assessment of whether the oil refineries are managing to produce sufficient low-sulphur bunkers, the provision may be deferred to 2025. Within areas where special concern for emissions is considered necessary, the limits are even stricter. The Emission Control Areas (ECAs) include the Baltic Sea, the North Sea and coastal areas off the USA and Canada. Under IMO regulations, vessels operating in ECAs must, by 1 January 2015, meet the emissions threshold requirements corresponding to use of bunkers with a maximum sulphur content of 0.1 per cent.

SO_x emissions from international shipping between 1990 and 2050



THE FIGURE ILLUSTRATES THE DROP IN EMISSIONS OF SULPHUR OXIDES FROM SHIPPING AS A CONSEQUENCE OF GLOBAL REGULATIONS IN MARPOL TO BE INTRODUCED IN 2020.
SOURCE - DET NORSKE VERITAS

The Norwegian Shipowners' Association supports these new emissions requirements set out in MARPOL Annex VI.

The strict emissions requirements will lead to a radical reduction in the SO_x emissions from shipping and improve the environment for individuals and communities. The Association considers it important for the international community to adhere to the SO_x provisions and ensure implementation on the same terms for everyone. Regional exemptions are invidious for a global industry such as shipping, since they can distort competition and cause trade to switch from shipping to other, less appro-

The Norwegian Shipowners' Association's position:

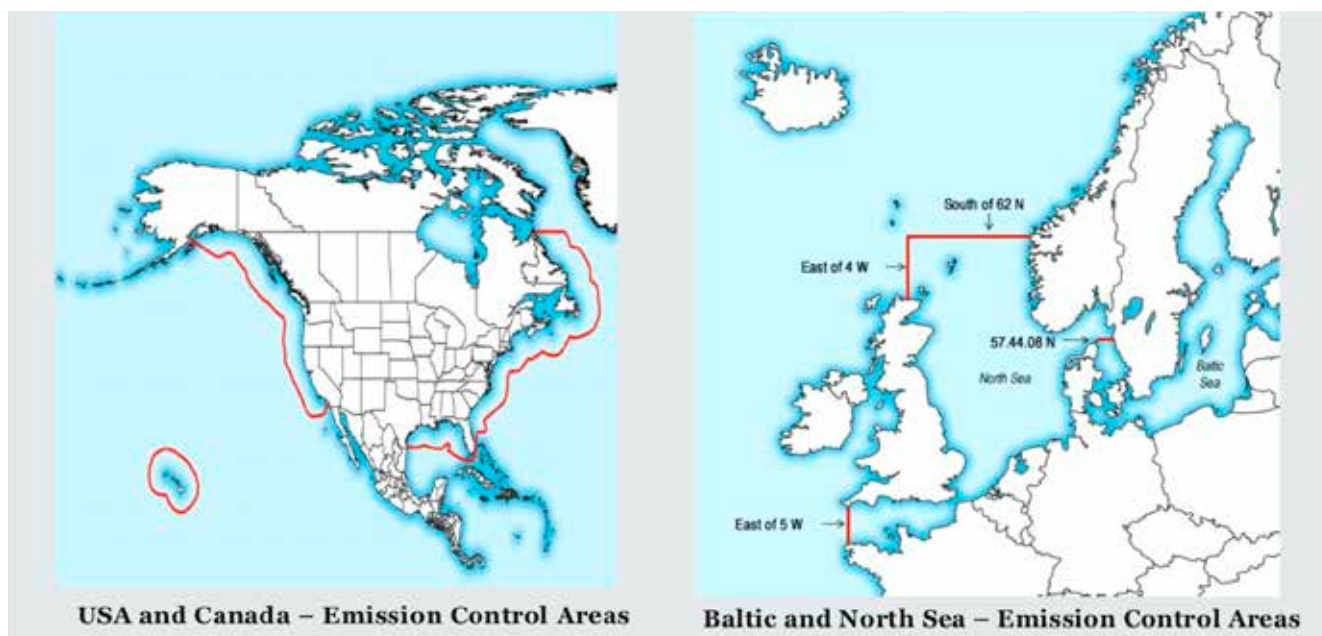
- The Norwegian Shipowners' Association supports the adopted international regulation mechanisms for SO_x emissions from shipping.
- The Norwegian Shipowners' Association believes that emissions-reducing measures for sulphur must be equated with the use of low-sulphur bunkers, for example, scrubbing of exhaust gases in open loop systems.
- The Norwegian Shipowners' Association will stimulate research and development of eco-friendly cleaning equipment for exhaust gases which reduces emissions generally and which cleans polluting and noxious exhaust gases from shipping.

priate and less green means of transport. In the period leading up to entry into force of the provisions, in order to achieve the targets shown in the table below, it is crucial for the oil companies to restructure their production with a view to meeting the estimated demand for low-sulphur bunkers.

Emissions of nitrogen oxides – NO_x

NO_x is the generic term for the two oxides of nitrogen: nitrogen monoxide and nitrogen dioxide. The main source of toxic nitrogen and phosphor compounds, including nitrogen oxides, is the combustion of hydrocarbons on land and at sea. Exhaust gases are the main cause of particulate matter, which can lead to health problems associated with asthma and respiratory problems. NO_x can also cause increased bacterial and algae growth, which in turn can cause imbalances in the ecosystem.

The revision of MARPOL Annex VI in 2008 led to stricter global NO_x requirements for shipping. The requirements can be implemented over time and within different geographical areas. The first was a requirement for an emissions reduction of 20 per cent for new engines installed in ships after 1 January 2011, compared with the emissions level in the year 2000. There is also a requirement to reduce NO_x emissions by 80 per cent for new engines installed in ships which operate within a NO_x ECA (NECA) from 1 January 2016. Today, only the coastline off the USA and Canada is defined as a NECA.



Emission Control Areas (ECAs) cover the east and west sides of the USA and the North Sea including the English Channel, and the Baltic Sea. Operations within these geographical areas are subject to special emissions restrictions for shipping. The North Sea and the Baltic Sea are already classified as a Sulphur Emission Control Area (SECA) and there are plans for the area to be also classified as a NO_x Emission Control Area (NECA). The USA has already introduced comprehensive emissions restrictions so that the areas are classified as both SECA and NECA.

MARPOL Annex VI contains a technology clause which requires a review of the technological developments for meeting the Tier III requirements, whereby the date of implementation shall be adjusted if this proves necessary. A technical expert group has reviewed the available technology and concluded that the date of 1 January 2016 for implementation of the NO_x provisions should be maintained. But some countries have argued for a deferral of the requirements for five years since there is little technology available and some of the technologies are deficient.

The Norwegian Shipowners' Association does not support the proposed deferral and wishes to maintain 2016, since we, like the technical expert group, believe there is adequate technology available to meet the requirements. A deferral is very disadvantageous for companies which have invested in research and development of technologies, and companies which are currently offering solutions to meet the requirements, but which depend on a larger market to survive.

