ASIA CLEAN ENERGY FORUM 2025

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Creating a clean ammonia society

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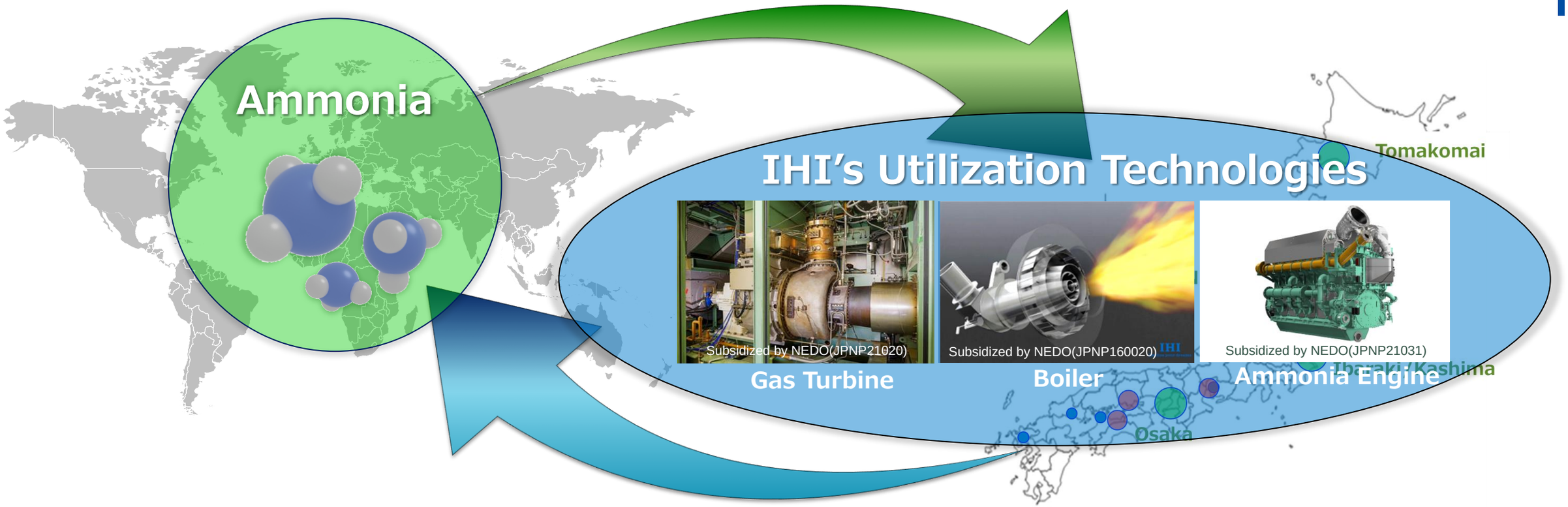
6th June 2025

Mio OKAZAKI
IHI POWER SYSTEM (M) SDN BHD
(100% Subsidiary Company of IHI Corporation)

IHI's Utilization Technologies to create clean ammonia society



In 2024, a series of world's first implementation demos under three important initiatives were conducted in Japan to verify the **reduced environmental impact**, **safe usage**, and **operational reliability** of **fuel ammonia** in a variety of applications.

IHI have been developing utilization technologies **since the beginning of the 2010s,** and **have achieved excellent results** whilst conducting multiple **breakthrough demonstrations.**

