



Bluer Oceans, Cleaner Environment and Sustainable Future

MOL Environment Digest 2018



Long-term Vision

To develop the MOL Group into an excellent and resilient organization that leads the world shipping industry

The MOL Group aims to manage its activities to promote sustainable growth in step with society, based on its Corporate Principles.

As a multi-modal transport group, we will:

- 1 actively contribute to global economic growth and development, anticipating the needs of our customers and the challenges of this new era
- 2 strive to maximize corporate value through creativity, operating efficiency and promotion of ethical and transparent management
- 3 nurture and protect the natural environment by maintaining the highest standards of operational safety and navigation

MOL Group Environmental Vision 2030

The Paris Agreement was established, the United Nation's Sustainable Development Goals (SDGs) were adopted, and the International Maritime Organization (IMO) has reinforced various environmental regulations in recent years; thus, demand is increasing for global environmental conservation as well as prevention of global warming, are increasing. In April 2017, the MOL Group, as an environmentally advanced company, established the "MOL Group Environmental Vision 2030" to clarify its approach to global environmental conservation.

MOL Group Environmental Vision 2030

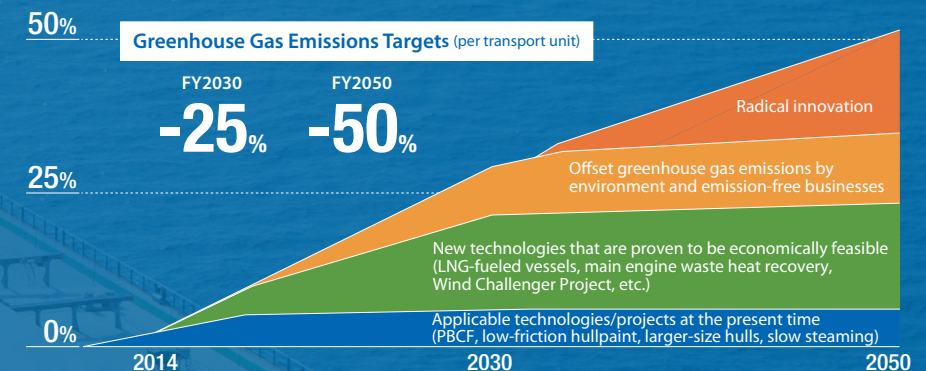
Shipping companies are responsible for undertaking the marine transportation vital to the infrastructure underpinning people's daily lives worldwide.

Meanwhile, the ratification of the Paris Agreement on climate control has unified efforts by the international community to mitigate global warming, With this in mind, the MOL Group believes that it has a social obligation to take innovative steps to help solve environmental issues such as greenhouse gas(GHG) emissions, air pollution and biodiversity impediments.

The MOL Group will grasp the environmental needs of customers and other stakeholders and provide solutions, in tandem with developing its environment and emission-free businesses into future core operations, with the aim of contributing to global environmental preservation.

'Environmental Vision 2030' Roadmap to Reduce Greenhouse Gas Emissions

The MOL Group targets reduction of GHG emissions per unit load by 25% by 2030 and by 50% by 2050 compared to fiscal year 2014.



Environmental Management Action Plan

In March 2017, the MOL Group established an action plan to address environmental issues such as global warming, air pollution, and threats to biodiversity.

Environmental Management Action Plan

- 1 Promote use and innovation of technologies for reducing environmental impact and advanced support technologies for safer vessel operation through the "ISHIN NEXT - MOL SMART SHIP PROJECT -".
- 2 Participate in projects to build vessels that run on alternative fuels such as LNG and supply alternative fuels.
- 3 Reduce greenhouse gas emissions by using ICT to optimize sailing even further.
- 4 Utilize renewable energy such as wind and solar power for vessel propulsion and at Group-related facilities in Japan and overseas.
- 5 Create environment and emission-free businesses.
- 6 Investigate emissions trading as a way to achieve greenhouse gas reduction targets.
- 7 Respond appropriately and proactively to air pollution prevention and the Ballast Water Management Convention.
- 8 Promote modal shift in transportation by enhancing the ferry and coastal shipping business in Japan.

