

Every fiscal year, MOL Sets Environmental Targets related to each important issue, and works steadily to achieve those targets.

Midterm Environment Plan: Fully aware of the environmental impact of its business activities, the MOL Group will lead the world shipping industry by proactively responding to environmental regulations and differentiating our services by aggressively developing and adopting the best technologies to protect the environment.

Legend: ● Achieved ○ Generally achieved △ Partially achieved ● Did not achieve (target period/content changes)

Objectives	FY2015 Environmental Targets	FY2015 Environmental Activities and Results	Achievement	FY2016 Environmental Targets	Reference
1 Build environmental business, which contributes to sustainable society	Study R&D of advanced environmental technology, creation of new environmental businesses, and taking part in logistics that contributes to the environmental protection.				
				MOL established the Technology, Innovation, and Environment Committee to promote the development and adoption of innovative environmental technologies that increase corporate value and enhance the effectiveness and profitability of our businesses. (1) Build a system that promotes internal sharing, extension, and review of information, and allows us to tap into and discover needs, including potential ones, from our customers' viewpoint. (2) Create a system that sets mid- and long-term targets for environmental technologies, creates road maps, and introduces new technologies in the MOL Group owned and operated fleet. (3) Explore and review issues in the maritime industry and formulate solutions.	P.22
2 Comply with Environmental Regulations	Reduce environmental impact through overall optimization and protect the global environment by engaging in company-wide efforts including ballast water management, ship recycling, prevention of global warming, prevention of atmospheric pollution, and response to diverse environmental regulations.				
	1. Further promote installation of the ballast water treatment system prior to the enforcement of new regulations, while monitoring developments in the ballast water convention. Test the effectiveness of the ballast water treatment system installed on a vessel, and provide the manufacturer with feedback on defects/malfunctions/failures and requests for improvements.	1. Appropriately installed ballast water treatment systems, while monitoring developments in the ballast water convention. Number of vessels equipped with the system in FY2015: 30 Evaluated effects of ballast water treatment systems installed on the vessels, and provided feedback and suggestions for improvement.	○	1. Further promote installation of the ballast water treatment system prior to the enforcement of new regulations, while monitoring developments in the ballast water convention. Test the effectiveness of the ballast water treatment system installed on a vessel, and provide the manufacturer with feedback on defects/malfunctions/failures and requests for improvements.	P.27-30
	2. Continue to consider installation of SOx emission reduction systems (scrubbers). Comply with SOx Emission Control Area (ECA) rules, which took effect in January 2015. Collect information on supplies of low-sulfur fuels, which produce fewer SOx emissions.	2. Continued to consider installation of SOx emission reduction systems (scrubbers). Started research on retrofitting car carriers with SOx scrubbers. Began comparing functions of manufacturers' equipment such as SOx scrubbers. Continued to collect information on supplies of low-sulfur fuels, which produce fewer SOx emissions.	○	2. Jointly collect information on scrubbers and fuel supply, with an eye toward retrofitting vessels with SOx emission reduction systems (scrubbers).	
	3. Continue to verify NOx reducing system (Selective Catalytic Reduction; SCR), and make a final evaluation.	3. Continued to verify NOx reducing system (Selective Catalytic Reduction; SCR) while using heavy fuel oil.	○	3. Collect and verify data on installed NOx reducing systems and complete the demonstration test.	
	4. Develop and implement specific reduction measures for complying with domestic environmental regulations such as the Amended Energy Conservation Act and Tokyo Metropolitan Environmental Security Ordinance.	4. Developed and implemented specific reduction measures in cooperation with MOL Engineering Co., Ltd., to comply with domestic environmental regulations such as the Amended Energy Conservation Act and Tokyo Metropolitan Environmental Security Ordinance. Has reduced unit energy consumption by 15.9%, compared to the 6% target for FY2009.	○	4. Develop and implement specific reduction measures for complying with domestic environmental regulations such as the Amended Energy Conservation Act and Tokyo Metropolitan Environmental Security Ordinance.	
5. Establish the selection criteria for environment-friendly scrapping yards in preparation for the enforcement of the Hong Kong International Convention.	5. Conducted a wide range of inspections in scrapping yards. Discussed the scrapping yard selection criteria based on international interpretation of the Hong Kong International Convention.	○	5. Select environment-friendly scrapping yards. 6. Prepare the inventory related to the Hong Kong International Convention, and promote its use on vessels. 7. Maintain the same level of paper, water, and electricity consumption as in FY2015.		
3 Proactively Utilize Technologies to Reduce Environmental Impacts	Promote energy-saving innovations for ships and eco-sailing through active utilization of refined energy-saving technology that MOL acquired in the ISHIN project for the next-generation vessel concept. Reduce CO ₂ emissions 11.5%* per ton-mile by FY2016 compared to FY2009.				