Fuel Ammonia Substitution Demonstration

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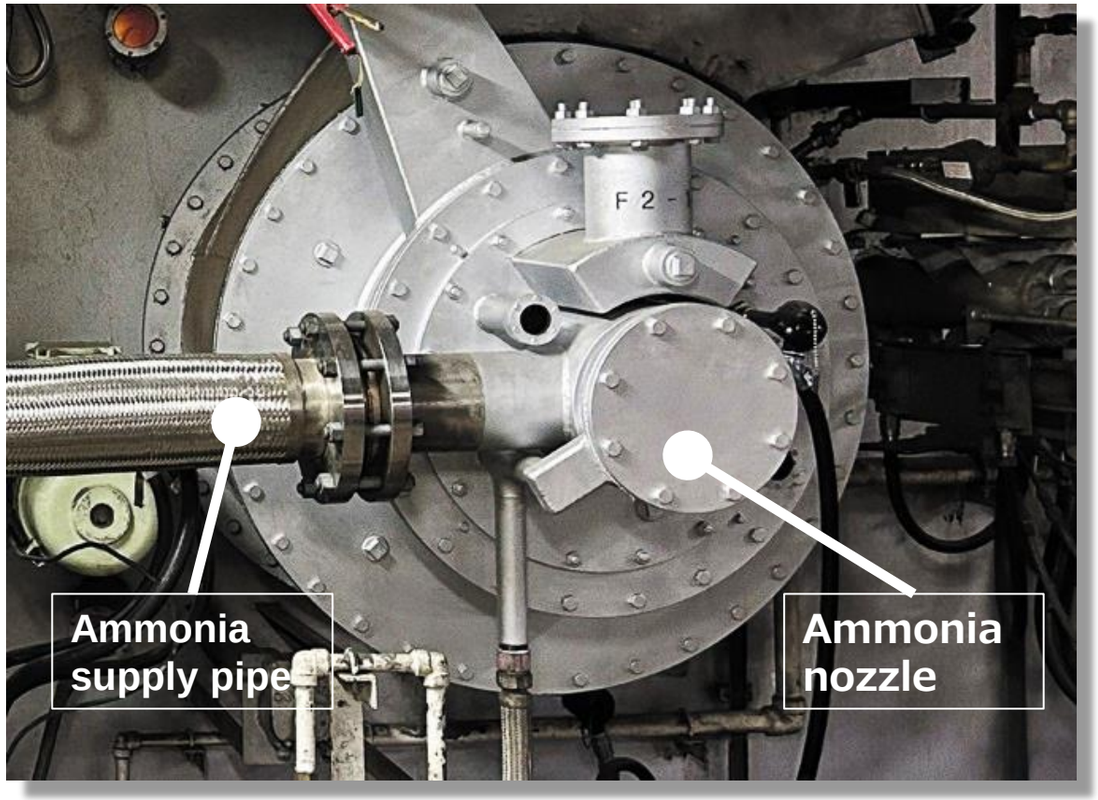
IHI and JERA Complete Fuel Ammonia Substitution Demonstration Testing at Hekinan Thermal Power Station in June, 2024.



This effort has yielded favorable environmental outcomes

- CO_2 emissions reduced by 20% (=in step with the ammonia substitution ratio)
- SO_2 emissions reduced by 20% (=in step with the ammonia substitution ratio)
- NO_x emissions equal to or lower than those prior to ammonia substitution
- N_2O emissions below detection limit

Fuel Ammonia Substitution Demonstration

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Table: Detailed Combustion Characteristics