Contributing to the achievement of SDGs

In October 2018, we formed the Sustainability Promotion Project Team with the aim of developing management strategies that contribute to achieving Sustainable Development Goals (SDGs). The "MOL Group Environmental Vision 2030" is closely linked with SDGs, so as we work to realize this vision, we will also contribute to the achievement of SDGs.



Addressing environmental issues throughout the value chain

MOL Group businesses cover a broad range of fields, from construction to dismantling of vessels, port and terminal operations, on-land warehouses, and truck transport, and the group serves a broad range of stakeholders. We will address to reduce environmental impact, not only in vessel operations and other businesses, but also in areas beyond that, wherever the environmental impact occurs, working closely with customers and other stakeholders.

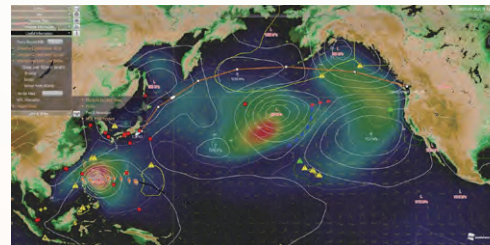
Building vessels

The MOL Group operates vessels that were built based on IMO regulations on newbuilding vessel fuel efficiency, with the aim of reducing greenhouse gas (GHG) emissions. We strive for even higher fuel efficiency than mandated by regulations by adopting various technologies to reduce our environmental impact such as Propeller Boss Cap Fins (PBCF), wind resistance-reducing vessel design, and high efficiency waste heat energy collection systems. Furthermore, we look at ways to redesign hull itself to reduce wind resistance, for example, by aerodynamically rounding the vessel's bow.



Transporting cargoes

During vessel operation, the MOL Group reduces GHGs by selecting the optimal route based on weather and hydrographic forecasts and the most efficient speed. We aim to maximize our ships' operational efficiency by leveraging IoT as well as the know-how of our mariners. In addition, we will move ahead to ensure the appropriate treatment of ballast water, which may put biodiversity at risk, and emissions of sulfur oxides (SOx), which cause air pollution.



Terminals/Warehouses/On-land transport

The Tokyo International Container Terminal has introduced a solar power generation system with a capacity of 200kW. At the same time, the MOL Group is proceeding with the introduction of more environmentally friendly cargo handling equipment and transport vehicles at its warehouses and terminals.



Dismantling and recycling vessels

Aged vessels at the end of their service lives are dismantled, and scrap steel and other materials are recycled. The IMO adopted the Ship Recycling Convention to ensure that vessel dismantling work is conducted with due concern for safety and the environment. The treaty has not yet taken effect, but we already dismantle vessels at yards that meet the standards prescribed in the treaty.



Promoting and developing 'environment and emission-free businesses into new businesses that will serve as next-generation pillars

In the management plan (Rolling Plan), launched in fiscal year 2017, we state "Develop the environment and emission-free businesses into future core operations" as one of the visions for the MOL Group Ten Years from Now. These are growth businesses such as renewable energy, alternative fuels, and prevention of CO₂ emissions, and we view them as business opportunities. CO₂ emissions from ocean-going vessels account for about 2% of the worldwide total, and have negative effects on other various environmental issues. The MOL Group also steadily promotes these businesses to fulfill its social responsibility as an ocean shipping company.

Renewable Energy Business

Generate and deliver eco-friendly electricity

- Offshore wind power generation
- Biomass power generation
- Solar power generation

In March 2017, we invested in Seajacks International Limited, which owns and operates Wind Turbine Installation (WTI) vessels, to enter in the renewable energy business. The MOL Group continually contributes to growth of renewable energy.



Alternative Fuel Business

Utilize and transport using innovative fuels

- LNG fueled vessels
- LNG fuel supply
- Ethanol ● Biomass fuel
- Hydrogen transport

In April 2019, the LNG-fueled tugboat *Ishin* was delivered, and an LNG bunker vessel is slated for delivery in 2020. MOL continues to move ahead with academia-industry-government projects aimed at expanding the use of more environmentally friendly fuels.



CO₂ Emissions Reduction Business

Support emissions reductions

- PBCF ● CCS (CO₂ capture and storage)
- Utilize wind power (for vessel propulsion)
- Northern sea routes
- Sell highly efficient equipment (storage batteries, LED lighting, etc.)

