

## Environment

### Decarbonization

#### Governance

- Climate Change Response Management System
- Risk and Opportunity Assessment Process

#### Strategy and Risk Management

- Scenario Analysis and Identification of Risks and Opportunities
- Net Zero Achievement Scenario
- NYK SUPER ECO SHIP 2050

#### Target

- New Decarbonization Goals

#### Initiatives

- GHG Reduction
- Zero GHG Emissions
  - Initiatives to Develop Next-generation Fuels and Renewable Energy –
- GHG Removal
- Research & Development

#### Co-creation with External Parties

- Participation in External Initiatives
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## Governance

### Climate Change Response Management System

Our Group has established a management system in which we analyze the risks and opportunities associated with the impact of climate change on our corporate activities and businesses over the medium to long term, incorporate those risks and opportunities into our management strategy, and promote our responses to them. Please see “Environmental Management” for the governance structure of environment-related issues, including responses to climate change.

For more information, click on the link below

[P.029 Environmental Management](#)

### Risk and Opportunity Assessment Process

In our Group, based on consultation from the ESG Strategy Headquarters, the ESG Strategy Committee discusses risks and opportunities associated with climate change while considering the contents presented by each business unit. The ESG Strategy Headquarters compiles the details on the matters discussed by the ESG Strategy Committee, and reports the same to the Directors and management personnel.

The Risk Management Committee, which is attended by the chairman, president, executive officers who are chief executives of respective departments and full-time auditors, manages and evaluates risks that can potentially a significant impact on the Company as a whole, and risks associated with climate change. The ESG Strategy Headquarters and Risk Management Committee work closely together to integrate such risks into the company-wide risks, and report them to the Directors twice each fiscal year.

## Strategy and Risk Management

The Group considers the transition to a decarbonized society as an opportunity, and actively promotes initiatives to achieve low-carbon emissions and decarbonization, aiming for sustainable growth by decoupling environmental impact and business activities. We will continue to contribute to the realization of a sustainable society by strengthening our own competitiveness through decarbonization initiatives, making proactive, forward-looking investments that respond to social demands for a decarbonized society, and creating mutual benefits with our stakeholders.

### Scenario Analysis and Identification of Risks and Opportunities

Our group recognizes that it is important to assess risks and opportunities using scenario analysis for climate change and understand the impact of these risks and opportunities on our business strategy and performance. From the long-term business operations perspective, we continue to work towards managing risks and identifying opportunities based on rational scenarios by factoring in climate change elements into our own transportation demand forecast.

In the “Disclosure Report Based on Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD)”, the business environment and strategies in 2050 are organized and disclosed using climate change scenarios for the “1.5°C scenario” and the “2-3°C scenario”. See “Disclosure Report Based on Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD)” for details on the scenario analysis by each business segment.



For more information, click on the link below

<https://www.nyk.com/english/sustainability/pdf/environment005en.pdf>

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### • Main Anticipated Risks and Opportunities Associated with Climate Change

Our Group continues to assess and manage the various potential risks and opportunities due to climate change, and strengthen our competitiveness while confirming the impact on our business from a long-term perspective.

Risks and opportunities Associated with Climate Change		Impact on the Group		Degree of impact		Our Company's strategy		
				1.5°C Scenario	2-3°C Scenario			
Transition Risks and opportunities	Regulations	Introduction of carbon pricing	Risks	• Increased investment burden for low-carbon technology due to stricter GHG emission regulations by the International Maritime Organization (IMO) and national authorities • Increased operating costs due to taxation related to GHG emissions from ships operated by our Company	Low	Low	• We will continue to improve operational efficiency through DX, and while working to reduce GHG emissions through the introduction of LNG and ammonia-fueled ships and alternative fuels, we will appropriately reflect these investment costs and the remaining carbon costs in transportation rates	
			Opportunities	• Shortage of highly skilled seafarers who are capable of handling LNG-fueled ships and next-generation fuel vessels	Medium	Low	• In addition to the core Japanese seafarers, we also recruit highly skilled crew through the maritime academy in the Philippines and our own ship management company in Singapore	
	Technology	Securing seafarers for LNG-fueled and next-generation fuel vessels	Opportunities	• New business opportunities for ship management companies due to the growing demand for highly skilled seafarers	High	Medium		
			Risks	• Decrease in revenue opportunities in the dry bulk and energy transportation business due to a decreased demand for existing energy resources with high GHG emissions	High	Medium	• Strengthening of existing core businesses in a wide range of areas, as well as develop new growth businesses, to strengthen management resilience	
	Market	Changes in cargo movement and transportation demand	Opportunities	• Expansion of new transportation businesses such as offshore wind power value chains, hydrogen, ammonia, and biofuels, in response to the increasing demand for renewable energy	High	Medium		
			Risks	• Customer alienation due to the delay in efforts to reduce GHG emissions	High	Medium	• Promotion of proactive investment in low-carbon and decarbonized ships ahead of other companies, and securing environmental superiority • Review of scenarios and investment plans as needed, taking into account social trends, advances in decarbonization technology, etc.	
		Rapid changes in customer trends	Opportunities	• First-mover advantage due to increased demand for low-carbon and decarbonized marine transport services	High	Medium		
			Risks	• Delay in decarbonization of our fleet (including early widespread of zero-emission vessels) resulting in stranded assets of the existing fuel ships and LNG-fueled ships	Medium	Low	• Collaborating with a Finnish ship technology consulting firm, we are promoting the specification design for the development of "Ammonia Ready LNG-Fueled Ships" that can be efficiently converted from LNG-fueled vessels to ammonia-fueled ships • To gradually reduce carbon emissions by using the existing assets, we have begun identifying issues and assessing the impact of using drop-in fuels such as biofuels for oil-fired ships and bio-LNG for LNG-fueled ships	
	Physical Risks	Acute	Frequent and severe abnormal weather/ocean conditions	Risks	• There is a possibility that we will not be able to use Green Finance, etc., and will have to raise funds under conditions that are inferior to those of our competitors	Medium	Low	• Actively communicating policies on environmental issues to external parties via the website and integrated reports (NYK Report), etc., and focusing on raising funds through Green Finance
				Opportunities	• Reducing the cost of raising funds by utilizing Green Finance to secure environmental superiority	High	Medium	
Chronic		Rise in sea levels	Risks	• Additional fuel costs incurred due to speeding up to avoid the storm zone due to encountering severe weather, or to maintain the vessel schedule	Low	Low	• Minimizing risk and costs through support for route change decisions using our own system and detailed operational support from vessels operations staff and maritime employees working on land.	
Acute	Climate change impact on the Panama Canal	Risks	• Restrictions on the use of real estate, warehouses, terminals, and port facilities owned by the NYK Group located in low-lying areas • Occurrence of delays due to limited operational ports	Low	Medium	• Although the assets affected by the rising sea levels are limited, we are considering flexible measures such as using leases to prepare for the increased risk		
		Risks	• The drought in Gatun Lake (the source of the Panama Canal) is becoming more serious due to the rise in temperatures and decreased rainfall around Panama	Medium	High	• We seek to build a strategic relationship with the Panama Canal Authority		

For more information, click on the link below

[P.066 ESG Finance](#)

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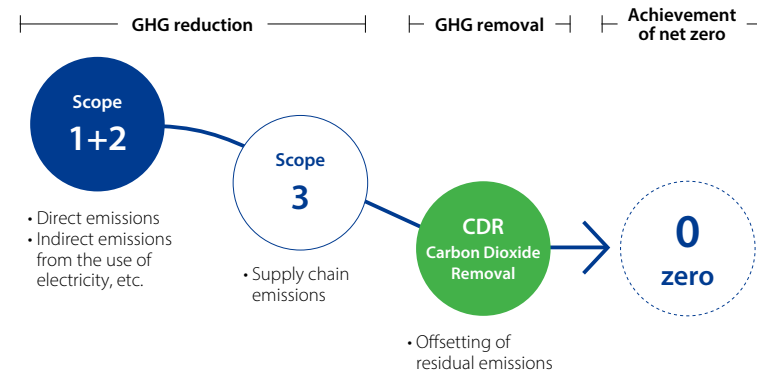
### Related Data

# Decarbonization

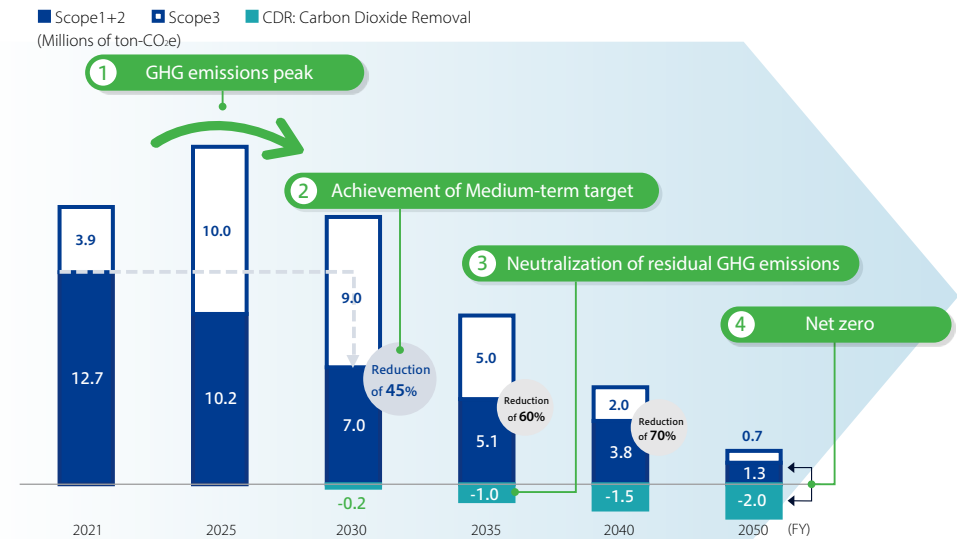
## Net Zero Achievement Scenario

To achieve net zero GHG emissions by 2050, our Group has formulated a scenario that takes a two-pronged approach of “reducing” and “removing” the GHG emissions. With steady implementation of this scenario, we aim to support the decarbonization of society from the perspective of marine transport, and ultimately to realize a sustainable society.

### Aiming for Net-Zero GHG Emissions through a Reduction and Removal Approach



### Scenario for Achieving Net Zero



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### ● Path to Net Zero / Reducing GHG Emissions

Our plan is to gradually deepen our efforts to reduce Scope 1 and 2 GHG emissions using two strategies. We will pursue Strategy ①, in which we will maximize energy efficiency (operation/specifications) till 2030, and then we will aim for Strategy ②, in which we will accelerate the use of alternative fuels after 2030.

With regards to Scope 3, we will share data with stakeholders and work with them in parallel with Strategies 1 and 2, with an aim to build an ecosystem through the creation of a low-carbon value chain.