	1. Reduce environmental impact (1) Reduce CO ₂ by 1% in FY2015 compared to FY2014. (2) Reduce NOx by 1% in FY2015 compared to FY2014. (3) Reduce SOx by 1% in FY2015 compared to FY2014.	1. Continued efforts by business divisions on further enhancement and increased use of slow steaming operation. Installed systems to improve propeller efficiency such as PBCF on all 15 newbuilding vessels delivered during FY2015. Studied adoption of the optimal trim system and vessel operation support system and conducted demonstration tests on the vessels in operation. Reduced CO ₂ emissions by 3.0% compared to FY2014 (by 17.9% compared to FY2009); Reduced NOx emissions by 3.0% compared to FY2014; Reduced SOx emissions by 5.2% compared to FY2014.	○	1. Reduce environmental impact (1) Reduce CO ₂ by 1% in FY2016 compared to FY2015. (2) Reduce NOx by 1% in FY2016 compared to FY2015. (3) Reduce SOx by 1% in FY2016 compared to FY2015.	P.13-14 P.23-26 P.27-30
	2. Install and verify the low-temperature waste heat recovery system (Variable Phase Cycle : VPC) on an actual vessel.	2. Started to order and assemble VPC system. Continued review of equipment layout.	○	2. Install and verify the VPC system on an actual vessel.	
	3. Develop and build methanol-fueled vessels.	3. Finished a verification test of the methanol-fueled engine. Conducted test sailing with the new engine (tested at the end of March).	○	3. Deliver 3 of methanol-fueled vessel series.	
	4. Conduct feasibility study of positioning the engine room for installing LNG fuel and SOx scrubbers for the new building container ship.	4. Conducted feasibility study of the specification changes required to equip container ships with methanol-fueled engines.	○	4. Continue deeper feasibility study of the specification changes required to equip container ships with methanol-fueled engines.	
	5. Begin planning and design of an LNG-fueled tugboat.	5. Continued study of the design, tank, and engine of an LNG-fueled tugboat.	○	5. Study the design, tank, and engine of an LNG-fueled tugboat. Study the conversion of other types of vessels to LNG-fuel.	
	6. Promote projects that use wind power, such as Power Assist Sail and Wind Challenger Project.	6. Power Assist Sail: Conducted Hazard Identification (HAZID ^{*1}), which is currently under evaluation. Window Challenger Project: Continued the study with the project participant organizations.	○	6. Promote projects that use wind power, such as Power Assist Sail and Wind Challenger Project.	
	7. Verify feasibility of a car carrier with teardrop-shaped stern (design a smoother stern shape).	7. Determined the basic vessel shape and layout based on the effects of different loading capacities. Started verification of wider-breadth type of vessel.	○	7. Promote R&D on ways to reduce wind resistance on car carriers.	
	8. Verify wind pressure reducing technologies on container ships.	8. Installed a windscreens on the bow of a container ship, and started collecting in-service data.	○	8. Continue to verify wind resistance reducing technologies on container ships.	
	9. Continue to verify and develop DPF <PM (particulate matter) removal system> installed on a vessel.	9. Conducted durability test of heavy fuel oil on a vessel that is already installed with Diesel Particulate Filter (DPF). Tests to verify the effectiveness are under way.	○	9. Continue to verify and develop DPF <PM (particulate matter) removal system> installed on a vessel.	
	10. Develop technologies to improve combustibility of vessel fuels at the MOL Technology Research Center.	10. Continued joint R&D on a special spray nozzle with a manufacturer, university, and research institute. Verified test data, using the test engine.	○	10. Fully practice Eco Sailing/Continue research on the use of big data for vessels.	
	11. Thoroughly implement Eco-Sailing and promote development of an advanced operation supporting system that improves operation efficiency.	11. Started research aimed at using big data for vessel, while taking into account joint use of data with manufacturers.	○	11. Reduce unit energy consumption at offices and on domestic coastal vessels for the medium to long term. Reduce by 1% in FY2016 compared to FY2015.	
	12. Continue to examine environmental concept vessels in consideration of internal needs and seeds and refine the concept of the environmental business.	12. Studied environmental concept vessels.	○	12. Move ahead with construction of four ferries, which will offer improved environmental performance (two slated for delivery in 2017, two in 2018).	
	13. Reduce unit energy consumption at offices and on domestic coastal vessels for the medium to long term. Reduce by 1% in FY2015 compared to FY2014.	13. Reduced unit energy consumption at offices by 2.7% compared to FY2014 but on the domestic coastal vessels side, consumption increased by 0.1% due to factors including stormy weather.	○	13. Promote more energy-efficient vessel operation through the use of improved power management systems.	
	14. Consider introduction of a wide variety of leading-edge environmental impact-reducing technologies on the world's largest 20,000 TEU container ship.	14. Introduced a variety of leading-edge environmental impact-reducing technologies on the world's largest 20,000 TEU container ship.	○		
15. Begin preparations to build two ferries that feature both high speed and excellent environmental performance.	15. Started construction of two ferries with delivery slated for 2017.	○			