The energy-saving Propeller Boss Cap Fins (PBCF) was jointly developed by MOL, Akishima Laboratories (Mitsui Zosen) Inc., and MOL Techno-Trade, Ltd. In 2017, MOL Techno-Trade started sales of an upgraded version of PBCF, which has been proven to reduce a vessel's fuel consumption by 5% compared to a similar ship not equipped with PBCF.



Environmental Value Creation Business

Create value from environmental activities themselves and conduct related trading activities

- Invest in energy conservation and renewable energy ventures
- Emission rights businesses (sale of carbon offsets)

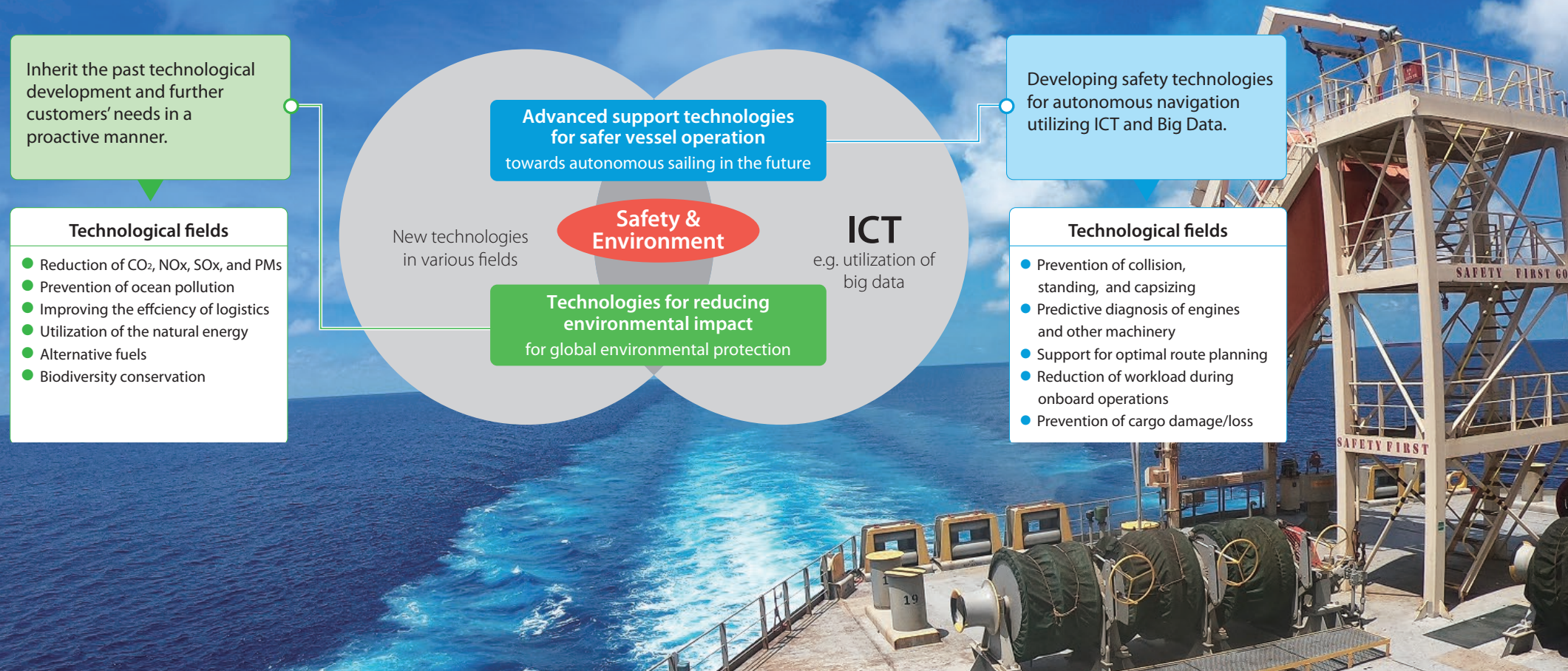
The MOL Group engages in environmental activities through various businesses besides ocean shipping. Every day, we are looking for new businesses such as emission rights and investment in renewable energy, where we can add value to our environmental activities by leveraging the know-how we have accumulated over many years.