### > Scope 1, 2 Strategy ① Maximize Energy Efficiency (Operation/ Specification)

We will promote the reduction of GHG emissions from our existing fleet by improving daily operations and energy efficiency.

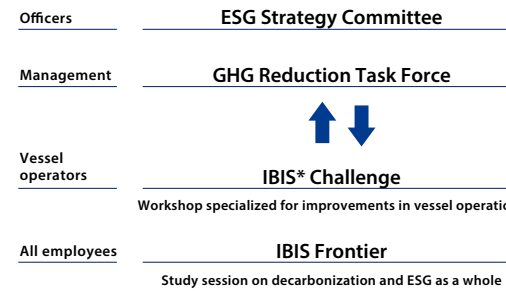
### > Scope 1, 2 Strategy ② Acceleration through Alternative Fuels

Starting in 2030, we will introduce alternative fuel vessels that take into account other environmental impact in addition to GHG emissions, and build a resilient fleet portfolio.

### ■ Scope 1,2 Strategy ①

#### Improvement of ship operation efficiency

Collaborating with customers to enhance frameworks and management aimed at maximizing the efficiency of vessel operations

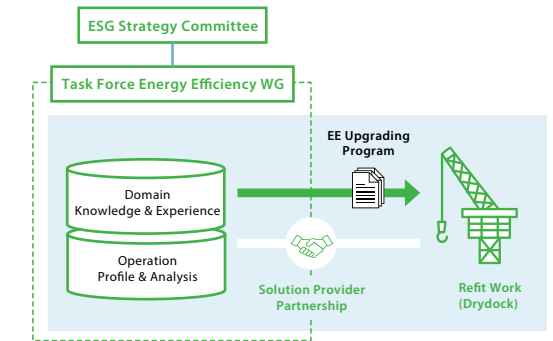


\*IBIS: Innovative Bunker and Idle-time Saving

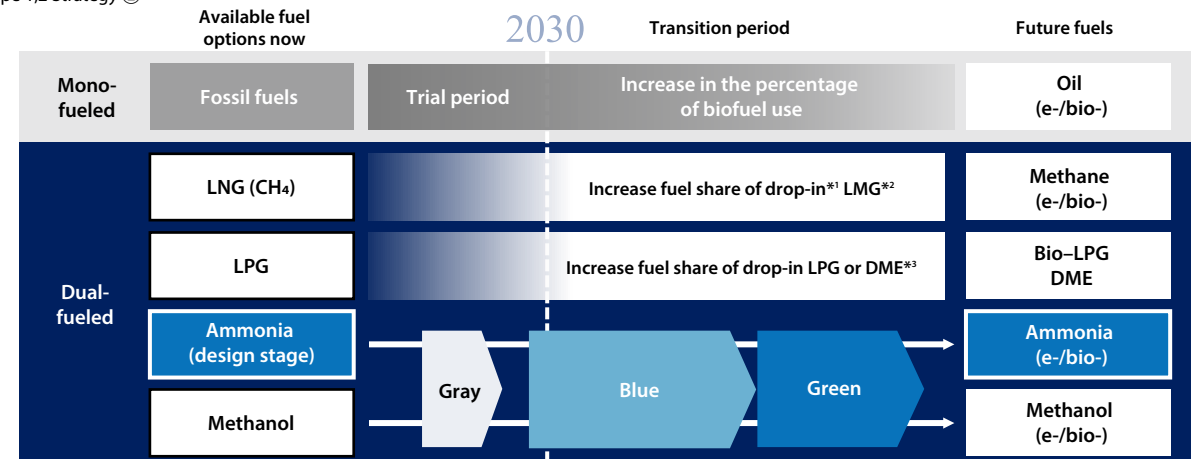


#### Enhancement of technical capabilities

Working with external partners to improve energy efficiency



### ■ Scope 1,2 Strategy ②



\*1 Drop-in: Fuel that can be used without requiring remodeling the ship or its engines. \*2 LMG: Liquefied Methane Gas \*3 DME: Dimethyl Ether

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### ● Path to Net Zero / GHG Removal

In order to cover the remaining GHG emissions that are difficult to shift to zero emissions, we will invest in and participate in projects to build a value chain for carbon capture, utilization, and storage (CCUS) that utilizes negative emissions technology (NETs)\*. We will also work to create new green businesses through carbon credits.

\*Negative Emission Technology (NETs): A general term for technologies that capture and remove CO<sub>2</sub> from the atmosphere or the ocean

### > Internal Carbon Pricing (ICP)

Our Group introduced an internal carbon pricing system (ICP) in fiscal 2020, and we are using it as reference information to aid investment decisions at the Investment and Credit Council and the Management Meeting in which investment decisions are deliberated. By linking financial information and GHG emissions using ICP, we visualize the value of GHG emissions reductions and promote sound decision-making by unifying the evaluation criteria for various departments and projects. The applicable prices are set at US\$120/t-CO<sub>2</sub> until fiscal 2026, US\$200/t-CO<sub>2</sub> from fiscal 2027 to fiscal 2030, and US\$250/t-CO<sub>2</sub> from fiscal 2031 onwards.

### NYK SUPER ECO SHIP 2050

In November 2018, NYK in collaboration with our group company MTI Co., Ltd., and Elomatic, a Finnish marine technology consulting firm, devised "NYK Super Eco Ship 2050" to achieve GHG reduction targets and realize the decarbonization of ships.

Equipped with the revised individual elemental technologies of the "NYK Super Eco Ship 2030" concept ship announced in 2009, this ship is a new zero-emission concept ship that reduces GHG emissions by 100% through the use of hull modifications, weight reduction, increased efficiency, and digitalization.

In the future, we will continue to promote collaboration with a wide range of global partners in the maritime industry with the aim of researching, developing, verifying, and introducing the elemental technologies set out in the NYK Super Eco Ship 2050.



For more information, click on the link below

<https://www.nyk.com/english/sustainability/pdf/environment006en.pdf>  
<https://www.youtube.com/watch?v=wXJTbcUjxmk>

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### Target

In November 2023, our Group announced the “NYK Group Decarbonization Story” in which we established decarbonization strategies and GHG reduction targets towards 2050.



For more information, click on the link below.

**NYK Group Decarbonization Story**  
<https://www.nyk.com/sustainability/pdf/environment003.pdf>

### New Decarbonization Goals

Since the medium-term management plan announced in 2018, our Group has disclosed greenhouse gas emission reduction targets and has been steadily working to achieve these targets. In recent years, the movement towards decarbonization in the international shipping industry has been gaining momentum. In the light of this global trend, for our Group to continue to be a presence that is needed by society and industry, we have revised our medium to long term environmental targets (announced in 2018; 30% reduction in CO<sub>2</sub> emissions from ships and marine transport by 2030 compared to 2015, and a 50% reduction by 2050), and we have revised our targets to achieve a 45% reduction by 2030 (Scope 1+2) and net zero by 2050 (Scope 1+2+3) with 2021 as the base year. Details of the latest GHG reduction targets are as follows.

To reduce emissions, we have changed from an efficiency target to a total emissions target (in accordance with the 1.5°C scenario of the Paris Agreement).

Target year	2030	2050
Scope 1+2 for the entire group	45% reduction (compared to fiscal 2021)	Net Zero
Scope 3 for the entire group	—	

Past GHG emission reduction targets are as follows.

Established	2018	2021
Publication Medium	Medium-term Management Plan “Staying Ahead 2022 with Digitalization and Green”	Green Pledge*
Type of Target	Efficiency	Total amount
Scope 1+2 for the entire group	Oceangoing ships + aircraft 30% reduction	Oceangoing ships Net Zero
Scope 3 for the entire group		
Target year	2030	2050
Base year	2015	—

\* Green Pledge: On September 30, 2021, the NYK Group decided to set a long-term target for reducing GHG emissions related to its international shipping business of achieving “Net Zero Emissions by 2050”.

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### Initiatives

In addition to initiatives and activities aimed at decarbonization from three aspects, "GHG Reduction", "Zero GHG Emissions," and "GHG Removal", our Group is promoting research and development associated with the decarbonization technology.

### GHG Reduction

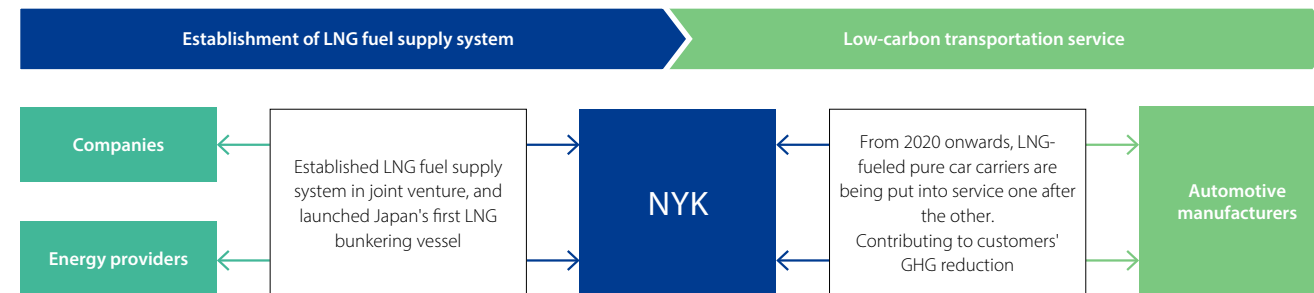
#### Overview on Active Use of LNG (Liquefied Natural Gas)

In 2017, our Group completed the world's first LNG fuel supply ship and began supplying LNG to vessels sailing in the North Sea and Baltic Sea in Europe. We have established a supply network for LNG fuel and a system that allows stable operation from the start, and we are now moving on to actual operations.

#### Establishment of LNG fuel supply system

Heavy fuel oil is currently the primary marine fuel used. However, its usage results in environmental destruction, including climate change. LNG, however, is a next-generation fuel that can significantly reduce CO<sub>2</sub>, NO<sub>x</sub> (nitrogen oxides), and SO<sub>x</sub> (sulfur oxides) emissions. We have positioned marine LNG as a bridging solution to the practical use of zero-emission fuels, and we are developing our LNG fuel supply business to be a front-runner in the industry.

As a shipping company, we can contribute to the LNG-fuel-demand side and the supply side. We are expanding our business globally in key locations and building an LNG-fuel value chain.