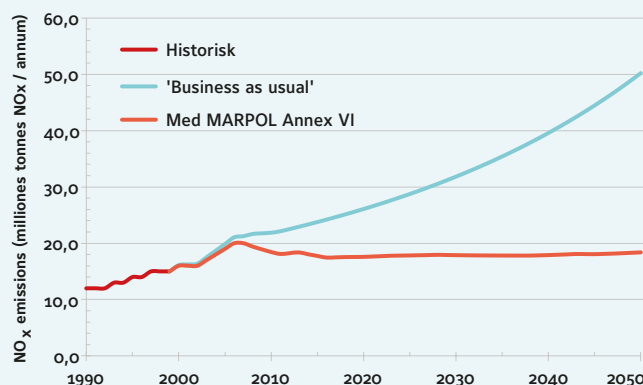
The Norwegian Shipowners' Association supports ambitious international rules and environmental initiatives to reduce atmospheric pollution. The Association recognises the importance of reducing the NO_x emissions from shipping further and supports the process under way with the aim of establishing a NECA in the North Sea and the Baltic Sea in accordance with MARPOL.

In addition to international requirements for NO_x emissions, Norway, in signing the Gothenburg Protocol in

1999, has committed itself to reducing its national NO_x emissions. In order to meet these commitments, the NO_x Fund was established in 2008. The NO_x Fund is industry's own initiative for reducing the emissions. Payments into the Fund replace national NO_x taxes, and participating companies can apply for financial support for emissions-reducing measures. The NO_x Fund has been crucial for the industry in receiving subsidies for undertaking emissions reduction measures.

The Norwegian Shipowners' Association views the NO_x Fund as an important and successful instrument and will work to ensure the scheme continues after 2017. The Association maintains that the NO_x Fund has been a well-designed measure that has contributed to reducing emissions from industry and especially from shipping.

NO_x emissions from international shipping between 1990 and 2050



SOURCE – DET NORSKE VERITAS
THE FIGURE ILLUSTRATES THE DROP IN EMISSIONS OF NITROGEN OXIDES FROM SHIPPING AS A CONSEQUENCE OF GLOBAL REGULATIONS IN MARPOL IN FORCE SINCE 2000.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association believes that the adopted NO_x Tier III reduction set out in MARPOL Annex VI must be completed to schedule from 2016.
- The Norwegian Shipowners' Association supports the initiative to establish a NECA in the North Sea and the Baltic Sea in accordance with MARPOL
- The Norwegian Shipowners' Association will work to ensure continuation of the NO_x Fund after 2017.

Emissions of exhaust particles – Particulate Matter (PM)

Particulate Matter (PM) is a generic term for small combusted particles in exhaust gases. Combustion in engines results in a primary exhaust which is a complex mixture of several hundred different organic and inorganic compounds of gas and particles. The composition and volume of emissions from diesel engines depend on factors such as the fuel's composition and additives, the condition of the engine and operating conditions such as speed, load and temperature. Furthermore, the emissions are affected by different technical devices for monitoring and adjusting the mix of diesel and air and treating exhaust fumes as they flow through the exhaust plant using catalytic converters and particle filters. Emissions from diesel engines are estimated to contribute up to 50 per cent of the fine particles in the air in congested urban areas.

It is estimated that shipping accounts for around 2 per cent of global particle emissions but that this proportion may have relatively greater implications because

the emissions take place in remote and also occasionally Arctic regions. According to a project carried out by International Global Atmospheric Chemistry (IGAC), *Bounding the role of BC in the climate system: A scientific assessment* (2013), there is a high probability that emissions of particles have a significant effect on global warming.

Compared with coal-fired power stations on the continent, the effect is modest, but bunkers* such as heavy fuel oil and marine gas oil add to short-range and long-range, transboundary, pollution and increase overall particle emissions that contribute to global warming. Particles are carried by the weather over long distances and reduce the reflectiveness (albedo) of ice at the Pole, which therefore absorbs more sunlight and melts more quickly. Particles from the bunkers of ships travelling in Arctic waters will fall on the ice, dirtying it and increasing absorption of heat and sunlight.

The Norwegian Shipowners' Association considers this to be an undesirable development in the Arctic. The Association has an objective, through its environmental vision, of reducing shipping's environmental impact and carbon footprint.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association believes that there may be a need for a reduction in particulate matter from shipping. Any regulations must be knowledge-based and regulated globally through the IMO.

Wallenius Wilhelmsen

For many years, Wallenius Wilhelmsen has adopted a strategic environmental profile that involves using low-sulphur bunkers in all of its fleet. This means using a higher quality of bunkers than is necessary for complying with national and international environmental regulations on the sulphur content of bunkers. Since 1999, the company has used bun-

kers with an average sulphur content of 1,5 per cent, whereas international provisions allow use of bunkers with up to 3,5 per cent sulphur. This has reduced emissions of polluting sulphurous gases from the Wallenius Wilhelmsen fleet and positioned the company in a future eco-conscious and demanding market.

Wallenius Wilhelmsen is working on a project to install and test scrubbers on MV Tarago, which is a 38,500 DWT ro-ro vessel. The object is to acquire experience of continuous operation of scrubbers with a view to reducing emissions of SO_x, NO_x, CO₂ and PM and improving the quality of waste water. Systematic measurement and documentation will be undertaken for analysis purposes, and the results will be made available to interested shipping companies, environmental organisations and government agencies. The long-term payback of the project is expected to be results show-



ing that Wallenius Wilhelmsen can use the same quality of bunkers across its entire area of operations, both in open seas and in Emission Control Areas, while avoiding technical irregularities due to bunkers quality or other difficulties for the crew and equipment that might entail time ashore or disruption to operations.

Solstad Green Operations

Solstad's "green operations" began as a trial project in 2009, with the aim of encouraging personnel to back measures to reduce bunkers consumption in the fleet. The company began by defining green operations as operational measures which reduced bunkers consumption by at least 500 litres, and introduced systems to measure and record these measures in a simple way. As an extra initiative, the company introduced a partnership with the Rainforest Foundation, committing to pay for the preservation of a quarter of an acre of rainforest for one year for each green operation implemented. In this way, through local initiatives, a contribution could also be made to a global initiative. Many employees found this an added motivation for their environmental efforts onboard.

Each quarter, the environmental results for each ship were presented in an internal report, and those ships that delivered good environmental performances were quick to be praised for their efforts. All green operations that are recorded appear in a special list, accessible to all employees. This offers both an in-house check of the measures introduced and a way of learning from those employees who are adept at discovering effective ideas.

Solstad's green operations are often described as "the systemisation of common sense", and sharing of information between the different ships and crews is an important part of maintaining the company's vigorous environmental performance.

The work on green operations quickly yielded clear results. From an incipient 900 or so green operations in the environmental programme's first quarter in 2009, the initiative gradually expanded to the current 4000 or more green operations per quarter. This means that around 2 green operations are recorded in the company, every hour of every day all year round.