“Senpaku ISHIN NEXT” ~MOL SMART SHIP PROJECT~

Promoting “Senpaku ISHIN NEXT” and pursuing advanced transport technologies to protecting the environment

The MOL Group launched the “Senpaku ISHIN NEXT” ~MOL SMART SHIP PROJECT~ as a new technology and development project, as a follow-up to the “Senpaku ISHIN Project” announced in 2009. In the new project, we examine a broad range of customer needs and develop underlying technologies for more advanced vessels, while sharing our technology and development policy with shareholders, including customers. We will develop advanced technologies to enhance safe operation and reduce environmental impact, connecting them as “One MOL” to more effectively meet customer needs. We believe these efforts will strengthen our business and improve corporate value.

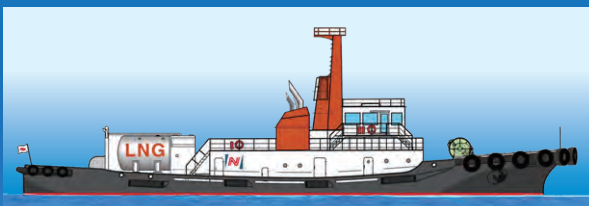


“Senpaku ISHIN NEXT” ~MOL SMART SHIP PROJECT~

LNG-fueled vessel

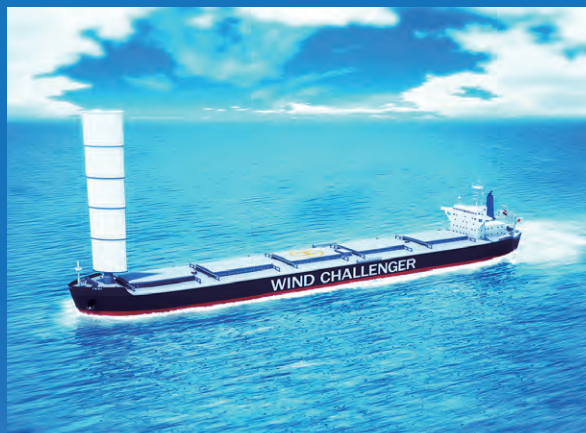
Adoption of LNG as fuel is an effective means of significantly reducing the environmental impact of ocean transport. Combustion of LNG results in almost zero SOx emissions, significantly lower NOx emissions, and about 25% lower CO₂ emissions compared to conventional heavy oil. In April 2019, the first LNG-fueled tugboat, the *Ishin*, which conforms to the IGF Code*, will be launched to serve Osaka Bay. In addition, we signed contracts for construction of an 18,600m³-type LNG bunker vessel, which is scheduled for delivery in 2020, and a long-term charter with Total.

*IGF Code: The International Code Of Safety For Ships Using Gases Or Other Low-Flash Point Fuels. The code stipulates safety requirements for vessels using gas and other low-ignition fuels, and was issued on January 1, 2017.



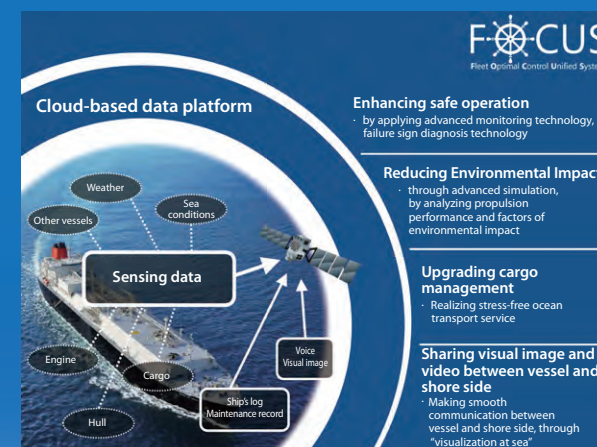
Wind Challenger

The Wind Challenger project aims to develop the technology to reduce CO₂ emissions by equipping merchant vessels with large rigid sails to aid in propulsion. The project's research and demonstration test phase was completed in September 2017, and it now enters the application and commercialization phase, conducted jointly with Oshima Shipbuilding Co., Ltd.



Utilization of Big Data

We collect and analyze detailed voyage and engine data from vessels in operation by using and applying IoT and Big Data transmitted between vessels and shoreside offices. This will help develop more advanced simulations that will help further reduce vessels' environmental impact.