#### Progress in LNG fuel supply business

Month/Year	Event
Feb-17	NYK takes delivery of the world's first LNG bunkering vessel, "Green Zeebrugge"
May-18	The four companies including Kawasaki Kisen Kaisha, Ltd., JERA Co., Inc.* <sup>1</sup> , Toyota Tsusho Corporation, and NYK establish two joint venture companies, Central LNG Shipping Co., Ltd. (CLS), and Central LNG Marine Fuel Co., Ltd. (CLMF) for the sale of LNG fuel in the Chubu region.
Jul-18	CLS orders an LNG fuel supply ship from Kawasaki Heavy Industries, Ltd. As the first LNG fuel supply ship in Japan, it is put into service in the Chubu region in 2020 and used for the LNG fuel supply business by CLMF
Aug-18	The four companies including Kyushu Electric Power Company Inc., Seibu Gas Co., Ltd., The Chugoku Electric Power Co., Inc. and NYK sign MOU to jointly study the feasibility of an LNG fuel supply business in the Setouchi and Kyushu regions.
Feb-19	MLZ signs an LNG fuel supply agreement with Equinor ASA, a Norwegian multinational energy company. Starts supplying four shuttle tankers at the Port of Rotterdam and other locations from 2020.
May-19	The four companies, including Kyushu Electric Power Company Inc., Seibu Gas Co., Ltd., The Chugoku Electric Power Co., Inc. and NYK implement the first LNG fuel supply in the Setouchi and Kyushu regions.
Sep-20	The first LNG fuel supply ship ordered by CLS is named "Kaguya"
Oct-20	The LNG fuel supply vessel "Kaguya" carries out Japan's first "ship-to-ship" <sup>**2</sup> LNG fuel supply to the LNG-fueled pure car carrier "SAKURA LEADER."
Sep-21	The four companies, including Itochu Enex Corporation, Kyushu Electric Power Company Inc., Seibu Gas Co., Ltd. and NYK sign MOU to jointly study the commercialization of LNG fuel supply for ships in the Kyushu and Setouchi regions. Full-scale study of building and owning LNG fuel supply ships
Feb-22	The four companies, including Kyushu Electric Power Company Inc., Itochu Enex Corporation, and Saibu Gas Co., Ltd., and NYK jointly establish KEYS Bunkering West Japan. Discussions on ship-to-ship LNG bunkering in western Japan
Mar-22	The four companies, including Itochu Enex Corporation, Kyushu Electric Power Company Inc., Seibu Gas Co., Ltd. and NYK establish a joint venture company, and sign a contract to build one LNG bunkering vessel to supply LNG fuel to ships.
Mar-24	The LNG bunkering vessel "KEYS Azalea," which was built a joint venture between four companies; Itochu Enex Co., Kyushu Electric Power Company Inc., Seibu Gas Co., Ltd., and NYK is complete.

\*1 At the time of the establishment of CLS and CLMF in May 2018, Chubu Electric Power Co., Ltd.  
\*2 Ship to Ship: A method of bunkering where an LNG bunkering vessel comes alongside an LNG-fueled vessel to supply LNG. This can be done at various locations, such as along the quay or pier or at anchor



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### ● LNG-fueled ships

#### ➢ Active investment in LNG-fueled pure car carriers (Low-carbon transportation service)

In October 2020, "SAKURA LEADER," Japan's first LNG-fueled pure car carrier, was completed. This ship is one of the world's largest pure car carriers, equipped with large LNG fuel tanks, and has been designed with a number of innovations to optimize key features such as the ship's width and maximize cargo loading space, making it possible to transport approximately 7,000 cars (standard car conversion) per ship.

This vessel is expected to improve energy efficiency (CO<sub>2</sub> emissions per unit of transport) by approximately 40%, which significantly exceeds the standard values of the International Maritime Organization (IMO) EEDI regulations\* Phase 3 (compliance requirements from 2025), and is expected to reduce SOx emissions by approximately 99% and NOx emissions by approximately 86% compared to conventional heavy oil-fired engines.

Following the introduction of the "SAKURA LEADER," we are actively promoting the introduction of low-carbon and decarbonized fuel ships, and as of June 2024, a total of eight LNG-fueled pure car carriers are in service.

\*EEDI regulations: Regulations on the energy efficiency of ships based on the 2013 amendments to the 1997 Protocol of the International Convention for the Prevention of Pollution from Ships (MARPOL Annex VI). The EEDI (Energy Efficiency Design Index) is a formula for measuring a ship's CO<sub>2</sub> emissions per ton-mile, and the reduction rate from the baseline value is gradually strengthened. For pure car carriers, a 5% reduction is mandatory in 2015 (Phase 1), a 15% reduction in 2020 (Phase 2), and a 30% reduction in 2025 (Phase 3).



The "SUMIRE LEADER" is the sixth LNG-fueled pure car carrier operated by NYK.

#### ➢ Active investment in LNG-fueled dry bulk carriers (Low-carbon transportation service)

In addition to pure car carriers, we are also focusing on the introduction of large dry bulk carriers that use LNG as main fuel. In 2019, the Company decided to build the world's first LNG-fueled large coal carrier, which was completed in 2024.

Moreover, in 2021, we decided to order the construction of our first capsized\* LNG-fueled dry bulk carrier, which was completed in 2024.

\*Capsized: A bulk carrier having a deadweight tonnage of 120,000 tons or more. Ships between 60,000 tons and 120,000 tons are called Panamax carriers.



LNG-fueled capsized dry bulk carrier "SG OCEAN" (LNG dual-fuel engine-equipped ship)

### ● IBIS Project for Optimal Ship Operation and GHG-Emissions Reduction

The NYK Group is actively pursuing various initiatives across our entire company to achieve higher quality, safe, environmentally friendly operations.

In fiscal 2012, we began the Innovative Bunker & Idle-time Saving (IBIS) project, which utilizes big data to drive a wide range of activities to improve operating efficiency. As the scope of our activities expanded, the project evolved into IBIS-TWO and IBIS TWO Plus. In particular, since fiscal 2020, we have been pursuing optimal economical vessel operation beyond the boundaries of group companies to contribute to the "Environment" in ESG through fuel-saving activities.

From fiscal 2023, the project name has been updated to IBIS Three, aiming to create both corporate and social value through the pursuit of optimal economic operations and GHG-emissions reduction. The improvement of operational efficiency through IBIS activities is an essential element for achieving our group's decarbonization goals. We will systematically promote the sharing of best practices, such as communication between offshore and onshore operators and remote support from onshore. Through these activities, we are challenging ourselves to achieve more advanced operations.



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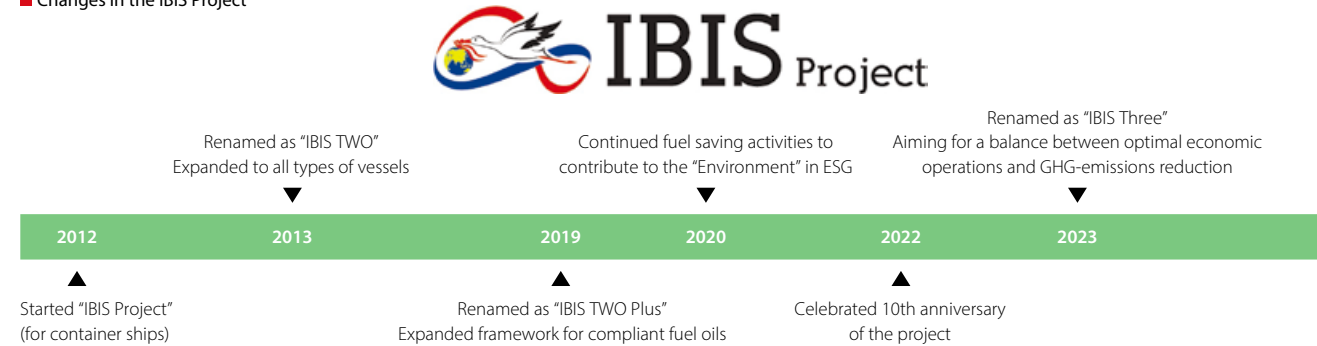
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### Changes in the IBIS Project



The logo for the "IBIS Project" depicts the Ibis (stork) carrying the blue earth, expressing the intention of protecting the blue earth through GHG-emission reduction. The background's two-colored rings represent our corporate colors of blue and red, symbolizing infinity (∞) and the continuous efforts toward fuel-saving and GHG-emissions reduction, as well as the preservation of the blue earth for eternity.

#### Removing extraneous matter and polishing propellers

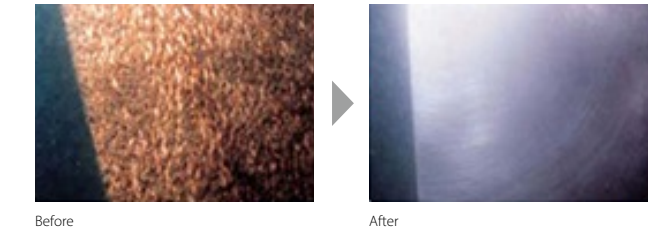
Seaweed and crustaceans adhere to hulls and propellers, and result in increased propulsion resistance, which drops ship speed and increases fuel consumption. Ordinarily, antifouling paint is used on ship bottoms to prevent matter from adhering to the hull, but after the passage of time, organisms begin to adhere anyway. Underwater cleaning (UWC) is subsequently required. We regularly have divers inspect the condition of the hull and bottom paint underwater, and at the optimal times perform UWC and propeller polishing. In addition to the fact that UWC and propeller polishing are effective in fuel-consumption savings\*, these activities are also important from the perspective of preserving biodiversity. Therefore, our Group is actively working on environmentally friendly hull maintenance.

\*With UWC we can expect to reduce fuel-consumption by about 10%, and by 1-2% in the case of propeller polishing

#### Comparison between before and after UWC



#### Comparison between before and after propeller polishing



#### Environmental Activities at Terminals and Warehouses

##### Domestic Terminals

We have set a target of achieving carbon neutrality by 2040 and aim to realize decarbonization at Japan's domestic ports.

##### (Example of activities)

- Installation of Hybrid-cargo-handling equipment (Ohi Container Terminal (Tokyo), Rokko Container Terminal (Kobe))
- Container Hangar (Ohi Terminal)
- Additives that reduce soot and smoke and improve fuel efficiency are used in the fuel
- Installation of hybrid cargo handling equipment
- Older trucks have been replaced with ones that emit less pollution
- Eco-driving training has been provided for truck drivers
- Waste generated in container yards is recycled.

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### • Overseas Terminals

Yusen Terminals Inc. (YTI) in Los Angeles has introduced a solar power generation system and electric vehicles for use within the terminal. Both of these measures have led to a reduction of CO<sub>2</sub> emissions and thus aided the City of Los Angeles's anti-pollution measures. YTI has installed power factor correction equipment to improve the efficiency of electricity use. The Company has also installed shoreside connection boxes for a system that supplies the necessary electricity.

In Belgium, NYK's wholly-owned subsidiary International Car Operators N.V. (ICO) operates the wind turbines on the grounds of the terminal in Zeebrugge, and the electricity generated by these turbines is used to power all of the facilities there. In addition, in January 2023, the two wind turbines at the completed car terminal in Tianjin, China, which is operated by an affiliated company in which NYK has invested, also began operating, and it became possible to cover all electricity needs with the solar power generation that has already been in operation.