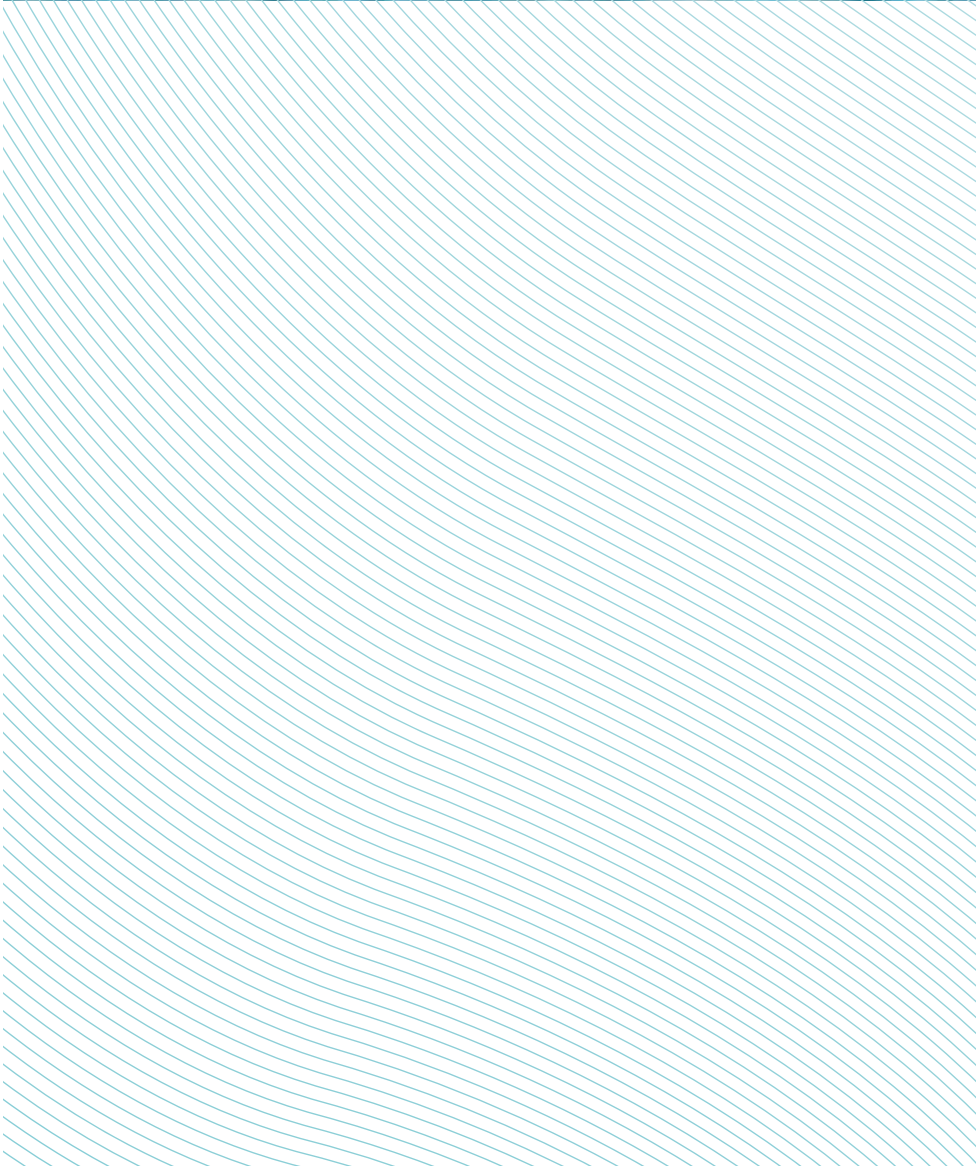


It gradually proved that the savings from Solstad's green operations were so good that they created the economic freedom to satisfy the UN's requirements for climate neutrality. Even with the purchase of carbon quotas, a ship implementing the environmental measures from green operations will be cheaper to operate than one without such measures. In 2010 Solstad Offshore therefore introduced the unique Climate Neutral Operations (CNO) concept, launched at the Offshore Northern Seas industry exhibition in Stavanger, which has attracted international interest.

The first contract for a climate-neutral vessel, the Norman Mjolne, was signed in 2011. This anchor handling vessel, built in 1985, provides clear evidence that, under the company's environmental programme, the age of a ship is not a constraint or an obstacle to sound environmental performance.

About Solstad Green Operations (SGO)

Definition of SGO:	Documented fuel savings measures of at least 500 litres.
Introduced:	Q4 2009
Quantity (2012):	18,064
Reduced emissions of CO₂:	Approx. 90.000 tonnes
Reduced bunkers costs:	Approx. NOK 170 million
Reduced maintenance costs:	Approx. NOK 25 million
Rainforest saved (2012):	18,060,000 m ² (equivalent to 990,000 tonnes of CO ₂)



Clean Seas

Pollution of the seas is a serious environmental problem and is being recorded from the Poles to the tropics and from coastal waters to the deep ocean. The coastal and inland sea environments are severely polluted. In the North Sea, Baltic and Mediterranean, the pollution is so serious that the ecosystems have suffered long-term, serious adverse impacts. The Norwegian Shipowners' Association supports global regulation to prevent the spread of undesirable species from one continent to another, and similarly ambitious requirements for environmentally sound handling of sewage and waste from international shipping. We also assert that further technological developments are needed in exhaust gas cleaning, bunkers tank protection and alternative fuels that, in the longer term, will reduce the potential for pollution from accidental discharges and further reduce atmospheric emissions from ordinary operations.

The most significant sources of aquatic pollution are the growing concentrations of coastal populations, shipping, industrialisation, offshore activities, aquaculture, tourism, littering and oil spills, as well as transfers from the atmosphere. The industry must assume its share of responsibility for helping clean up the seas. There are therefore a number of new international regulations and measures to promote, for instance, ballast water cleaning, and to prevent pollution from sewage, discharges of environmentally harmful substances, and littering of the seas.

Heavy fuel oil

For many years, heavy fuel oil has reigned supreme as the fuel for international shipping. The reason for this is that heavy fuel oil is economically the most profitable and, from a technical point of view, is a suitable fuel for maritime engines. Heavy fuel oil is also extensively used for power production in land-based industries. Engines and fuel have developed in step and it is now more than a century since the German engineer Rudolf Diesel patented a combustion engine and exhibited it at the Paris World's Fair in 1900 – it was fuelled using peanut oil.

There are presently no real commercial alternatives in the market to replace heavy fuel oil as bunkers in all segments of the shipping industry. Even though many alternative fuels and new propulsion technologies are in development, in practice, only heavy fuel oil is predictable and accessible on a global scale.

Heavy fuel oil is a residual product of the refining of crude oil, once other products such as gases, naphtha, paraffin, diesel, light fuel oils and lubricating oils have been removed. The construction and age of a refinery largely determine the quantity of residual products remaining at the end of the refining process. It can vary from 30 to 50 per cent bitumen at some refineries, down to 3 to 5 per cent coke at others. Out of concern for the total environment account, it is important to note that the percentage may change as a consequence of the refining process. The higher the proportion of light products manufactured, the more energy the refinery consumes and the “heavier” the residual heavy fuel oil. If this residual product is to be converted into better bunkers quality, the refineries must be modernised and the energy

consumption of such restructuring will be considerable. This means that the net effect of environmentally harmful emissions along the energy chain is not unreservedly positive.