Environmental Regulations

Environmental Regulations and MOL Group Initiatives

The IMO establishes international rules that require international ocean shipping companies to operate in a safe, environmentally responsible manner. These regulations, reflecting society’s growing demands for environmental conservation, become stricter every year. The MOL Group works constantly with its group companies and outside organizations to ensure timely and appropriate responses to changing regulations.

Photo Credit : BOTAŞ

Prevention of Global Warming

The Paris Agreement was established, and the International Maritime Organization (IMO) formulates measures to control greenhouse gas (GHG) emissions in the international ocean shipping industry. In April 2018, IMO adopted a measure calling for a 40% reduction in GHG emissions (compared to 2008) by 2030, and 50% reduction (compared to 2008) by 2050. To realize these targets, the IMO has been discussing ways to strengthen EEDI and SEEMP, which took effect in 2013, as well as other specific measures.



Photo Credit : IMO



Regulations to Prevent Global Warming

* Phase 3 is under discussion at IMO.

	2014	2015	2016	2017	2018	2019	2020	2025
EEDI	Phase 0	Phase 1					Phase 2	Phase 3*
SEEMP	Mandatory							
DCS						Mandatory		

In 2013, conventions related to energy efficiency (EEDI and SEEMP) were adopted as measures to reduce GHG emissions from international ocean shipping.

EEDI (Energy Efficiency Design Index) is a measure of a ship’s energy efficiency (g/ton-mile)
The required EEDI of each Phase is as follows: Phase 0=0%, Phase 1=10%, Phase 2=20% (Applied to new ships)

SEEMP (Ship Energy Efficiency Management Plan) is required to be drawn up to show optimal measures of operation that should be adjusted to the characteristics of individual ships, and to be kept onboard a ship. (Applied to both new and existing ships)

Data Collection System is intended to report fuel consumption data from ships to the IMO, which will analyze it and set strategies toward reduction of GHG emissions, including introduction of market based measures.

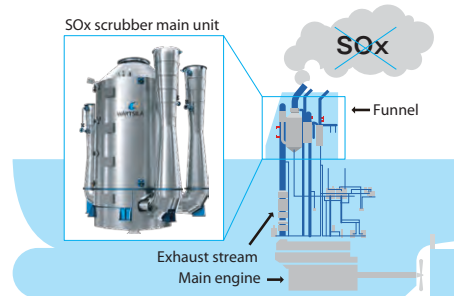
Environmental Regulations

Prevention of Air Pollution

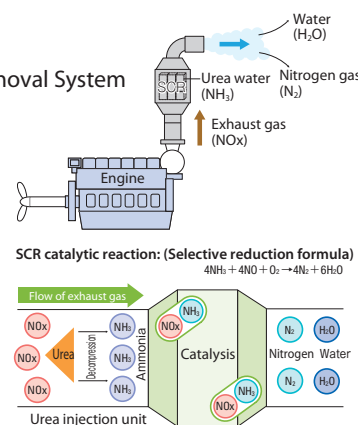
Nitrogen oxides (NOx) and sulfur oxides (SOx) cause acid rain and air pollution. IMO decided to reduce the maximum permitted sulfur content in fuel oil from the current 3.5% or less to 0.5% or less after 2020. A critical issue is whether shipping companies will be able to procure fuel oil that meets those standards on a timely basis.

MOL has decided to equip some of its vessels with SOx scrubbers, and is moving ahead in cooperation with scrubber manufacturers and shipyards.

SOx Scrubber



NOx Removal System (SCR)



Regulations to Prevent Air Pollution

		2014	2015	2016	2017	2018	2019	2020
SOx (sulfur oxides)	General sea area	Sulfur content 3.5%						Sulfur content 0.5%
	ECA	Sulfur content 1.0%	Sulfur content 0.1%					
NOx (nitrogen oxides)	General sea area	Tier II regulation						
	ECA	Tier II regulation		Tier III regulation				

SOx Emissions Regulations: Sulfur content in fuel oil is controlled to reduce SOx in exhaust emissions. From 2015, the ratio level in the Emission Control Areas (ECAs*) was reduced to 0.1% or less. In October 2016, the IMO decided to reduce sulfur content in fuel oil to 0.5% or less even in general sea areas after 2020.