Solar power generation system at the Los Angeles Terminal



Wind turbines installed in a completed car terminal (Belgium)

### • Installation of solar-power generation equipment in various facilities

NYK has been operating rooftop solar-power generation facilities at the NYK Tobitakyu general training institute since 2002. Consisting of six generators with 420 solar panels (120 centimeters by 80 centimeters), the system can meet approximately 30% of the electricity needs of the institute. In addition, we have installed and are operating solar power generation systems at facilities in Japan and overseas.

### Zero GHG Emissions

#### -Initiatives to Develop Next-generation Fuels and Renewable Energy-

### • Ammonia

Amid the accelerating energy shift towards a decarbonized society, in the shipping industry in which GHG-emission reduction is an urgent issue, research and development is underway to switch from the conventional heavy oil to LNG and then to next-generation zero-emission fuels for marine vessels.

Ammonia, which does not emit CO<sub>2</sub> when burned, is considered as a zero-emission fuel that will contribute to the prevention of global warming; however, there are several hurdles to overcome before it can be used as a marine fuel. One of the issues is ensuring safety. Ammonia is toxic in nature. Therefore, it is essential to take measures to ensure that seafarers handle it safely. Moreover, to use Ammonia as fuel, production is required on a scale that is completely different from that required for conventional fertilizer use, which means that it is essential to create a fuel ammonia market and build a supply chain.

Through the support of the Green Innovation Fund\* and collaboration with our partners, the NYK Group is involved in the technological development of next-generation fuel ships, including ammonia, as well as leading the way in implementation of the entire supply chain for the commercialization of next-generation fuels, including legal compliance and safety guidelines.

\* Green Innovation Fund: A 2 trillion-yen fund created in NEDO to significantly accelerate current efforts such as structural transformation of the energy and industrial sector and innovation through bold investment toward carbon neutrality by 2050. The fund provides continuous support from R&D and demonstration to social implementation for up to 10 years for companies that share ambitious and concrete goals with the public and private sectors and tackle them as management issues. NEDO mainly provides support in 14 priority areas for which action plans are being formulated in the green growth strategy.

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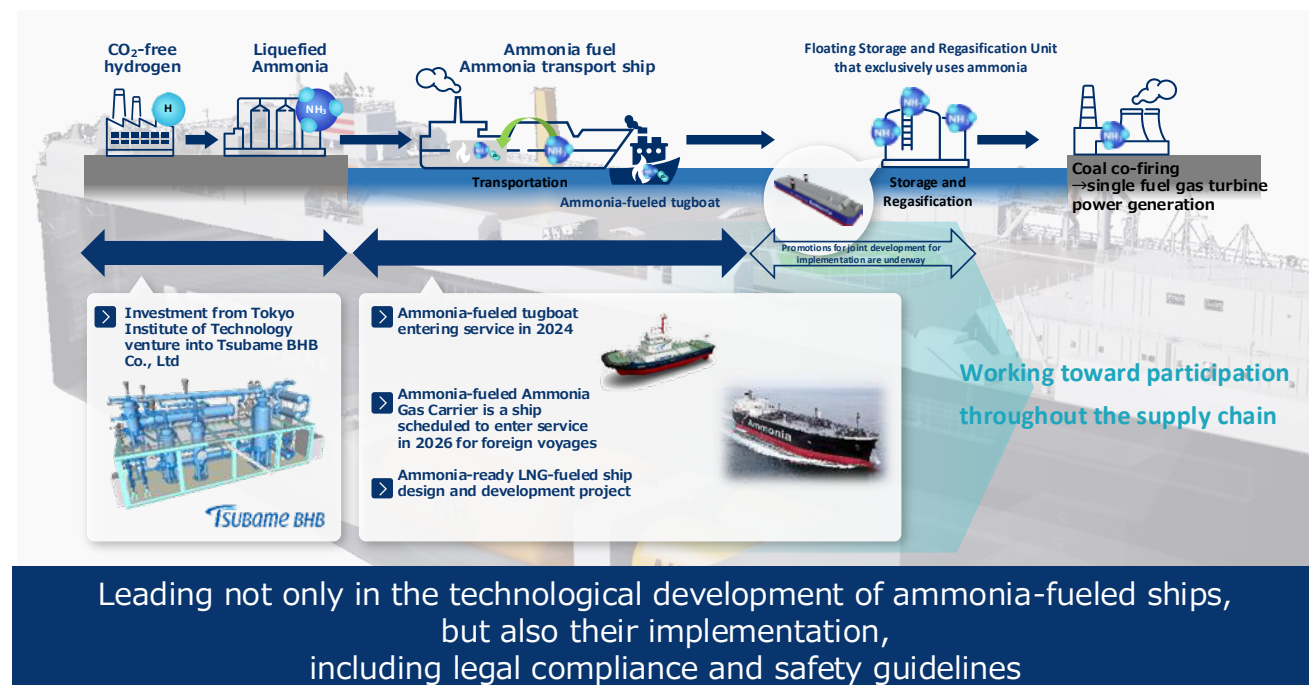
#### Related Data

## Decarbonization

### Prospects for Ammonia-fueled Ship Development Project



### Driving establishment of ammonia supply chain with partners



### Demonstration project begins for commercialization of vessels equipped with domestically produced ammonia-fueled engine

In October 2021, our Company was selected for a public call for proposals for a subsidy project by the New Energy and Industrial Technology Development Organization (NEDO), which is a part of the Green Innovation Fund Project. We have begun a demonstration project for commercialization of vessels equipped with domestically produced ammonia-fueled engines in collaboration with our joint development partners; Japan Engine Corporation, IHI Power Systems Co., Ltd., Nippon Shipyard Co., Ltd., and the cooperating organization Nippon Kaiji Kyokai. In December 2023, we concluded a series of agreements related to the construction of the first ammonia-fueled medium gas carrier (AFMGC) equipped with a domestically produced engine.

### Ammonia-fueled tugboat (AFT)

As part of the “Demonstration project begins for commercialization of vessels equipped with domestically produced ammonia-fueled engine”, we are working with IHI Power Systems Co., Ltd., and Nippon Kaiji Kyokai to commercialize the world's first ammonia-fueled tugboat. We obtained Approval in Principle (AIP)\* in July 2022.

NYK Group's Shin Nihonkai Ocean Co., Ltd., carried out modification work at Oppama factory of Keihin Dock Co. Ltd. (Kanagawa Prefecture) to convert the LNG-fueled tugboat “Sakigake,” previously operated in Tokyo Bay, into an ammonia-fueled tugboat.

\* Approval in Principle (AIP): This is a certificate issued by a certification body to indicate that the basic design has been reviewed and approved as meeting the technical requirements and safety standards.

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In this modification work, the entire engine system including the main engine (hereinafter referred to as “engine”) and the fuel tank were replaced. This involved cutting the engine room to remove the existing LNG fuel equipment and installing new equipment designed for ammonia fuel. The newly installed ammonia fuel engine has completed its operational testing at the IHI Power Systems Co., Ltd. Ota Plant (Gunma Prefecture). It has been confirmed that emissions of N<sub>2</sub>O (nitrous oxide), which has a

greenhouse effect approximately 300 times that of CO<sub>2</sub>, as well as unburned ammonia, are nearly zero.

The ammonia-fueled tugboat “Sakigake” was completed in August 2024. Subsequently, Shin Nihonkai Ocean Co., Ltd. undertook demonstration operations for the tugboat as the world's first ammonia-fueled vessel to verify decarbonization effects and operational safety.

#### Development and Implementation of Ammonia-fueled Tugboat

Application	In charge	FY2021	FY2022	FY2023	FY2024	FY2025	FY2026	FY2027
Main machinery	IHI Power Systems	Development, Manufacturing, and Trial Operation of 4-stroke Engines						
Ship development	Nippon Yusen Kabushiki Kaisha (NYK)	Hull Design, Trial Operation, and Construction				Completion		
Operation	Nippon Yusen Kabushiki Kaisha (NYK)	Compliance with Laws and Regulations, Development of Operation Manuals					Demonstrational Operation/Actual Operation	

ClassNK (Nippon Kaiji Kyokai)

Technical verification of safety  
Basic research for the formulation of international guidelines  
Support for compliance with laws and regulations

#### > Ammonia-fueled Ammonia Gas Carrier (AFAGC)

As a part of the initiative "Demonstration project for commercialization of vessels equipped with domestically produced ammonia-fueled engine," we are collaborating with Japan Engine Corporation, IHI Power Systems Co., Ltd., and Nihon Shipyard Co., Ltd. to advance the research and development of ammonia-fueled ammonia transport vessels (AFAGC). In September 2022, we obtained approval in principle (AiP), and we are working on further design optimization with the aim of launching the ship in 2026.



AFAGC exterior



Ammonia-fueled tugboat "Sakigake"

#### > Ammonia-fuel Ready LNG-Fueled Vessel (ARLFV)

We are working on the design and development of “Ammonia-Ready LNG Fuel Vessel,” which is an LNG-fueled ship capable of being converted to use ammonia as a marine fuel immediately after the facilities for supplying ammonia as a marine fuel are established. This initiative is undertaken in collaboration with MTI, our group company and Elomatic, a Finnish ship technology consulting firm.

The three companies are positioning the ammonia-ready LNG-fueled ships as the next-bridge solution until marine fuel is completely switched from LNG to ammonia. The concept design is now complete, and we are currently working with shipyards and marine equipment manufacturers on the actual design.

#### > LNG Fuel Supply Initiatives

##### • The world's first fuel ammonia supply to ships using the truck-to-ship method

In July 2024, we supplied fuel ammonia to the NYK-owned ammonia-fueled tugboat that was later completed in late August of the same year. This is the world's first case of supplying fuel ammonia to a ship using the truck-to-ship method\* (as of July 2024, according to our research).

\* Truck to Ship method: A method of supplying fuel to ships, in which fuel is supplied to ships from tank lorries via flexible hoses.

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### • Development of Japan's first fuel ammonia supply system for ships

In August 2023, we signed a basic agreement with TB Global Technologies Co., Ltd. (TBG), the domestic leader in manufacturing cargo handling equipment for liquids such as crude oil and LNG, to jointly develop Japan's first "bunkering boom" designed specifically for fueling ammonia between vessels. By incorporating TBG's technology that reliably prevents liquid leakage, we aim to contribute to the decarbonization of vessels and significantly enhance safety when supplying highly toxic ammonia to ships. In July 2024, we obtained the basic design approval (AiP) for the same device from the Nippon Kaiji Kyokai.

### • Ammonia Floating Storage Regasification Barge (A-FSRB)

The three companies, including Nihon Shipyard Co., Ltd. IHI, and NYK are engaged in the world's first research and development of a barge equipped with a dedicated floating storage and regasification unit for ammonia. In January 2023, we obtained Approval in Principle (AiP) for its basic design. By utilizing it as an alternative to onshore facilities (such as storage tanks, regasification equipment) for the stable supply of fuel ammonia, it is expected to contribute to the early realization of the introduction of fuel ammonia.