*1 HAZID stands for Hazard Identification, which systematically identifies and documents risks.

FOCUS

Progressively Adopting Technologies to Reduce Environmental Impact

Compared to other modes ocean shipping is an environmentally friendly means of transport with lower CO₂ emissions per unit load. The MOL Group continually takes an active approach to technological innovation aimed at further reducing the environmental impact of its operations.

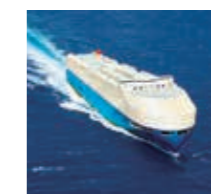
① Main Engine: R&D on System to Recover Waste Heat from Low-temperature Sources Variable Phase Cycle (VPC)

VPC is a technology we have worked on from the viewpoint of making effective use of exhaust gas after fuel is burned in the engine, as well as heat generated from the engine itself. In general, on-board energy recovery systems rely on high-pressure, high-temperature exhaust gas from the engine, but VPC collects heat generated when the engine is in operation. MOL, in cooperation with Nippon Kaiji Kyokai (ClassNK) and Mitsui Engineering & Shipbuilding Co., Ltd., plans to select a test vessel, equip with a VPC system, and conduct a demonstration test to determine its effectiveness in reducing CO₂ emissions.

② Next-generation Car Carrier FLEXIE

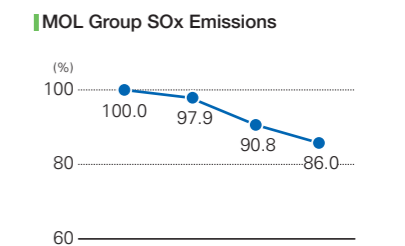
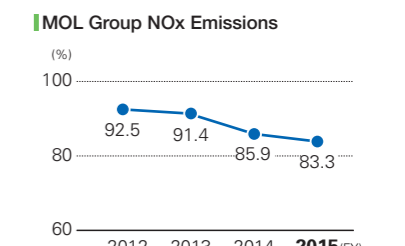
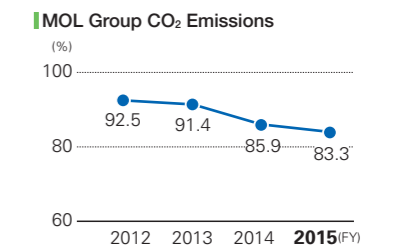
The name is derived from the word "flexible," which refers to features such as the newly designed liftable decks, and expresses not only the ship's flexibility in boosting loading efficiency, but also in fulfilling MOL's sales and marketing strategy aimed at meeting diverse customer demands.