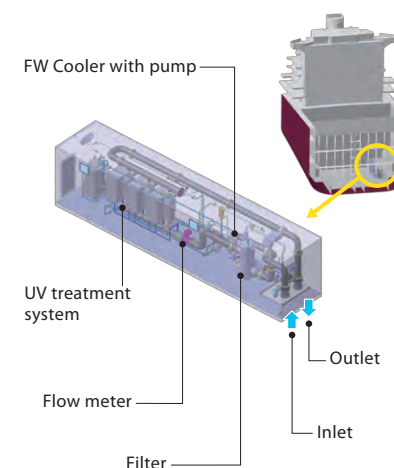
NOx Emissions Regulations: NOx in exhaust gas from engines is controlled in a step-by-step manner. Tier I regulates emission levels by rated engine rpm, targeting vessels built between 2000 and 2010. Tier II requires vessels built in 2011 or later to reduce a further 15.5-21.8% from the Tier I level. In the ECAs*, Tier III applies to vessels built in 2016 or later, requiring reduction of 80% from the Tier I level.

*ECA-designated sea areas: ① North America Coast – within 200 nautical miles (SOx/NOx), ② United States Caribbean Sea (SOx/NOx), and ③ Baltic Sea and North Sea (currently SOx only, SOx/NOx in 2021 and later).

Conservation of Biodiversity

A convention to prevent cross-border transfer of foreign marine organisms through vessel ballast water was adopted by the IMO in 2004 and has been in effect since September 2017. Under the convention, vessels, including existing vessels, are mandated to install ballast water treatment systems, by September 2024.

In fiscal 2014, MOL set a Company-wide policy to install ballast water management systems on our vessels before the convention took effect. We have already completed installation on 114 owned vessels (as of April 2018).



Regulations to Protect the Marine Environment

		2015	2016	2017	2018	2019	2020
Ballast Water Management Convention	General sea area	Adopted in 2004: yet to take effect			Mandatory		
	USCG regulations	Enforced in 2012	Mandatory				
Ship Recycling Convention		Adopted in 2009: yet to take effect, effective year undetermined					
Convention on Biofouling on Hulls		Guidelines adopted in 2011					

Ballast Water Management Convention: A convention to prevent cross-border transfer of foreign marine organisms through vessel ballast water was adopted by the IMO in 2004 and has been in effect since September 2017. Under the convention, vessels, including existing vessels, are mandated to install ballast water treatment systems, by September 2024.

USCG Ballast Water Management Regulations: The United States Coast Guard regulations took effect in 2012. They are almost the same in content as the Ballast Water Management Convention; they require a unique type of approval for ballast water treatment systems. From 2016, all vessels calling at U.S. ports are required in principle to install ballast water treatment system at the first docking.

Ship Recycling Convention: It aims to prevent workplace accidents and environmental pollution in ship recycling. It was adopted in 2009, and will be issued 24 months after the requirements are satisfied. It sets standards for ship recycling facilities and recycling procedures, and requires ships to create, maintain and update an inventory list of onboard hazardous substances.

Convention on Biofouling on Hulls: As marine organisms attached to the bottom of ships and crossing national borders have emerged as an environmental issue, IMO is discussing ways to address it. The "Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species" was adopted in 2011, and may be incorporated in a future treaty.

External Recognition

Environment Related

ISO 14001 Certification **A**

MOL has used its own environmental management system, MOL EMS21, since April 2001, and it holds ISO 14001 certification, an international standard for environmental management. (Since 2003)

ISO 50001 Certification

MOL acquired ISO 50001 certification for its energy management system and ISO 14001 certification for its environmental management system.

Certified companies: MOL Ship Management Co., Ltd. (Since 2014), MOL Ship Management (Singapore) Pte. Ltd. (Since 2014), and Magsaysay MOL Ship Management, Inc. (Since 2015)

Certified as "A-" in CDP Climate Change Report 2017

MOL was rated Leadership Level "A-" in research analyzing climate change data through CDP, an international non-governmental organization. (2017)

NOAA's Channel Islands National Marine Sanctuary Honors MOL with Award

The United States National Oceanic and Atmospheric Administration's (NOAA) Channel Islands National Marine Sanctuary has honored MOL with an award for the company's participation in the 2016 Vessel Speed Reduction (VSR) incentive program. (2017)