### • Hydrogen

#### > Capital Participation in JSE Ocean to Establish International Liquefied Hydrogen Supply Chain

In September 2023, NYK agreed to participate in a third-party capital increase alongside Kawasaki Kisen Kaisha, Ltd. and Mitsui O.S.K. Lines, Ltd., to invest in and collaborate with JSE Ocean Co., Ltd., a subsidiary of Japan Hydrogen Energy Co., Ltd.

JSE Ocean was established in January 2023 as a subsidiary of Japan Hydrogen Energy Co., Ltd. with the purpose of exploring marine transportation of liquefied hydrogen using liquefied

hydrogen carriers. Through this third-party capital increase, NYK will jointly work on ensuring safe and efficient operation of the world's first large, liquefied hydrogen carrier and on exploring viable business models for future marine transportation.

#### > Advanced Hydrogen Energy Chain Association for Technology Development (AHEAD)

To realize a hydrogen society as early as possible, we have been participating in the Advanced Hydrogen Energy Chain Association for Technology Development (AHEAD) since 2017.

In 2020, AHEAD was selected by the NEDO grant program and completed the world's first demonstration of an international hydrogen supply chain using MCH (methylcyclohexane).

Since 2021, AHEAD has started to supply MCH produced in Brunei to ENEOS Corporation's demonstration project in Japan till 2022.

#### > Partnership for Practical Application of Next-Generation Fuels

Challenging new fields requires a combination of "technological capabilities" and "collaborative creation," and collaborative creation is the driving force behind innovation. We are participating in the below networks to create further collaborative creation.

We will continue our efforts to decarbonize not only the shipping industry but also society as a whole through collaborative creation with world-class partners.

#### > Examples of collaborative creation with partners

- Clean Fuel Ammonia Association
- Hydrogen Council
- The Maersk Mc-Kinney Moller Center for Zero Carbon Shipping
- Getting to Zero Coalition
- Hydrogen Value Chain Development Council



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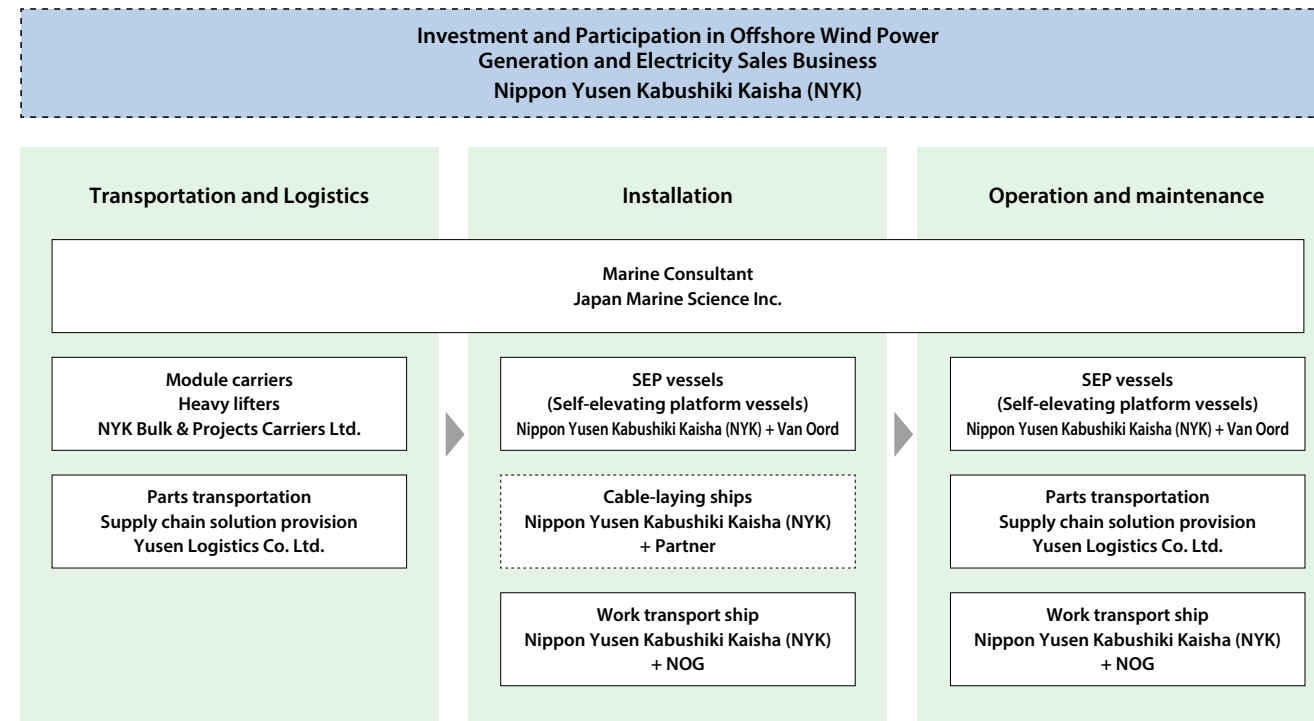
## Decarbonization

### Offshore wind power

The offshore wind market in Japan is expected to expand rapidly. In addition to the technological capabilities and knowledge of Japanese regulations and legal systems that we have cultivated over many years through our shipping business, the NYK Group is taking

full advantage of the knowledge that we have gained through our offshore business and the nationwide group companies that we have established throughout Japan to actively participate in the entire offshore wind value chain.

### Scope of the Group's Services in Offshore Wind Power Generation Business



Solid line: Indicates already participated or announced participation  
Dotted line: Indicates areas under consideration

### Jack-up vessel (Self-Elevating Platform Vessel)

In cooperation with Van Oord Offshore Wind BV in the Netherlands, NYK is making efforts to own and operate a self-propelled SEP vessel (Self-Elevating Platform) in Japan for use in the installation of offshore wind power turbines and operating it in Japan. We aim to introduce SEP vessels into the Japanese market that meet Japan-specific requirements, such as vessel registration, and are capable of installing increasingly large wind turbines.



Jack-up vessel

### Crew Transfer Vessel (CTV)

In cooperation with Northern Offshore Group AB (NOG) in Sweden, NYK is making efforts to own and operate crew transfer vessels (CTVs) for the offshore wind business in Japan, with the aim of building a domestic CTV based on NOG's original vessel design. In addition, NYK will establish a nationwide CTV service network for the future development of the offshore wind business in Japan. As part of the collaboration with NOG, NYK purchased a new CTV named "Energizer" in 2022. The CTV is currently being operated in Europe by NOG subsidiary Northern Offshore Services AS (NOS), with which NYK is currently promoting personnel exchanges.

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Image of CTV owned by NOS

NYK has concluded a time charter contract with Siemens Gamesa, the world-leading provider of wind power solutions, for a CTV for an offshore wind power generation facility. The CTV is named "Rera As" and started operation in Ishikari, Hokkaido, in July 2023. It is the first CTV owned and managed by the NYK Group inside Japan.



CTV "Rera As"

#### > Maritime consulting services

Japan Marine Science Inc. (JMS), an NYK Group company, provides comprehensive maritime consulting services. For the offshore wind business, JMS offers site environment assessments, feasibility-study support for wind-turbine scale and specifications, use of a maritime simulator to examine vessel safety during and after the installation of wind turbines, diving inspections during wind turbine operation, training via simulator for workboat crews, and marine monitoring systems.



Maritime simulator

#### > Transportation business for offshore wind business

Having a history of more than 100 years, NYK Bulk & Projects Carriers Ltd. (NBP) is Japan's leading shipping company operating module carriers (Deck Carriers) and heavy-lift cargo (Heavy Lifters).

NBP has a track record in overseas offshore wind projects for the transport of nacelles (generators) via a heavy lifter and jackets (foundations) by module carriers.

In September 2021, heavy lifters with 800 mt lifting capacity were added to the NBP fleet, and the company is actively participating in offshore wind power projects in Japan.



Module carrier

#### > Collaboration with Regions

We opened the Akita branch in April 2022 and the Hokkaido branch in April 2024, strengthening our ties with local governments and communities.

For more information, click on the link below

[P.097 Community](#)

#### ● Biofuels\*

#### > Ongoing Trials for Practical Application of Biofuels

We are continuing with test voyages using biofuels and participating in demonstration projects to advance discussions toward full-scale operational implementation.

Starting in fiscal 2024, we are conducting full-scale trials to use biofuels, considered to have net-zero CO<sub>2</sub> emissions, for long-term operation of existing heavy fuel oil-powered vessels. Building on previous short-term trials, we are now advancing to a comprehensive evaluation of the long-term use of biofuels, focusing on safety, stable supply, and other critical factors.

As part of this initiative, in May 2024, we launched our first long-term biofuel trial voyage on a large crude oil tanker.



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\* Biofuel: A fuel made from renewable, biologically sourced organic materials (biomass), and is expected to serve as an alternative to petroleum-based heavy oil and diesel. CO<sub>2</sub> emissions from burning biofuels are considered to be effectively zero.



Long-term operational test voyage using the large crude oil carrier "Tenjun"

#### GHG Removal

##### • CO<sub>2</sub> Capture, Utilization, and Storage (CCUS\*)

In industries in which GHG emission reductions are technically and economically challenging, efforts in CO<sub>2</sub> capture, utilization, and storage are also essential for achieving net-zero goals. There are currently many CCUS projects being planned around the world including Japan. It is expected that multiple CCUS projects will be launched in parallel in Japan from the second half of the 2020s onwards. With this background, our Group is also participating in the CCUS value chain.

\*CCUS (Carbon dioxide Capture, Utilization, and Storage): Involves the capture, conversion, and storage of CO<sub>2</sub>; it is garnering attention as an effective means of achieving a carbon-neutral society. In such a value chain, LCO<sub>2</sub> ships are expected to play an indispensable role in transporting liquefied CO<sub>2</sub> to storage and utilization sites, and future demand for them is expected to grow.

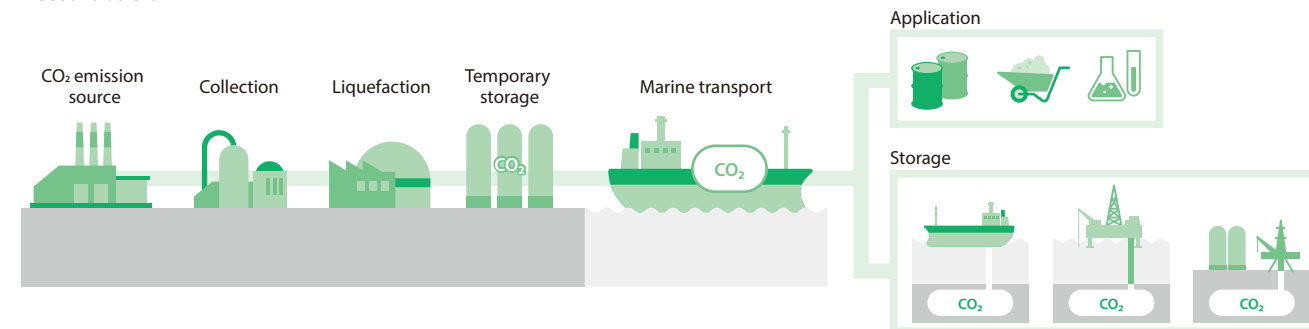
#### > Developing large LCO<sub>2</sub> carrier jointly with Mitsubishi Shipbuilding Corporation

In collaboration with Mitsubishi Shipbuilding Corporation, we are developing a technology for transporting CO<sub>2</sub> by large vessels, which are expected to be in growing demand globally in a carbon-neutral society.