The rounded bow shape of the FLEXIE, which is slated to be delivered in 2017, will minimize wind resistance and is expected to reduce CO₂ emissions by about 2% compared to today's car carriers.



The new shape is the result of joint research by MOL, MOL Techno-Trade, Ltd., and Akishima Laboratories (Mitsui Zosen) Inc.

Major Environmental Indicators



Reduction of CO₂ Emissions by CO₂ Measures (Unit: thousand tons)

FY	FY2011	FY2012	FY2013	FY2014	FY2015
CO ₂ Emissions	432	303	280	348	303

Cost Reduction by CO₂ Measures (Unit: ¥ billion)

FY	FY2011	FY2012	FY2013	FY2014	FY2015
Cost Reduction	7.3	5.3	5.5	5.5	3.1

- The amounts are estimated with reduced CO₂ emissions and reduced cost based mainly on increased use of slow steaming, installation of PBCFs, and the fuel-saving effects of low-friction paint.
- The calculations do not include cases in which it is difficult to measure the effects.

Legend: ●Achieved ○Generally achieved △Partially achieved ●Did not achieve (target period/content changes)

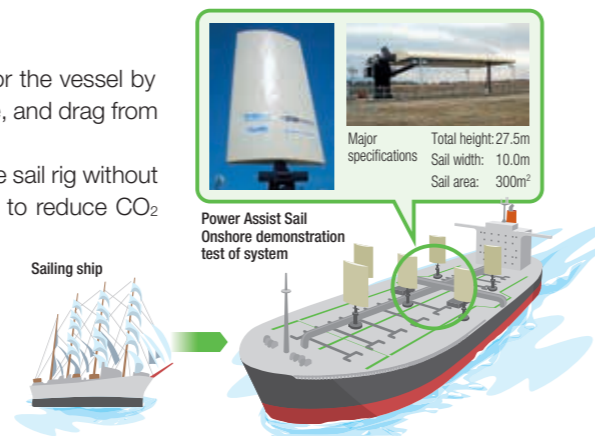
Objectives	FY2015 Environmental Targets	FY2015 Environmental Activities and Results	Achievement	FY2016 Environmental Targets	Reference
4 Actively Disclose Environmental Data	Respond to stakeholders' interests in MOL's environmental policy by disclosing KPI for transport with low environmental impact and various environmental data using the Web site and Safety, Environmental and Social Reports.				
	Proactively promote calculation, analysis, and disclosure of following data and disclosure of reduction effects. 1. Energy consumption volume 2. GHG emission volume (Including Scope 1-3) 3. SOx, NOx emission volume 4. Consumption volume of other resources	1-4: Disclosed environmental data through the Environmental and Social Report, the company Web site, and other various external media. Recognized in the Climate Disclosure Leadership Index (CDLI). In addition, MOL Liner made its own disclosure of CO ₂ , NOx, and SOx emissions on its Web site.	●	1. Proactively promote calculation, analysis, and disclosure of following data and disclosure of reduction effect through the Environmental and Social Report, the company website, and various other external media. (1) Energy consumption volume (2) GHG emission volume (Including Scope 1-3) (3) SOx, NOx emission volume (4) Consumption volume of other resources	P.26 P.43 P.46
5 Ensure Safe Operations	Ensure safe operations to prevent unexpected environmental impacts, and pursue zero ocean pollution caused by marine incidents.				
	1. Prevent serious marine incidents by improving MOL's safe operation system.	1. Held the company-wide biannual safety campaign twice, and held division-by-division safety operation meetings to enhance safe operation. In addition, regularly visited vessels. Serious marine incidents occurred despite these efforts to raise safety awareness of employees both on land and at sea.	△	1. Prevent serious marine incidents by improving MOL's safe operation system.	P.13-14 P.15-20
	2. Further improve the quality of new vessel design and construction.	2. Reported problems to manufacturers/held information exchange meetings with them. MOL and its group companies conducted shipyard assessment visits. Checked the shipyards' HSE* manuals to share safety standards among MOL and shipyards. Validated health/hygiene/safety management methods of workers and superintendents.	○	2. Further improve the quality of new vessel design and construction through health, safety, and environmental (HSE*) activities at shipyards.	
3. Continue to adopt the MOL Safety Standard Specifications on newbuilding vessels.	3. Adopted for all 15 newbuilding vessels delivered.	○	3. Continue to adopt the MOL Safety Standard Specifications on newbuilding vessels.		
6 Contribute to Conservation of Biodiversity	Raise awareness of biodiversity protection, promote waste reduction from vessels, and participate in volunteer activities for conserving biodiversity on a company-wide level.				
	1. Continue to reduce waste from vessels such as on-board waste, waste oil, and bilge.	1. Continued to reduce waste from vessels such as on-board waste, waste oil, and bilge.	○	1. Continue to reduce waste from vessels such as on-board waste, waste oil, and bilge.	Web