3 vessels Earn 'Technology Special Prize' in Ship of the Year 2016 Awards **B**

Three MOL methanol carriers Taranaki Sun, Manchac Sun, and Cajun Sun - the world's first equipped with methanol-burning dual-fuel low-speed diesel main engines - received the "Technology Special Prize" in the Ship of the Year 2016 awards sponsored by The Japan Society of Naval Architects and Ocean Engineers (JASNAOE). (2017)

"PBCF" Selected by Port of Vancouver's Environmental Program

Propeller Boss Cap Fins (PBCF), co-developed by MOL, was selected as a vessel noise-reduction technology by the Eco Action Program implemented by Port of Vancouver, Canada. (2017)

"PBCF" Receives 2017 Nikkei Global Environmental Technology Award

Propeller Boss Cap Fins (PBCF) which is jointly developed by MOL received the 2017 Nikkei Global Environmental Technology Award, which is presented by Nikkei Inc. (2017)

A**B**

3 Vessels Earn the MLIT's Minister Award and the JMA's Director-General Award

Three MOL-operated vessels received commendations from the Minister of Land, Infrastructure, Transport and Tourism (MLIT), and Director-General of the Japan Meteorological Agency (JMA) for the contribution of meteorological work's development by observing marine weather conditions. (2018)

< The MLIT's Minister Award >

LNG carrier [Al Bidda]

< The JMA's Director-General Award >

Bulk carrier [Energia Centaurus]

LNG carrier [Energy Navigator]

Containership 'MOL Truth' Earned 'Ship of the Year 2017'

20,000 TEU containership MOL Truth, one of the world's largest containership built in Japan, has received the "Ship of the Year 2017" award from the Japan Society of Naval Architects and Ocean Engineers (JASNAOE). The MOL Truth earned high evaluations as a cutting-edge "eco ship" that makes full use of the most advanced telecommunication and IoT/AI technologies. (2018)

LNG-fueled Tugboat *Ishin* Earns Highest 4-star for Coastal Ship Energy Conservation Rating **C**

LNG-fueled Tugboat *Ishin* earned the top rating of four stars from the Ministry of Land, Infrastructure, Transport and Tourism's energy-saving rating scheme for Japan's coastal ships. The *Ishin* is highly evaluated its environmental performance. (2018)

MOL's Next-generation Car Carrier FLEXIE Series Wins Good Design Award 2018 **D**

MOL-operated next-generation car carrier series "FLEXIE" received the Good Design Award 2018, from the Japan Industrial Design Promotion Organization (JDP). (2018)

C**D**

CSR Related (Including Socially Responsible Investment (SRI) Index)

Earns inclusion in Dow Jones Sustainability Indices **E**

MOL has been included in the Dow Jones Sustainability Indices (DJSI) Asia Pacific thanks to its highly regarded efforts in the areas of environmental protection, CSR, and IR activities. The DJSI identifies companies expected to show long-term sustainable growth. (Since 2003)

Earns inclusion in FTSE4Good Index **F**

FTSE Russell is a global index company owned by the London Stock Exchange. FTSE Russell has included MOL in one of its major socially responsible investment indices, the FTSE4Good Index. (Since 2003)

FTSE Blossom Japan **G**

MOL has been included in the FTSE Blossom Japan Index, introduced in 2017 by FTSE Russell targeting Japanese companies with excellent performance related to environmental, social, and governance (ESG) issues.

E**F****G**MSCI ESG Leaders Indexes **H**

MOL has been included in the MSCI ESG Leaders Indexes for its superior efforts on measures taken for risks and opportunities related to ESG. (Since 2010; index name changed in 2017.)

MSCI Japan ESG Select Leaders Index **I**

MOL has been included in the MSCI Japan ESG Select Leaders Index, introduced in 2017 targeting companies with high ESG performance relative to sector peers.

MSCI Japan Empowering Women Index **J**

MOL has been included in the MSCI Japan Empowering Women Index, introduced in 2017 targeting companies that promote and maintain a high level of gender diversity among their workforce.

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H**I****J**

For more information, please refer our websites.

CSR/Environment : <https://www.mol.co.jp/en/csr/index.html>

Environmental Data : <https://www.mol.co.jp/en/csr/environment/data/index.html>

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