Through this joint project, we will contribute to developing various technologies, such as liquefied CO<sub>2</sub> carriers (LCO<sub>2</sub> carriers), which are necessary for establishing the CCUS value chain in which we will participate.

In May 2022, we obtained Approval in Principle (AiP) from the Nippon Kaiji Kyokai for the basic design of a large, liquefied CO<sub>2</sub> carrier (LCO<sub>2</sub> vessel), and in June 2023, we received AiP for a dual-purpose ammonia and liquefied CO<sub>2</sub> carrier.

#### ■ CCUS Value Chain



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### > Participation in LCO<sub>2</sub> Transportation and Storage Business

In December 2021, NYK established a joint venture company, Knutsen NYK Carbon Carriers AS (hereafter, KNCC) with a Norwegian Knutsen Group. KNCC aims to develop a global business for the marine transport and storage of liquefied CO<sub>2</sub>.

In addition to utilizing the already established liquefied CO<sub>2</sub> transport technology, we have also begun developing technology for transporting and storing CO<sub>2</sub> in a liquefied state at room temperature (PCO<sub>2</sub>\*). In April 2022, we received classification certification from DNV, the Norwegian classification society. This is the first time in the world that a cargo tank system capable of transporting and storing liquefied CO<sub>2</sub> at sea at normal temperatures has been granted the classification certification.

Subsequently, NYK and KNCC renamed the project "LCO<sub>2</sub>-EP System" and continued to advance the detailed design. In June 2023, we successfully obtained General Approval for Ship Application (GASA) from DNV for the detailed design. Accordingly, we were able to install the "LCO<sub>2</sub>-EP system" on new and existing ships.



Image of a liquefied CO<sub>2</sub> transport ship

### • Carbon Offset\*

#### > Carbon Offset Transportation Service

Amid growing interest in environmental considerations throughout the supply chain, our Group is working on carbon offset transportation services as one of the options for providing environmentally valuable marine transportation services in response to requests for such services from domestic and international customers.

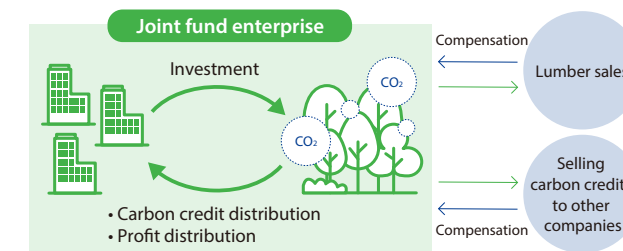
In September 2019, we became the first Japanese shipping company to implement carbon offsetting. In March 2023, we completed the coal carrier "Kagura" for Chugoku Electric Power Co., Inc., utilizing carbon offsetting to theoretically achieve zero GHG emissions for the entire voyage under a long-term transportation contract with the company, thereby making coal marine transportation under this contract carbon neutral.

\* Carbon Offset: Offsetting GHG emissions by purchasing credits representing reductions or absorptions of greenhouse gases achieved elsewhere, or by participating in projects that realize reductions or absorptions of emissions in other locations, for some or all of the difficult-to-reduce emissions.

### > Joint Investment in Forest Fund Organized by Sumitomo Forestry Group

In July 2023, we participated in the "Eastwood Climate Smart Forestry Fund I," a forest fund organized by Eastwood Forests LLC, a forest asset management subsidiary of Sumitomo Forestry Co., Ltd., alongside nine other Japanese companies. Through this fund, we aim to enhance the CO<sub>2</sub> absorption capacity of forests, generate an average of approximately 1 million tons of additional CO<sub>2</sub> absorption per year, and contribute to the realization of a decarbonized society by creating and returning high-quality carbon credits.

#### ■ Joint Investment in Forest Fund Organized by Sumitomo Forestry Group



### > Investing in Australian carbon credit sales company

In September 2021, we have invested in Australian Integrated Carbon Pty Ltd (Ai Carbon), an Australian company that absorbs CO<sub>2</sub> and sells carbon credits obtained through primeval forest restoration projects, through Japan Integrated Carbon (JIC), a holding company established jointly with Mitsubishi Corporation.

As of March 2024, Ai Carbon has achieved CO<sub>2</sub> absorption of up to 5 million tons per year, and is expanding its business with the aim of achieving cumulative CO<sub>2</sub> absorption of 100 million tons by 2050. Through our involvement in this project, we aim to gain experience and expertise in the carbon credit creation business.

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Image of primeval forest restoration projects

### Research & Development

#### • Development of Technology that Enables Energy-efficient Operation

With the promotion of energy-efficient navigation, ships are generally operated at lower speeds than those assumed when they were built. On this background, the NYK Group is working to convert ships to low-speed operation specifications and improve propulsion performance by modifying the bulbous bow\* of ships in service and installing the MT-FAST hull appendage.

Big Data analyses using actual voyage data gathered over half a year after the implementation of improvements in June 2014 were conducted by the NYK Group, and a 23% reduction in CO<sub>2</sub> emissions was confirmed. The conversion was also verified not to affect the safe operation of the vessel or the operating condition of the engine.

The NYK Group has established a method for examining modifications suitable for operational conditions in a short period and efficiently (patent obtained). Based on this method, we will proceed with modifications for our operational vessels in the future to further enhance energy-saving effects.

\*Bulbous bow: A protruding bulb at the front of a ship just below the waterline. The bulb modifies the way the water flows around the hull, reducing drag and thus increasing speed, range and fuel efficiency.

#### > Mechanisms to Increase Combustion Efficiency “MT-FAST”

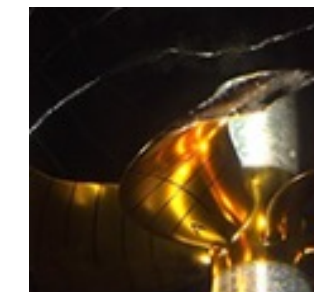
The ideal shape of a ship for fuel-saving operations is one with minimal wave and wind resistance. However, ships must place priority on cargo tonnage and volume, which imposes constraints that make it difficult to achieve this ideal. Therefore, a number of appendages that can be added to ships to help them save fuel have been developed. One example is a propulsion-improvement unit “MT-FAST”, which MTI Co., Ltd. jointly developed with Tsuneishi Shipbuilding Company. The rotation of the propellers in the water creates a swirling flow that impairs propulsion. Attaching wings to the ship helps to recover this lost propulsion. Our propulsion-improvement unit (patented) was developed by the Monohakobi Technology Institute in February 2008 as part of a joint project, and experiments indicate that the unit has an energy-conservation effect of approximately 4-6 percent.



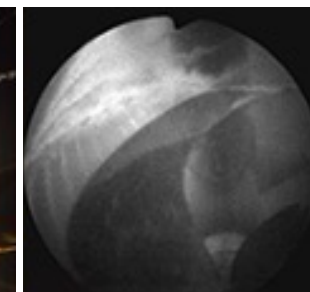
MT-FAST

#### • Building Environmentally Friendly Vessels ‘High-efficiency Propellers’

NYK, together with MTI Co., Ltd. and Furuno Electric Co., Ltd., has developed sensors to measure the flow of water around ship in operation. The data collected using the sensor is shared with Nihon Shipyard Co., Ltd. for analysis and utilization. Based on those foundations, we designed a propeller that pursues even higher efficiency through simulations that replicate actual vessels, achieving approximately a 2% reduction in CO<sub>2</sub> emissions. Similar measurements were conducted on a large crude oil tanker delivered in 2020, and improvements were made to the shape of the stern appendages on subsequent new buildings of the same type, resulting in a reduction in CO<sub>2</sub> emissions of approximately 2%. We plan to continue this research and expand it to other types of vessels in the future. We will utilize this full-scale simulation technology to designing hull forms as lower resistance toward 2050.



Model propeller tank test



Actual ship observation

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### > Saving Energy through “Bubbles” - Air-Lubrication System

Our air-lubrication system is an energy-saving technology that reduces friction between the hull and seawater by supplying air bubbles to the bottom of the vessel. In 2010, the NYK Group launched two module carriers\*, Yamato and Yamatai, which became the world's first operational ocean vessels equipped with an air-lubrication system based on an air-blower. In July 2012, the group introduced the coal carrier Soyo, which is equipped with a world first an air-lubrication system featuring a main engine scavenging-air bypass (related patent acquired). The group has confirmed that the air-blower-based system reduces CO<sub>2</sub> emissions by an average of approximately 6 percent, while the system using a main engine scavenging air bypass is expected to reduce CO<sub>2</sub> emissions between approximately 4 percent and 8 percent.

\* Module carrier: Special heavy load carrier with roll-on, roll-off ramp way to transport thousand-ton prefabricated structures of plant facilities to be installed on oil/gas development sites or industrial locations.



Image from the bottom of a module carrier equipped with an air lubrication system

### > Taking an active role in environmental regulations through development of new oil additive

Nippon Yuka Kogyo Co. Ltd., a NYK Group company, has been investigating the properties of VLSFO (fuel oil with a sulfur content of 0.5% or less) as one of the measures to comply with SOx emission requirements, and in May 2019 developed the sludge\*-dispersing fuel oil additive “Yunic 800VLS”. Yunic 800VLS is effective against most of deteriorated compliant fuel oil, and with taking account into present fuel problem situations, we feel our main target need to be changed to reduction of fuel for contribution of environmental protection, from sludge trouble prevention. Since we were aware of it, in May 2022, the both companies developed the Yunic 800VLS “grade-up” version, which is having not only more powerful sludge dispersion characteristics to cover the rest of stubborn deterioration fuel, but fuel consumption reductions.

Yunic 800Eco enhances sludge dispersion and improves combustion. In three fuel consumption ratio reduction tests conducted with compliant fuel oils in Japan and overseas, we observed fuel consumption was reduced by up to 1.2% compared to when the additive was not used, and carbon monoxide (CO) emissions were also reduced.

We will continue to work to develop additives that are more fuel-efficient and versatile, while maintaining the current sludge dispersion effect, and contribute to the reduction of CO<sub>2</sub> emissions from ships.