	2. Prevent cross-border transportation of foreign marine organisms through ballast water exchange in the open sea, and implement vessel cleaning to remove organisms on vessels to help conserve biodiversity.	2. Disseminated Ballast Water Management Report, which is the new requirement concerning ballast water management in the U.S., to vessels. Shared case study information on problems caused by ballast water exchange operations and issued warnings of dangers related to the use of ballast water.	○	2. Prevent cross-border transportation of foreign marine organisms through ballast water exchange in the open sea, and implement vessel cleaning to remove organisms on vessels to help conserve biodiversity.	
	3. Support volunteer activities to help conserve biodiversity in Japan and overseas, such as tree planting.	3. Conducted beach cleanup in Kamakura and Kashima in Japan, and in Hong Kong and Malaysia overseas.	○	3. Support volunteer activities to help conserve biodiversity in Japan and overseas, such as tree planting.	
4. Promote navigation with special consideration in the areas with high populations of large-sized marine life.	4. Circulated the information about sea areas with high populations of large marine, on the Port and Navigation Information. Especially containerhips, which frequently sail in sea areas with high populations of large marine life, continued to operate along the North America East Coast and in other areas in conformity with laws and regulations.	○	4. Promote navigation with special consideration in the areas with high populations of large-sized marine life.		
7 Advocate Transport Policies and Measures Aimed at Contributing to Reduction of Environmental Impact	Proactively make recommendations so that environmental policy promotes utilization and reinforcement of the high environmental efficiency of shipping as transport mode, and contribute to environmental impact reduction and sustainable growth.				
	1. Make various efforts to encourage the modal shift, which has a low environmental impact, to industry groups, government agencies, and relevant ministries. 2. Actively participate in energy-saving policies.	1. Promoted the Modal Shift, which aims at reducing the environmental impact of transportation, in cooperation with Japan's Ministry of Land, Infrastructure, Transport and Tourism and Ministry of Economy, Trade and Industry. 2. Proactively made recommendations through the Japanese Shipowners' Association and Ministry of Economy, Trade and Industry to develop a more feasible Monitoring, Reporting, and Verification (MRV) system, which is to be introduced in the near future.	○ ○	1. Make various efforts to encourage the modal shift, which has a low environmental impact, to industry groups, government agencies, and relevant ministries. 2. Actively participate in energy-saving policies.	
8 Environmental Investment	Make environmental investment of 20 billion yen in 3 years, 60 billion yen in 6 years to respond to environmental regulations and to promote energy-saving innovation for vessels.				
	1. Make proactive investments in new environmental technologies such as methanol-fueled vessels. 2. Further improve waste heat energy recovery systems for vessel main engines. 3. Promote installation of ballast water treatment systems prior to the enforcement of new regulations, and respond to environmental regulations.	1. Environmental Investments in FY2015 was 4.63 billion yen. Recalculated again after results were finalized. (Details) Environment-related R&D activities: High-efficiency waste heat energy recovery system, Methanol-fueled vessel etc. 0.28 billion yen Utilization and expansion of existing environmental technologies: PBCF, Electronically controlled engine, Onshore power supply system, Low-friction hull paint, etc. 0.91 billion yen Compliance with environmental regulations: Ballast Water Treatment System, Ship Recycling Regulation and SOx Regulation related etc. 2.19 billion yen Initiatives to save bunker fuel: Fuel additives, optimal trim, vessel operation support system 0.99 billion yen Initiatives of Group companies: International Ocean Shipping group companies' environment investments 0.26 billion yen	○	1. Make proactive investments in new environmental technologies such as methanol- and LNG-fueled vessels. 2. Develop a low-temperature waste heat recovery system (VPC). 3. Promote installation of ballast water treatment systems prior to the enforcement of new regulations, and respond to environmental regulations.	P.23-30