The environmental consequences of the use of heavy fuel oil have resulted in a number of international regulations concerned with atmospheric emissions and emergency preparedness for oil pollution at sea. The measures cover everything from combinations of cleaning of exhaust gases, changes in engine parameters to orders concerning emergency planning and marine engineering requirements such as double-skin and less vulnerable bunkers tanks.

Global regulations already adopted will gradually change the market for heavy fuel oil. The sulphur regulations in MARPOL Annex VI introduce local emissions levels for the ECA/SECA areas which correspond to the use of bunkers with no more than 0.1 per cent sulphur from 2015. From 2020, or no later than 2025, the provisions will be expanded to global emissions levels of no more than 0.5 per cent sulphur content and include all shipping. In practice, the new rules will give shipping the choice between installing cleaning plant (scrubbers) or moving over to low-sulphur marine gas oil. In themselves, these requirements will bring about considerable changes in demand in the heavy fuel oil market. The PWC report “Reducing CO₂ emissions from international shipping”

commissioned by the Norwegian Shipowners’ Association in 2011, estimates that, whereas in 2011 the relative proportions of heavy fuel oil/gas oil were 80/20, this will gradually change to become 20/80 by 2030. The Norwegian Shipowners’ Association notes that the sulphur regulations on their own appear to be changing demand in the direction of higher bunkers’ quality in the future bunkers market. The Association therefore believes that the trends resulting from already adopted regulations are moving towards a change in the use of heavy fuel oil.

When demand changes, the refineries which produce heavy fuel oil will need to convert their production. This will be an extensive, costly and time-consuming process, and put the question to the owners as to which product qualities the market will demand in future. In the report “Future scenarios towards 2030 for deep sea shipping”, it is suggested that a refining process involving de-sulphuring of heavy fuel oil in order to satisfy the sulphur regulations will be more expensive for the producers than to manufacture higher bunkers qualities such as marine gas oil. The reason for this is an assumed higher energy consumption in the de-sulphuring process, which will also increase CO₂ emissions. What will determine the different production volumes will be the demand for the different products and the prices in the market that the refineries can achieve.

The Norwegian Shipowners’ Association’s position:

- The Norwegian Shipowners’ Association believes that the use of heavy fuel oil as bunkers for shipping presents a challenge in the contexts of climate, the environment and reputation. But today, there are no real alternatives on the market capable of replacing heavy fuel oil in all maritime segments.
- The Norwegian Shipowners’ Association therefore believes that there needs to be continued development of technology for cleaning exhaust gases and protecting bunkers tanks in order to reduce spills and emissions from ordinary operations and from accidents when using heavy fuel oil.
- Already adopted global regulations will in themselves entail a considerable change in the years ahead in the direction of reduced consumption of heavy fuel oil. The Norwegian Shipowners’ Association will therefore seek to promote the development of commercially relevant alternatives to the use of heavy fuel oil. The alternatives must yield a documented environmental gain and satisfy relevant health, safety and environmental requirements.

Accidents and incidents leading to discharges of heavy fuel oil and lubricating oils into the sea happen relatively rarely, but have major adverse impacts. The consequences for the environment and society and of wide media coverage of accidents have given factual and emotional arguments to politicians and green organisations nationally and internationally in favour of putting a global ban on the use of heavy fuel oil as bunkers on the agenda. The effects on humans and the environment ensuing from the pollution from the Exxon Valdez (1989), Erika (1999) and Prestige (2002) tankers were considerable, with both large oil cargoes and bunkers damaging the environment; these made a fundamental contribution to the development of the UN's MARPOL pollution prevention convention. But bunker spills from the Server (2007) and Full City (2011) incidents on the Norwegian coast also placed more focus on the negative impacts of accidental discharges from shipping.

The heavy fuel oil supplied to the market today is a relatively cheap, safe and thoroughly tested fuel option. Nonetheless, the use of heavy fuel oil involves challenges under normal operation relating to maintenance and atmospheric pollution from sulphur and particles. On the emissions side, both aquatic and atmospheric, the industry has worked to deal with heavy fuel oil consumption. For example, equipment has been installed on board to clean exhaust gases, as described above. In addition, constructional improvements have been made to prevent spills in the event of an accident by building double-skin fuel tanks and positioning them where they will be less exposed in the case of grounding. This is one area where Norwegian shipping companies and equipment suppliers have a great international lead.

Extensive efforts are in progress to develop new, alternative marine propulsion forms such as fuel cells, biofuel and wind. The commercial fossil fuel alternatives to heavy fuel oil presently available are however very limited, and those that do exist, such as diesel and LNG, have other types of difficulties associated with energy consumption during refining and the pollutants they contain. These factors must be evaluated within



the overall environmental account, in addition to the global availability of alternative fuels, before any further restrictions in the use of heavy fuel oil are implemented.

The use of heavy fuel oil in shipping represents a challenge for the climate and environment. But today, there are no real alternatives on the market capable of replacing heavy fuel oil in all maritime segments.

The Norwegian Shipowners' Association therefore believes that there needs to be continued development of technology for cleaning exhaust gases and protecting bunkers tanks in order to reduce spills and emissions from ordinary operations and from accidents when using heavy fuel oil for propulsion.

Ballast water

The dispersal of harmful and invasive species to the waters are one of the largest global threats to natural diversity. Marine species often have good natural dispersal abilities, and many arrive annually with the ocean currents. It can therefore be difficult to determine whether a species which is observed for the first time has arrived of its own accord or been carried with human assistance. We consider a species to be introduced when it establishes itself in a new area it could not have spread to without human intervention. The result of such an introduction is often a change in the natural composition of species, which will upset the local eco-system. Shipping is one of the core human activities responsible for the spread of marine species. Dispersal occurs primarily when ships take on ballast water* in one port and release it in another. Species which grow on ship hulls are also an important factor in the translocation of species from one ecological environment to another.

In February 2004, the IMO adopted a convention for the Control and Management of Ships' Ballast Water



and Sediments, also known as the Ballast Water Management Convention. The purpose of the Ballast Water Management Convention is to reduce the threat to the marine environment constituted by the introduction of foreign organisms via ships' ballast water. The Convention will apply to all vessels in international shipping.

The Norwegian Shipowners' Association supports the Convention and over the years has worked to secure its implementation as rapidly as possible. At the same time, the Association notes that international shipping faces a number of practical challenges in implementation and in meeting the requirements within the defined deadlines. Internationally, there are questions as to whether there is enough approved cleaning equipment on the market, whether the shipyards have sufficient capacity for installing it, and, given the number ships, up to 50,000 in 2017, whether the initial deadlines were not too short.