\* Sludge: A sediment contained in fuel. Preventing sludge buildup and dispersing it can improve combustion.

### ● Participation in Tidal Power Generation Demonstration Project in Off-grid Area in Singapore

In 2019, NYK and our group company MTI participated in the “tidal power generation demonstration project on Singapore's Sentosa Island” as joint research partners. In 2022, our company participated

in a tidal power demonstration project in Singapore conducted by Bluenergy, a solution provider for integrated power generation, storage, and distribution in marine renewable energy.

In this power generation demonstration project which utilizes tidal energy in off-grid areas that are not connected to the power grid, operations of the first power generation equipment in Southeast Asia began in March 2023.

Tidal power generation is a highly efficient renewable energy source that is easy to predict as it uses the stable flow of water and direction of the tide throughout the year. To contribute to the early realization of a decarbonized society by utilizing marine energy, we will advance the estimation of power generation efficiency, storage and generation costs, and the verification of storage devices based on power generation data.

#### Co-creation with External Parties

##### Participation in External Initiatives

NYK group continues to participate in various initiatives and promote co-creation toward the realization of decarbonization.



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### Major Decarbonization-related Initiatives with NYK Group Participation

Initiative/Organization Name	Theme	Time of Participation
International Shipping GHG Zero Emission Project	Climate Change/Decarbonization	Aug-18
Climate Change Initiative “Japan Climate Initiative”	Climate Change/Decarbonization	Sep-18
Clean Fuel Ammonia Association	Ammonia	Apr-19
Task Force on Climate-related Financial Disclosures (TCFD) Consortium	Climate Change/Decarbonization	May-19
Coalition of Non-Profit Organizations “Getting to Zero Coalition”	Climate Change/Decarbonization	Oct-19
Japan Business Federation “Challenge Zero Declaration”	Climate Change/Decarbonization	Mar-20
Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping	Climate Change/Decarbonization	Jul-20
Hydrogen Council	Hydrogen	Jul-20
Japan Hydrogen Association (JH2A)	Hydrogen	Dec-20
International think tank for CO <sub>2</sub> capture and storage technology “Global CCS Institute”	Climate Change/Decarbonization	Jul-21
GX League	Climate Change/Decarbonization	May-23
GCMD (Global Centre for Maritime Decarbonization)	Climate Change/Decarbonization	Jul-23
Methane Abatement in Maritime Innovation Initiative (MAMII)	Climate Change/Decarbonization	Sep-23
Smart Freight Centre (SFC)	Climate Change/Decarbonization	Apr-24

### Participation in Ministry of Economy, Trade and Industry's “GX League”

Since 2023, our company has been participating in the GX League, organized by the Ministry of Economy, Trade and Industry. “GX League” is a platform where companies, government agencies, and universities came together and committed to achieving sustainable growth in the current and future society, with the goal of realizing carbon neutrality by 2050. The organizations collaborate in pursuing challenges towards GX\* and engage in practical efforts to transform the economic and social systems and create new markets.

Through our participation in the GX League, we will further accelerate co-creation with various stakeholders.

\*GX (Green Transformation): We view the response to achieving decarbonization in Japan and worldwide as a growth opportunity, undertaking challenges to transition to decarbonization as quickly as possible, with the aim of transforming the entire economic and social system (as defined by the Ministry of Economy, Trade and Industry).

### GCMD and a Japanese company have concluded a first strategic partnership agreement

In July 2023, NYK became the first Japanese company to sign a strategic partnership agreement with the Global Centre for Maritime Decarbonization (GCMD), a non-profit organization in Singapore that promotes the decarbonization of the shipping industry.

GCMD is conducting a number of surveys and demonstration projects to present a concrete and clear path to achieving decarbonization in international shipping. In May 2024, we started “Project LOTUS” in collaboration with GCMD. This project is examining the impact of biofuels on engine performance and fuel supply systems.

### Participation in MAMII Environmental Initiative Aimed at Methane Emissions Reduction

In September 2023, we joined the Methane Abatement in Maritime Innovation Initiative (MAMII), an environmental initiative aimed at reducing methane emissions in the maritime industry, as a major partner.

MAMII is led by Safetytech Accelerator Limited, a non-profit organization established by Lloyd's Register. Since its launch in September 2022, a total of 16 companies and organizations, including NYK, have participated. Under MAMII, the amount of methane emissions from LNG-fueled ships are measured and evaluated, and knowledge on reducing methane emissions is shared among participating companies to provide support for introducing technologies and the like. Moreover, the organization also studies and disseminates information regarding the environmental impact of LNG fuel across the supply chain.

### Became Member of Smart Freight Centre

In April 2024, we became a member of Smart Freight Centre (SFC), an international non-profit organization that aims to reduce GHG emissions in the logistics sector. We have established the Global Ro-Ro Community, aimed at standardizing GHG emissions calculation for Ro-Ro vessels\*, including car carriers, in collaboration with SFC, the overseas shipping company Wallenius Wilhelmsen ASA, and the Nippon Kaiji Kyokai. The community will work to develop a standard model for calculating GHG emissions related to marine transport, with the aim of achieving a fair and transparent understanding of carbon emissions.

\* Ro-Ro vessels: A cargo ship that can be driven directly onto the ship by cars, trucks, trailers, construction machinery and agricultural machinery

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### ● Activities as Member of Japanese Shipowners' Association

The Japanese Shipowners' Association, in cooperation with the Ministry of Land, Infrastructure, Transport and Tourism, is demonstrating leadership in discussions at the International Maritime Organization (IMO) regarding the introduction of regulations and the reduction of GHG emissions.

We are active as a member of the Environmental Committee of the Japanese Shipowners' Association, as well as the various steering committees and task forces that form part of the committee. In the GHG Task Force, which serves as a forum for discussions on GHG emissions, NYK acts as the chair and represents member companies. As a shipowner and ship operator, we actively participate in discussions on a feasible climate change framework within the shipping industry.

### ● Participation in International consortium "DecarbonICE"

We participated in an international project "DecarbonICE," which researches technology for capturing CO<sub>2</sub> on board ships, converting it to dry ice, and storing it in seabed sediments.

The project was launched in October 2019 by Denmark's Maritime Research and Development Center, NYK, and shipping companies and shipyards from around the world. The aim is to prepare for obtaining approval from the IMO regarding CO<sub>2</sub> recovery and storage technology on board ships, methods for investigating environmental impact, safety, etc.

The project concept involves: ① capturing CO<sub>2</sub> and other exhaust gases emitted from vessels during operation and converting them into dry ice through an ultra-low temperature process, and ② safely and permanently storing the CO<sub>2</sub> in deep-sea sediments as liquid or hydrates by sending the dry ice from the vessel to the deep sea.

In the future, by combining this with biofuels and other alternatives, it is anticipated that we can achieve "carbon negative" transportation, where the amount of CO<sub>2</sub> captured exceeds the amount of CO<sub>2</sub> emitted, moving beyond mere carbon neutrality.

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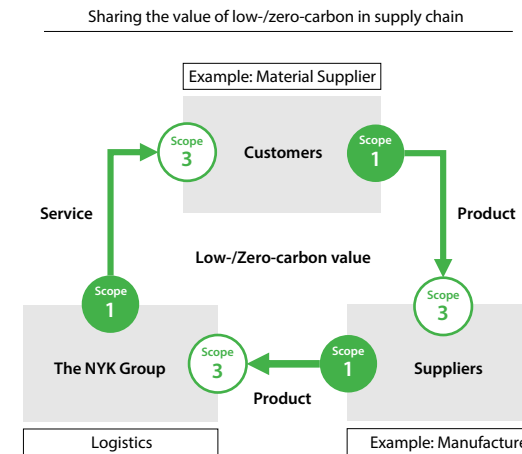
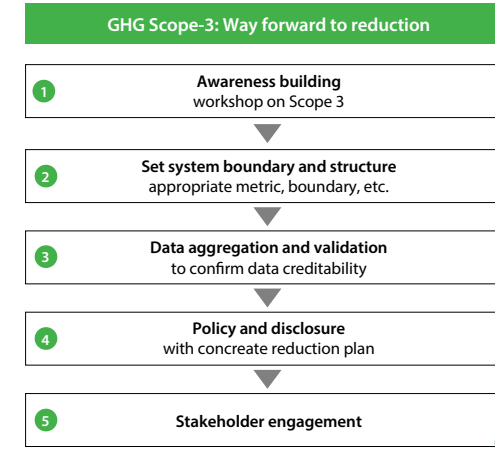
#### Related Data

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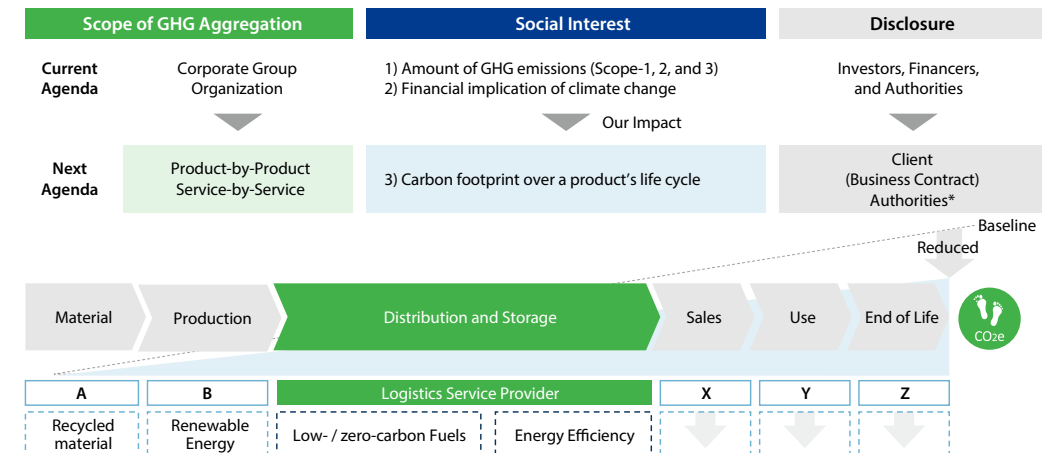
### Co-creation with Stakeholders

In pursuit of reducing GHG emissions in Scope 3, we are promoting initiatives aimed at achieving a low-carbon and decarbonized society, working together with our business partners to reduce emissions (carbon footprints) for each product.

### Towards Reduction of Scope 3 Emissions



### Carbon Footprint Garnering More and More Attention



\*EU: Battery Regulation, Carbon Boarder Adjustment Mechanism etc.



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### Co-creation with Customers

#### ● World's First LNG-fueled Panamax Coal Carrier Begins Operations

We completed construction of the world's first LNG-fueled Panamax\* coal carrier in collaboration with Kyushu Electric Power Company Inc., and commenced its operations in October 2023. This vessel is operated by NYK and is used to transport coal from overseas to Kyushu Electric Power Company Inc. By using LNG fuel, we anticipate a reduction in emissions of approximately 100% for SO<sub>x</sub>, about 80% for NO<sub>x</sub>, and around 30% for CO<sub>2</sub> compared to conventional marine fuel oils. We believe this will contribute to achieving a low-carbon society amidst the global strengthening of environmental regulations.