* HSE: Health, Safety & Environment.

③ Power Assist Sail

The Power Assist Sail provides supplementary propulsion force for the vessel by using the lift force of crosswinds, similar to the wings of an airplane, and drag from tailwinds.

Taking advantage of the sail's small size, the goal is to install the sail rig without making major design changes to existing vessels. It is estimated to reduce CO₂ emissions by 2-5%.



It is a joint research project by MOL, MOL Techno-Trade, Ltd., and Akishima Laboratories (Mitsui Zosen) Inc. under ClassNK's "Joint R&D with Industries and Academic Partners" program.

④ Hybrid PCC Solar Power Generation System

The world's first newbuilding hybrid car carrier Emerald Ace is equipped with a hybrid electric power supply system that combines a 160kW solar generation system with lithium-ion batteries that can store some 2.2MWh of electricity. On board the vessel, electricity is generated by the solar power system while it is underway and stored in the lithium-ion batteries. The batteries provide all the electricity the vessel needs while it is in berth, resulting in zero emissions at the pier. We are also currently verifying the durability of solar panels at sea in the four years since the vessel was delivered in 2012.



Actively Disclose Environmental Data

Clean Shipping Index (CSI)

The Clean Shipping Index is an environmental assessment tool for ships and shipowners, used by a network of cargo owners and forwarders (customers) when buying sea transport. Ship owners present the environmental performance on emissions of CO₂, sulfur oxides, particulate matter and nitrogen oxides and the use and handling of chemicals, waste and waste water. Vessels are then ranked from 'low performance' to 'good performance'. With the information collected, the cargo owners and forwarders evaluate the ship owner in the procurement process. In line with MOL's target to "Actively Disclose Environmental Data", MOL started reporting in CSI in 2013.

Clean Cargo Working Group (CCWG)

The global nonprofit organization "Business for Social Responsibility (BSR)," which works with containerhip owners, container shipping customers, and non-vessel operating common carriers, has established the Clean Cargo Working Group (CCWG) in 2003. CCWG measures, evaluates, and reports the Ship owner environmental performance including CO₂, NOx, SOx and Environmental Management System. MOL has been participating since 2012.

CDP

CDP is a U.K.-based non-profit organization that represents 827 institutional investors all over the world. It holds about \$100 trillion in total (about one-third of the total invested capital in the world). It sends specific questionnaires asking about strategies on climate change and on greenhouse gas emissions to companies. Answers and scores of the results are publicly announced, and the scores are becoming a key indicator in measuring corporate value. MOL has responded to CDP's inquiries every year, and was recognized for Climate Disclosure Leadership Index (CDLI) in FY2015.

[For details of CDLI: Page 46]

[For details of third-party verification of CO₂ emissions: Page 43]