The Norwegian Shipowners' Association notes that the deadline has been extended so that ships constructed before entry into force of the Convention must fulfil the treatment requirements at their first periodic International Oil Pollution Prevention (IOPP) Certificate renewal survey after entry into force of the Convention. In practice, this entails the deferral of the need to install cleaning equipment for an indeterminate period until

the Convention enters into force, while the installation requirement is spread over a 5-year period (the IOPP period). The drawback of this deferral is that it does not credit those shipping companies that already have equipment installed, it effectively penalizes loyal first-movers in international shipping, and it alters the international, consensual decision basis on which the investment in treatment equipment was originally based.

The Norwegian Shipowners' Association notes that, in June 2012, the USA implemented regional provisions on the treatment of ballast water in American waters which exceed the provisions in the Convention. The rules entail that all vessels sailing in US waters must

The Ballast Water Management Convention:

The IMO, the International Maritime Organisation, established the Ballast Water Management Convention at a diplomatic conference on 13 February 2004. The International Convention for the Control and Management of Ships' Ballast Water and Sediments regulates the uptake, discharge and treatment of ballast water and sediments. The treatment requirement means that ships have to replace their ballast water in specific zones or at set distances from the coast. Over a defined time period, a requirement to clean ballast water before it is discharged is being introduced, to the effect that, after a certain time, all ships will have treatment technology on board. The Convention will come into force 12 months after at least 30 nation states which together comprise more than 35 per cent of the global merchant fleet's gross tonnage have submitted the relevant documentation. Norway signed the Convention in December 2006. Since 2004, 36 states comprising 29.07 per cent of the global merchant fleet's gross tonnage have ratified the Convention.

Principles for treating ballast water:

- Mechanical technology – filtration
- Physical technology – UV radiation
- Chemical technology – oxidation (chlorination) / biocides
- Combination technologies – filtration/oxidation, filtration/UV radiation, UV radiation / pressure/vacuum system

When alien species are introduced to an ecosystem, they are hard to remove and represent a serious threat to the existing variety in the habitat.



The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association will work to have the Ballast Water Management Convention implemented as soon as possible.
- The Norwegian Shipowners' Association believes that the special national rules are a source of uncertainty for the industry and will work to ensure such situations are avoided, especially considering the major investments that installation of approved treatment equipment requires.
- The Norwegian Shipowners' Association does not support amendments to the regulations for type approval of treatment equipment for ballast water. We will work for a grandfather clause for already approved equipment pursuant to the IMO's regulations.

Torvald Klaveness Group: - the greatest individual environmental benefit will come from combining technical and commercial know-how to develop vessel designs that allow transport in both directions, thereby reducing the time the ship is in ballast and maximising transport effort per tonne of bunkers. A culture of innovation focused on the environment is leading to new green technology developments.

Treatment of ballast water – for centuries, the management of ballast from ships has created imbalances in ecosystems around the world. For example, the discharge of untreated ballast water has resulted in the introduction of unwanted species from one marine ecosystem into another. In partnership with Optimarin, Torvald Klaveness Group has developed ballast water treatment equipment that is available on the commercial market and will be installed in the shipping company's latest newbuilds.

have type-approved equipment on board in compliance with the US Coast Guard's own guidelines. Ships with type-approved equipment in compliance with the IMO's guidelines will therefore have to apply for additional approval. As a matter of principle, such national provisions are considered to be extremely detrimental and undermine the IMO's position as a global regulator for shipping. The Norwegian Shipowners' Association believes that the special rules adopted in the USA are a source of uncertainty for the industry, considering the major investments that installation of approved treatment equipment requires.

Sewage

Water pollution is a major international environmental problem and a primary cause of the spread of disease among humans and animals. Runoff of nitrates and phosphates from agriculture, combined with sewage discharge and pollution from industrial eco-toxins has caused serious pollution of the Baltic Sea. The same is true of inland seas, such as Lake Baikal in Russia and Lake Erie in the USA. Pollution has also contaminated the groundwater in many parts of the world.

There are strict international rules for preventing sewage pollution from international shipping. MARPOL Annex IV stipulates that ships without an approved sewage



treatment facility on board must be 12 nm from land and moving at a specific speed through the water in order to discharge untreated sewage. Ships which have an approved treatment facility, which in practice applies to nearly all passenger ships, must be at least 3nm from land in order to discharge treated sewage. In principle, this applies everywhere outside of IMO-defined Special Areas where it is restricted.

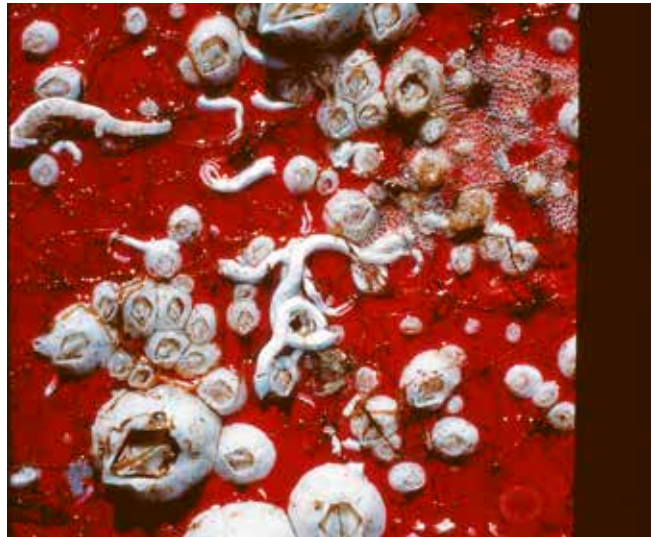
For ships constructed from 1 January 2016 onwards, the discharge of sewage is subject to a total ban. For existing passenger ships, sewage discharge will be prohibited in certain areas as of 1 January 2018. In other areas, more stringent requirements for sewage installations on passenger ships have been introduced. In these cases, the ships must be equipped with either a holding tank of sufficient capacity or a type-approved sewage treatment facility in accordance with IMO guidelines.

Garbage

A rough estimate from the “Save the North Sea” organisation reckons that around 6.5 to 7 million tonnes of garbage end up in the seas from different sources each year. If toxins from the garbage enter the food chain, the garbage can prove hazardous for both humans and animals. A total of 10 per cent of garbage in the sea is loose

netting and objects from fishing. These objects threaten the growth of fish stocks and species’ diversity. In addition to fishing paraphernalia, around 10,000 containers fall overboard each year from cargo vessels around the world. They may be loaded with hazardous cargo and thereby pose a serious threat to marine life. Floating containers may also collide with ships, with the associated risk of damage to the ship. Plastic constitutes a serious threat to the environment and animals. Estimates indicate that there are 13,000 bits of plastic garbage in each square kilometre of sea, with much higher densities in certain belts due to ocean currents. In 2002, 6 kilos of plastic were found for each kilo of plankton in the surface waters of the Pacific.