LNG-fueled Panamax Coal Carrier "Shoyo"

\* Panamax: Panamax bulkers are defined as ships with deadweight tonnage of 70,000 to 99,999 tons. The world's first LNG-fueled Panamax bulker, according to a survey by the NYK Research Group as of October 2023

#### ● Collaborating with Customers to Decarbonize Maritime Transport Between Japan and Chile (NYK Bulk & Projects)

Our group company, NYK Bulk & Projects Carriers Ltd., has signed an MOU with Corporación Nacional del Cobre de Chile (CODELCO), a leading copper producer and state-owned company in Chile, to jointly explore decarbonization in the maritime transport of copper concentrates.

Based on this MOU, NYK Bulk & Projects Carriers Ltd. has agreed in November 2023 to collaborate with Oshima Shipbuilding Co., Ltd., part of the Sumitomo Corporation Group, to explore the construction of up to 15 Handymax bulk carriers\* capable of using ammonia as fuel, with plans to build them in the late 2020s.

Demand for copper is expected to increase worldwide in the

future due to factors such as the development of transmission networks for offshore wind power generation and the spread of electric vehicles. CODELCO aims to achieve carbon-free copper concentrate by utilizing this vessel for transportation to the Far East, thereby eliminating GHG emissions throughout the entire process of production, transportation, and supply.

Additionally, in January 2024, NYK Bulk & Projects Carriers Ltd. signed an MOU with Enaex S.A., a Chilean ammonium nitrate manufacturing company, to jointly explore the supply of green ammonia produced from renewable energy for ammonia-fueled vessels. The two companies will now move forward with specific discussions with the aim of supplying green ammonia to ships at the Port of Mejillones in the Antofagasta Region in northern Chile.

\* Handymax bulker: Dry bulk carriers that transport a wide variety of dry bulk cargo, with a deadweight of around 50,000 tons. This ship type is equipped with a crane to enable cargo handling at any port.

#### ● Strategic Partnership with BHP Toward Decarbonization

In June 2022, we signed an MOU with BHP, a major player in the resources sector, to establish a strategic partnership aimed at expanding and deepening their business relationship and achieving decarbonization in the supply chain for maritime transportation.

The two companies will leverage existing energy-saving technologies and alternative fuels, and will particularly promote research and development on next-generation ship fuels using green ammonia\*<sup>1</sup> and blue ammonia\*<sup>2</sup>, aiming for future net-zero emissions.

\*1 Green ammonia: Ammonia produced from renewable energy sources

\*2 Blue ammonia: Ammonia produced from natural gas and other raw materials, and treated by burying the CO<sub>2</sub> generated in the production process in the ground and the like.

#### ● Strategic Partnership with BP toward Decarbonization

In September 2021, we signed a memorandum of understanding with BP, a major global marine fuel and lubricants supplier, to collaborate on future fuels and transportation solutions to help industrial sectors, including shipping, decarbonize. Both companies will collaborate and identify opportunities to help transition from current marine fuels to alternatives such as LNG, biofuels, and methanol, and to develop future zero-emission ship fuels such as ammonia and hydrogen. We will also consider potential marine transportation and other solutions to reduce CO<sub>2</sub>, and explore participation in the supply chains for ammonia and hydrogen to be used in heavy industry and power generation to help those sectors to decarbonize.

### Co-creation with Suppliers

#### ● Collaboration with Shipowners

We hold regular meetings (once a month) with ship owners and ship management companies to share information and exchange opinions on the safety and environmental performance of all the ships we operate, including those we charter. Additionally, we share data related to navigation and machinery, which is obtained hourly through the Ship Information Management System (SIMS), with shipowners and ship management companies. This helps prevent machinery accidents and confirms the safety of super slow steaming (SSS) while minimizing the load on the main engine. By achieving ultra-low speed navigation with the cooperation of the shipowners, we are contributing to reducing fuel consumption and environmental impact.

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### Co-creation with Regions

#### • Contribution to “Zero Carbon Yokohama” of Yokohama City

We support the “Zero Carbon Yokohama”<sup>\*1</sup> initiative, which is working towards the realization of a decarbonized society in Yokohama city. We have gradually switched the power supply for “NYK Hikawamaru,”<sup>\*\*2</sup> (moored and open to the public at Yamashita park, as well as the Yokohama port Daikoku C-3 terminal, Yokohama branch, and NYK Maritime Museum) to electricity derived from renewable energy sources. Additionally, since 2022, we have effectively transitioned all power consumption for our headquarters and the NYK Building to electricity sourced from renewable energies.

<sup>\*1</sup> Zero Carbon Yokohama: A plan enacted by the city of Yokohama in Kanagawa prefecture to strengthen countermeasures against global warming and realize decarbonization by 2050 (net-zero GHG emissions) as soon as possible in the last half of this century, and to promote efforts to realize a sustainable large-city model.

<sup>\*\*2</sup> NYK Hikawamaru: This passenger-cargo ship was completed in 1930 and was active on routes such as the Seattle route. During World War II, the ship was utilized as a hospital ship, and after the war, it served as a repatriation and returning ship. Currently, NYK HIKAWAMARU is moored at Yamashita Park in Yokohama city. It was designated as an Important Cultural Property in August 2016, becoming the first preserved ship to receive this designation as a valuable resource for conveying shipbuilding technology from its time of completion.

### Investment in Startups

We aim to discover startups having groundbreaking ideas and technologies, fostering their growth and co-creation with an eye toward future collaboration. This initiative seeks to promote the decarbonization of our businesses and create new ventures that bring added value to society.

#### • Tsubame BHB

In June 2021, NYK decided to invest in Tsubame BHB Co. Ltd., a venture company originating at the Tokyo Institute of Technology. Tsubame BHB has established the practical application of an on-site ammonia synthesis system invented by Professor Emeritus Hideo Hosono that uses a manufacturing method to produce a required amount of ammonia at a required location. This method operates at lower temperatures and pressures than conventional technologies, and is expected to contribute to the decentralization of production. We have high expectations for Tsubame BHB as a partner that plays a role in the ammonia value chain.

#### • Startup Bootcamp

In June 2021, we implemented a startup accelerator program in collaboration with Mitsubishi Corporation to find and support startups with ideas and technologies for realizing a low-carbon and decarbonized society. Partnering with Startupbootcamp Australia as an accelerator partner to discover and support startups from around the world, in 2021, we conducted the “Startupbootcamp” program, in which we evaluated applicants from all over the world under the theme of decarbonization and completed one cycle of the acceleration program with 10 selected startups for their business development.

#### • Marunouchi Climate Tech Growth Fund

In May 2023, we signed an investment agreement with the “Marunouchi Climate Tech Growth Fund,” which primarily targets climate tech-related businesses that contribute to decarbonization. This fund was established by Mitsubishi Corporation, Mitsubishi UFJ Bank, and Pavilion Private Equity Co., Ltd., and aims to make growth investments in climate tech-related startups through Marunouchi Innovation Partners, Inc.

### Distribution of Information at International Conferences

#### • NYK Participates in “COP28” in Dubai

NYK management took part in discussions at various events during the 28th Conference of the Parties to the United Nations Framework Convention on Climate Change (“COP28”) held in Dubai, UAE, from November 30 to December 13, 2023.

The NYK representatives disseminated information on climate change initiatives by the company and the international shipping industry. To provide information on climate change initiatives, governments and industry groups hosted COP28 side events, as well as various panel discussions that often had participants engaging in lively discussions.

Our executive officer took stage as a panelist on November 6 and spoke about the NYK Group’s decarbonization initiatives and the current status and issues regarding ship-recycling.



NYK Participates in COP28

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#### ■ The NYK Group's GHG Emissions by Scope

(Units: t-CO<sub>2</sub>e)

Overall emissions	FY2021	FY2022	FY2023	Ratio in FY2023 (%)
Scope 1	12,678,695	11,255,044	11,410,363	76.4
Scope 2	45,391	76,255	63,342	0.4
Scope 1+2	12,724,086	11,331,299	11,473,705	—
Scope 3	3,890,661	3,264,023	3,455,848	23.1
Scope 1+2+3	16,614,748	14,595,322	14,929,553	—
Emissions from biofuel (from ships)	—	—	15,230	—

Note 1: The scope of aggregation includes headquarters and consolidated subsidiaries.

Note 2: CO<sub>2</sub>e: CO<sub>2</sub> equivalent.

Note 3: GHG emission data for Scope 1, Scope 2, Scope 3, and biofuel has been verified by a third-party organization.

Verification Report (<https://www.nyk.com/english/sustainability/pdf/environment009en.pdf>)

Note 4: Scope 2 emissions are calculated on a market basis.

Breakdown of emissions	Sub category	FY2021	FY2022	FY2023
Scope 1	Ships	10,708,996	10,123,951	10,224,932
	Aircraft	1,721,397	964,063	1,048,651
	Others	248,301	167,029	136,779
	<b>Total</b>	<b>12,678,695</b>	<b>11,255,044</b>	<b>11,410,363</b>
Scope 2 Market basis		45,391	76,255	63,342
Scope 2 Location basis		49,010	77,710	67,375

Note: In fiscal 2022, a renewable energy certificate was used to offset the electricity used at the Yokohama branch and the NYK Maritime Museum (234,641 kWh).

#### ■ The NYK Group's Energy Consumption Amounts (GHG-related)

Breakdown of emissions	Sub category	Unit	FY2021	FY2022	FY2023
Scope 1	Heavy oil A (MDO)	Tons	30,415	27,219	143,986
	Heavy oil C	Tons	3,184,649	2,979,644	2,972,183
	Gas oil (ships)	Tons	159,484	173,779	69,341
	LNG (ships)	Tons	5,620	14,387	41,530
	Jet fuel	KL	699,024	391,486	423,584
	Gasoline	KL	71,860	9,058	3,602
	Kerosene	KL	52	49	32
	Diesel	KL	23,285	49,408	41,418
	LPG	Tons	511	375	2,547
	Natural gas	m <sup>3</sup>	8,624,448	7,460,194	7,834,651
Scope 2-related	Private power generation derived from renewable energies	MWh	—	5,970	8,874
	Electricity	MWh	119,880	162,030	146,029
Scope 3-related	Electricity derived from renewable energy	MWh	—	—	15,722
	Waste (office)	Tons	5,679	6,831	10,142
Biofuel	Ships	Tons	—	—	6,287

Note: Electricity consumption in Japan is calculated on a market basis. CO<sub>2</sub> emissions volume from electric power consumption for each fiscal year has been calculated using the coefficients for each electricity provider (actual figures for each fiscal year) published by the Ministry of the Environment.