There are now international rules in place to deal with pollution from ships’ waste. In this context, waste means all types of food, domestic and operational waste, with the exception of fresh fish and parts thereof, which are produced during the normal running of the ship. MARPOL Annex V has been recently revised and regulates these matters as of 1 January 2013. Through the revision, the previous fundamental principle of MARPOL Annex V has been reversed. Formerly, it was permitted to discharge anything into the sea, except what was listed in the Convention, but the revision stipulates a general pro-



hibition against discharging anything at sea, except what is listed in the Convention. This change entails that passenger ships are now obliged to notify their passengers and crew of this prohibition against throwing anything into the sea. The Norwegian Shipowners' Association takes a positive view of this change.

Fouling and antifouling

In the past, to prevent fouling of ships' hulls, organotin compounds were used in antifouling coatings. These compounds are classified as environmentally hazardous and highly toxic for marine organisms. They are released to the environment through gradual leaching from the antifouling on vessel hulls and through spills of antifouling from various dock activities in shipyards. This may result in adverse long-term impacts on the aquatic environment because the compounds are slow to degrade and readily accumulate in living organisms.

In 2001, the IMO adopted a prohibition against organotins in antifouling on all ships. Since 1 January 2003, it has been prohibited to apply environmentally harmful antifouling to all ships, and as of 1 January 2008, in principle, such antifouling treatments are to have been stripped from all ships. The International Convention on the Control of Harmful Anti-fouling Systems on Ships (the AFS Convention) was ratified by Norway on 4 July 2003 and came into force on 17 September 2008.

Anti-fouling today is far more eco-friendly. Nonetheless, the new chemicals pose other, new challenges for the environment. Organisms now attach more easily to the hull, which in itself reduces ships' energy efficiency. Because fouling happens more quickly, more unwanted organisms are also transported to foreign waters than previously.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association will support global proposals through the IMO which impose proper handling of sewage and garbage from international shipping.
- The Norwegian Shipowners' Association will work to ensure coastal and port states fulfil their MARPOL obligations so that sewage and garbage can be managed in a sustainable and environmentally-friendly way.
- The Norwegian Shipowners' Association will work to ensure that coastal and port states contribute to the development of technology and regulations so that the cleaning of hulls, rudders and propellers can take place in ports during regular stevedoring.



The Path towards Zero Emissions

The road to zero emissions will need to run through far-sighted and targeted research and innovation. A wide range of initiatives are being taken to improve shipping's energy efficiency and to reduce its impact on climate and the environment. The Norwegian Shipowners' Association will campaign for a commitment to natural gas and biogas for vessel propulsion.

Natural gas and biogas

Natural gas was created many millions of years ago through the breakdown and conversion of ancient organic material compressed below the Earth's surface. **Biogas** is formed through the decomposition of new biological material in the absence of oxygen. The burning of natural gas reduces CO₂ emissions compared with burning oil. Biogas is considered to be climate-neutral since its combustion does not cause an increase in greenhouse gas emissions. Natural gas and purified biogas have nearly identical compositions and can be used interchangeably.

The Norwegian Shipowners' Association views the use of natural gas and biogas as an important source of cleaner energy in the years ahead. On a number of occasions, the Norwegian authorities have expressed a similar position and defined a strategic objective for Norwegian and European shipping to convert from traditional fuels to gas to the greatest possible extent. Research shows, for example, that LNG (liquefied natural gas) for ship propulsion will eliminate emissions of particles and sulphur and reduce CO₂ emissions by 15-20 per cent and NO emissions by 90 per cent. The application areas will be primarily within the energy and transport sector where LNG already is, and can continue to be, an important factor in providing environmentally-friendly ferries and greener short sea shipping, which in turn will underpin the principle of switching goods from land to sea. The Norwegian maritime cluster has a strong focus on the use of LNG and has taken a leading role inter-

nationally in terms of certification and operation. In Norwegian short sea shipping, there are currently around 35 vessels running on gas, with a further 35-40 in the pipeline over the next 5-10 years. For the Norwegian shipyard and supplier industries, for the government's petroleum revenues, and not least for the environment, it would be beneficial if Europe's short sea traffic replaced existing fuels with LNG.

In order to increase the use of gas, there must be a critical mass of gas-powered ships demanding gas as bunkers from suppliers in the ports they call at. Currently, for example, only a limited number of ports supply services within the bunkering, storage and distribution of LNG. This also makes the shipping companies reluctant to invest in LNG engines because opportunities for bunkering in the ports are limited, while potential LNG suppliers do not want to invest in plant since there is insufficient demand for the fuel from shipping.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association will work to target natural gas and biogas for ship propulsion and consolidate Norwegian shipping's position as a world leader in gas-powered ships.
- The Association will work to encourage wider distribution and increased use of gas in Norway and in Europe.

Shore power

Atmospheric pollution from ships lying in port is one of a number of emissions sources causing poor air quality both locally and globally. Ships at quayside use auxiliary engines to produce power for heating, cooling, offloading facilities and lighting. A number of measures may be useful for reducing the environmental impact of ships in port. One of these is to supply the ships with eco-friendly and sustainable hydro-electricity from the land-based electricity grid.

A national initiative for shore power would lead to more ships calling at Norwegian ports to want to install systems on board to allow the supply of electricity from onshore. Shipping faces stricter regulations dealing with atmospheric pollution, where, for example, the EU's Sulphur Directive obliges all ships in EU, from 2015, either to use fuel with a maximum sulphur content of 0.1 per cent or to connect to shore power. The EU's policy is to encourage facilities for adopting shore power since this also contributes to reducing greenhouse gas emissions.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association maintains that the use of shore power is an effective means of reducing emissions from ships in ports in built-up and urban areas.
- The Association holds that use of shore power must be viewed in a wider context of our ambition of switching goods from road to sea.

Battery-powered ships

There is a future potential for battery-powered ships. Electrification using lithium batteries is a global trend that has been under way for many years across different sectors, driven by greatly decreasing battery prices and increasing energy density. The maritime sector is now ready to join this trend.

Battery hybridisation can yield considerable reductions in fuel consumption, maintenance and environmental pollution, improve the ship's reactivity, functionality and reliability, be a storage platform for energy accumulation from heat recovery, regenerative breaking cranes and for the use of renewable energy. Batteries will also improve LNG-based solutions. Electric ships will be one means

of implementing the EU objective of increased electromobility.

The Eidesvik and Østensjø shipping companies will put battery hybrid offshore supply vessels into service in 2013. NORLED and Fjellstrand have been awarded the contract to build and operate the world's largest fully-electric battery ferry with a capacity of 120 cars for operating between Lavik and Oppedal, from 2015. The authorities, industry and DNV are engaged in activities which will mean that this new technology can be implemented in a safe, reliable, eco-friendly and cost-efficient manner.

Hydrogen-powered ships

Hydrogen may become one of the most important energy carriers in the future. Hydrogen can be produced both from renewable energy sources and fossil fuels. The use of hydrogen produces no environmentally harmful emissions, and water will be an effectively inexhaustible feedstock for hydrogen production. Although there remain certain safety challenges associated with hydrogen as an energy carrier, it can become an eco-friendly and sustainable element of future energy systems on board the world's ships, since the use of hydrogen does not entail polluting emissions. Hydrogen can be used in the same way as conventional fuels which are combusted in boilers or engines to produce heat or power; it can also be converted into electrical energy in fuel cells where the hydrogen reacts electro-chemically with oxygen and the combustion product from these hydrogen processes is primarily water.

Many people dream of a hydrogen society where pure hydrogen can be produced and stored safely and efficiently. Hydrogen could then be used as a fuel for generating electrical power on board ships and make it possible to use exclusively green and sustainable electric propulsion machinery. But there remain a number of research challenges before the hydrogen society is realistic and economically viable.

Sustainability and corporate social responsibility

Sustainability and corporate social responsibility are key prerequisites for the generation of profitability and shareholder values for Norwegian shipping companies in the long term. Sustainable business development is



«Color Magic»

“Color Magic” was fitted for shore power in 2011, and the onshore installations on the quay were constructed in summer 2011. The first connection was made in autumn 2011. This was followed by testing and improvement of safety functions due to the high voltage (11,000 volts) which entails particular safety requirements in this fully automated installation.

For a number of years, the Port of Oslo and Color Line discussed the potential for using power from onshore so that the ships’ own diesel engines could be halted while moored at Oslo. Substantive discussion of the matter began in early 2010 since there was then sufficient electrical supply available in the area and since a new international standard for the use of high-voltage electricity simplified the choice of technical solution. With a positive approach from partners such as the Port of Oslo, Bellona and Hafslund Nett, and

with a pledge of up to 30 per cent subsidy from Enova, Transnova and the Port of Oslo, a decision to go ahead with the project was made by Color Line in early 2011. In addition to “Color Magic”, the ship “Color Fantasy” was also converted for onshore power during a drydock visit in spring 2012, and by June 2012 both ships were fully ready for the regular use of onshore power – the first fully automated, high-voltage onshore power facility of its type in Norway and perhaps the world. No crew or quayside workers need to touch the installation’s conductive parts.

The plant is now working as planned and is used by the ships in more than 90 per cent of their port calls. The plant is achieving a reduction in CO₂ emissions from the ships of up to 3,000 tonnes over the year. But perhaps even more important for Oslo’s air quality is the reduction in nitrogen oxides, sulphur oxides and particles, and reduced noise in the vicinity.

about combining long-term profit with a due emphasis on ethics, the environment and social concerns in line with the requirements and expectations of society and the company’s stakeholders. It is about understanding and recognising how the industry is affected both strategically and operationally by new trends and challenges, and being able to see new opportunities and manage risk.

The Norwegian Shipowners’ Association is a leading employers’ organisation and the seafarers are our most important resource. Our members have around 55,000 employees from 50 different countries and negotiate tariff agreements with the 12 largest recruitment coun-

tries. We have accordingly endeavoured to make the Norwegian maritime industries international leaders in terms of tariff agreements, good working conditions and high HSE standards. We set high standards for our own role as employers because it helps secure for the industry highly-qualified seafarers and makes Norwegian shipping companies attractive employers. The objective is to safeguard the industry’s future competitiveness. Environmental awareness will become an increasingly important competitive advantage. If the shipping industry does not deliver on the environment, over time market shares will be lost because customers, consumers and the authorities expect environmental awareness.

For safeguarding future competitiveness, it is also key for the authorities to ensure that existing national and international regulations are actually adhered to and effectively enforced. In anticipation of binding international regulations, voluntary standards, checklists and guidelines can play an important role. But the challenges that the industry faces cannot be solved by the authorities alone. This must be done in cooperation with the industry where it is essential that the parties understand each other's challenges and dilemmas.

Competence challenges

If environmental challenges are to be solved, we need to understand the relationships between the various factors, how they affect each other and how harmful impacts can be reduced or eliminated. We can all influence the environment around us, and an understanding and basic knowledge of environmental science is important for appreciation of the importance of concerted efforts and the transnational nature of the challenges.

The environment should be an even more important feature of schooling throughout the age range. There should be more focus on environmental science in teacher training, and we must improve at using resources for environmental research and innovative approaches throughout society. The Norwegian Shipowners' Association believes that an environmental professorship could be a legitimate sub-goal for such an initiative.

Smart environmental solutions are likely to be realised in the interfaces between day-to-day operations and essential improvements. Cooperation between seafarers and engineers creates innovative solutions, and is a result of a common understanding of the factors and the significance of interdisciplinary collaboration. It is within this scenario that the Norwegian maritime cluster is strongest. A focus on environmental competence will be crucial for achieving the goals of a healthy and habitable Earth for the present and future generations.

Research, development and innovation

Few sectors are as exposed to competition and market preconditions as shipping. It is the ability to stay at the forefront of developments that has made Norwegian shipping and other maritime industry a success through the generations. This is an industry characterised by

an unparalleled ability to innovate and generate value. At the same time, it would be naïve to assume that Norwegian industry's unique capacity to innovate could not be copied by others. We cannot maintain our lead without a will to take risks and invest. We need to excel at both knowledge and innovation if we are to keep our global lead. The need for innovation is now greater than ever, and new maritime solutions must be developed in order to meet future requirements for energy-efficiency and eco-friendliness.

Research, development and innovation in the maritime industry are currently realised primarily through initiatives from the industry itself and support from national research programmes. A number of the Norwegian Shipowners' Association's members make major contributions to environmental research and development. In order for Norway to maintain its position as a maritime super power and be a pioneer for eco-friendly shipping, the Norwegian Shipowners' Association holds that Norway needs a national research policy embodying well-defined priority focus areas and which facilitates long-term holistic research based on society's and the industry's needs. The Norwegian authorities must also pave the way for innovativeness and inventiveness in the maritime industry. This includes an increased focus on and more grants for subsidy schemes for technological innovation.

Maritim 21 is an integrated strategy for maritime research and innovation developed by the maritime industry itself on behalf of the Ministry of Trade and Industry. Under the strategy, the industry highlights the following priority areas, which are all important contributors to the development of greener shipping:

- Maritime innovation and business development
- Efficient and environmentally-friendly energy use
- LNG - distribution and use
- Demanding maritime operations – vessel design, equipment, manufacture and operation
- Transport and operations in the High North

Public subsidies for maritime research are mainly granted through the **MAROFF programme** which is administrated by the Research Council of Norway. The Norwegian Shipowners' Association is on the programme board of MAROFF and has helped coordinate



the current programme schedule for MAROFF with the priorities that the industry itself set out in Maritim 21. The grants to the MAROFF programme rose substantially from 2006 to 2009, but since then the subsidy has, in practice, remained unchanged. The annual budget in 2012 was approx. NOK 130 million. For comparison, there will be a need for public investment of more than NOK 500 million per annum if the priorities set out in the Maritim 21 strategy are to be realised. On this basis, the Norwegian Shipowners' Association believes that state aid for the MAROFF programme must be increased considerably if the requirements for research and skills development in the maritime industry are to be met.

If Norway is to maintain and develop its position as a leading global maritime nation, the Norwegian Shipowners' Association believes that there is a need to invest in entirely new and visionary infrastructure for research and development. The industry has taken the initiative to create the national knowledge centre for ocean space technology, **Ocean Space Centre**, based on the world-leading centre of expertise at MARINTEK at NTNU - the Norwegian University of Science and Technology in Trondheim. The Norwegian Shipowners' Association is the largest external owner of MARINTEK and, through this ownership, is pivotal for work on Ocean Space Centre.

Ocean Space Centre is to be a maritime technology centre of expertise for the future and will create opportunities for developing advanced ocean space technology. Climate and environmental research will be key, with a special focus on sustainable exploitation of marine resources and environmentally friendly solutions for shipping. The Norwegian Shipowners' Association believes that the establishment of Ocean Space Centre will make a major contribution to Norway maintaining its position as a knowledge society. It will give Norway a new edge and provide a knowledge boost of global dimensions. Financing of the infrastructure investment necessary to realise Ocean Space Centre will be a pub-

lic sector commitment, not least because Ocean Space Centre will also be a powerhouse for research in areas other than pure marine technology.

The **Global Maritime Knowledge Hub** network was created by the Norwegian Shipowners' Association and Oslo Maritime Forum in 2008 to strengthen the Norwegian maritime research centres, and to forge links between industry and academia. As at 2013, through the Global Maritime Knowledge Hub, the maritime industry has financed 19 professorships and 2 science centres.

The Triality project

Triality is an example of a hypothetical concept from Det Norske Veritas which demonstrates the potential scope future shipping: how theoretical design and innovative thinking can be made real and implemented if the daring and capital are in place. Triality has the same cargo capacity and operation length as a conventional VLCC (Very Large Crude Carrier), but emits 34 per cent less CO₂.

With the Triality concept, the designers are showing the way ahead to energy-efficient eco-ships by achieving three key goals:

- More eco-friendly than current conventional VLCCs.
- The technical solutions are achievable and implementable.
- Lower operating costs than current VLCCs.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association believes that research and innovation are important prerequisites for securing the Norwegian maritime industry's future competitiveness.
- A complete maritime cluster is crucial for securing the development of new eco-friendly technologies and concepts for the future.



Viking Lady

Eidesvik Offshore, with head offices in Boemlo, operates 5 of the 10 gas-powered supply ships on the Norwegian Continental Shelf. “Viking Lady” is a Platform Supply Vessel for offshore installations that can run on both diesel and natural gas (LNG). Viking Lady was an environmental rallying point during the 2009 Copenhagen climate change conference.

Viking Lady also has fuel cells on board which generate electrical power using methane from LNG. A fuel cell uses only half as much fuel as a gas-powered engine, making it extremely green and climate-friendly. All the energy generators on board, whether gas-powered engines or fuel cells, supply electricity to an electrical panel which distributes it to electric motors to drive the propellers and thrusters. In addition, a container with batteries has been installed on board to provide sufficient power to run the ship when it is at the quay for stevedoring or stationary using dynamic positioning supplying goods and equipment to installations out on the field.

Overall, employing these different environmental technologies leads to a reduction in emissions of nitrogen oxides (NO_x) of 90 per cent relative to diesel-powered machinery. In addition, emissions of sulphur, soot and particles are eliminated and CO₂ emissions reduced by 25 per cent.

The emissions reductions which Viking Lady has achieved through its eco-friendly solutions correspond to the annual emissions of 22,000 cars.

The Norwegian Shipowners' Association's position:

- The Norwegian Shipowners' Association maintains that green ships are the ships of the future. Future markets will have sustainable solutions and environmentally-friendly ships, and customers in the future will want to be associated with eco-friendliness and sustainability.
- In dialogue with its members, the Norwegian Shipowners' Association seeks to evaluate how knowledge about environmentally-friendly shipping can best be shared among the members and to identify opportunities for how Norwegian industry participants can increase their cooperation to develop, implement and promote eco-friendly solutions for the shipping of the future.

Terms and definitions

- **The AFS Convention:** International Convention on the Control of Harmful Anti-fouling Systems on Ships. This Convention regulates the coatings that are permitted to be used for ship hulls.
- **The Ballast Water Management Convention:** The Ballast Water Management Convention requires that ships clean ballast water to minimise the risk of marine biological species being transferred between oceans. The Convention has not been ratified by enough countries with sufficient tonnage, and has therefore not come into force.
- **Beaching:** Ships for scrapping are sailed up onto the beach at high water and scrapped where they lie. This is a less eco-friendly alternative than scrapping in a dry dock.
- **Bunkers:** Fuel for propelling ships. Includes HFO (Heavy Fuel Oil), MGO (Marine Gas Oil) or LNG (Liquefied Natural Gas).
- **Catalytic converter:** A catalyst is a substance which increases the speed of a chemical reaction without being permanently changed itself. In the context of ships and engines, a catalytic converter means a system in the ship's exhaust system which removes NO_x.
- **ECA:** Emission Control Area, an area where atmospheric emissions (exhaust) are regulated.
- **EU:** the European Union.
- **The Gothenburg Protocol:** An international environmental treaty dealing with long-range, trans-boundary air pollution. The Protocol covers emissions of sulphur oxides, nitrogen oxides, ammonia and volatile organic compounds. The Protocol came into force on 17 May 2005 and has been ratified by most European countries and the USA.
- **IMO:** The International Maritime Organization. A UN organisation that determines international regulations for shipping. Consists of an Assembly, committees and specialist sub-committees.
- **The MARPOL Convention:** International Convention for the Prevention of Pollution from Ships. Contains 6 different annexes which regulate different aspects of a ship's emissions.
- **MARPOL Annex I:** Regulations for the Prevention of Pollution by Oil.
- **MARPOL Annex II:** Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk.
- **MARPOL Annex III:** Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form.
- **MARPOL Annex IV:** Prevention of Pollution by Sewage from Ships.
- **MARPOL Annex V:** Prevention of Pollution by Garbage from Ships.
- **MARPOL Annex VI:** Prevention of Air Pollution from Ships.
- **NECA (NO_x Emission Control Area),** an area where the ship's emissions of NO_x are regulated. Applies to newbuilds. To date, only the USA has NECAs.
- **The NO_x Fund:** The industrial NO_x Fund incorporates 15 cooperating industry organisations with the main aim of reducing NO_x emissions. The Fund is a cost-sharing organisation in which the member companies can apply for subsidies for emissions-reducing measures. For the member companies, payments to the Fund replace government NO_x taxes. Payment go into the Fund and are paid out as financial support for NO_x-reducing measures.
- **Particle filter:** a filter which removes particles, in this context from exhaust gas.
- **Scrubbers:** The exhaust gas is washed using seawater or blown through a dry reagent (dry-scrubbing) in several stages, in order to remove sulphur and particles from the exhaust. In a wet scrubber, the dry residues are separated from the water and pumped to a sludge tank, while the water returns to the sea (open loop) or is cleaned and recirculated on board (closed loop). The sludge tank is emptied on land.
- **SECA:** Sulphur Emission Control Area, an area where the volume of sulphur oxides in the exhaust is regulated by restricting sulphur in the fuel.