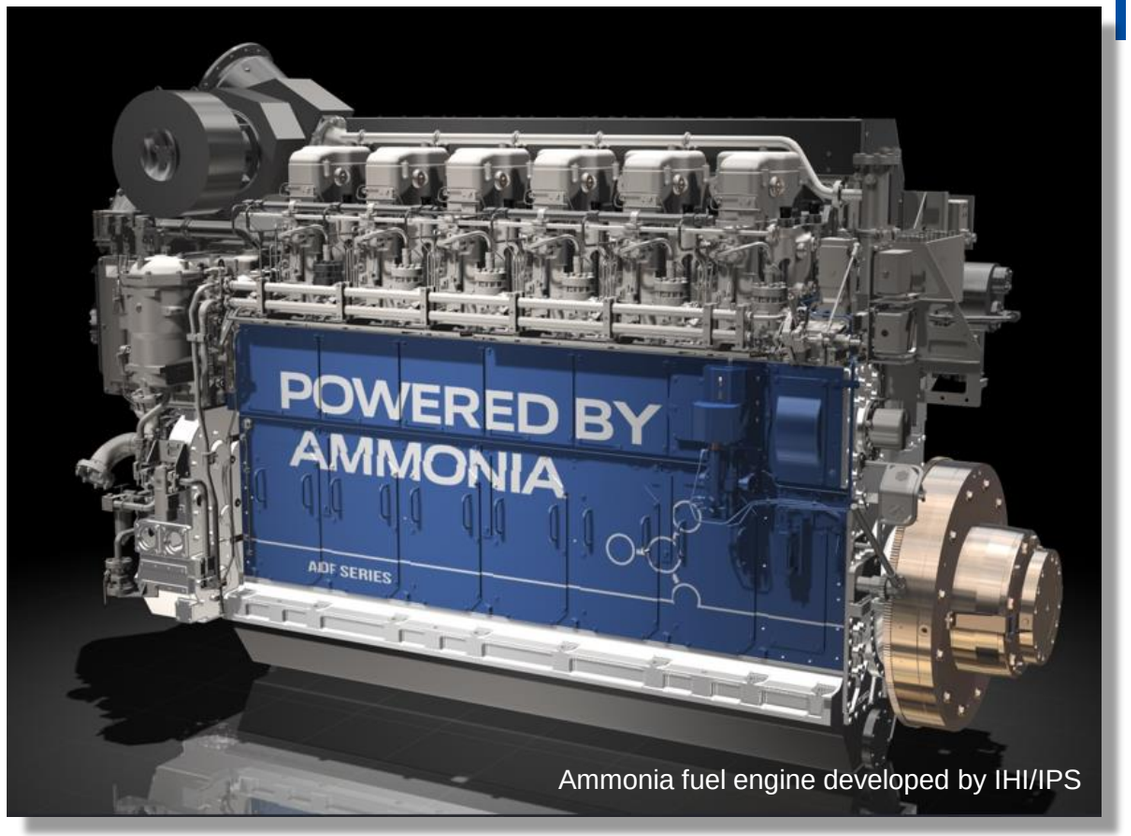
Item	Unit	Single firing of conventional fuel	Ammonia 20% Firing	Comparison: Ammonia 20% Firing /Conventional fuel
NO_x	ppm [Dry, 6%O_2basis]	134	106	⊿20%
SO_x	ppm [Wet]	502	397	⊿20%
Unburned matters in ash	%	1.6	1.8	No significant changes
CO_2	% [Dry, 6%O_2basis]	13.4	10.8	⊿20%
N_2O	ppm	Equal to or less than the lower limit of quantification		
Unburned NH_3	ppm			

Two awards received in April 2025:
The 2024 Technology Award from ***The Combustion Society of Japan*** (for IHI)
The JSME Award (Technology) from ***The Japan Society of Mechanical Engineers*** (for IHI & JERA)

Ammonia-Fueled Tugboat “Sakigake”

Subsidized by NEDO(JPNP21031)

Source: NYK Line



Ammonia fuel engine developed by IHI/IPS

The world’s first commercial-use ammonia-fueled vessel, Sakigake, has successfully completed a three-month demonstration voyage, during which the vessel engaged in tugboat operations in Tokyo Bay and **achieved a GHG-emission reduction of up to approximately 95%,** as part of a Green Innovation Fund Project **under Japan’s New Energy and Industrial Technology Development Organization (NEDO).** (March, 2025)

Ammonia 100% gas turbine “IM270”

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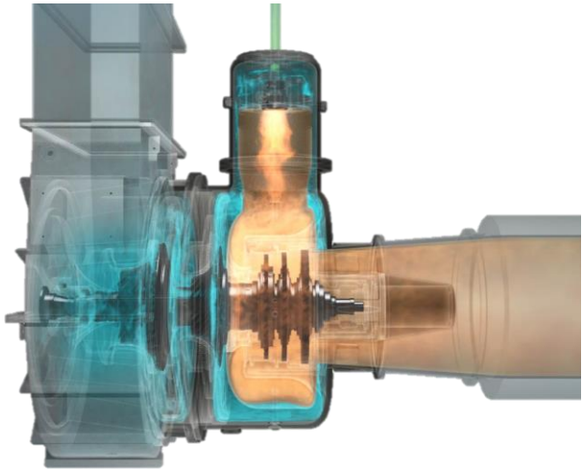
Developing a fully ammonia-powered 2MW-class gas turbine.

Built an ammonia gas turbine test facility in Yokohama Works, Japan.

Achieved full load operation with 100% liquid ammonia combustion in 2022.

99+% Reduction of Green House Gas (CO_2 & N_2O) from natural gas operation.

Regulatory compliant NOx emission level with conventional NOx after treatment systems.

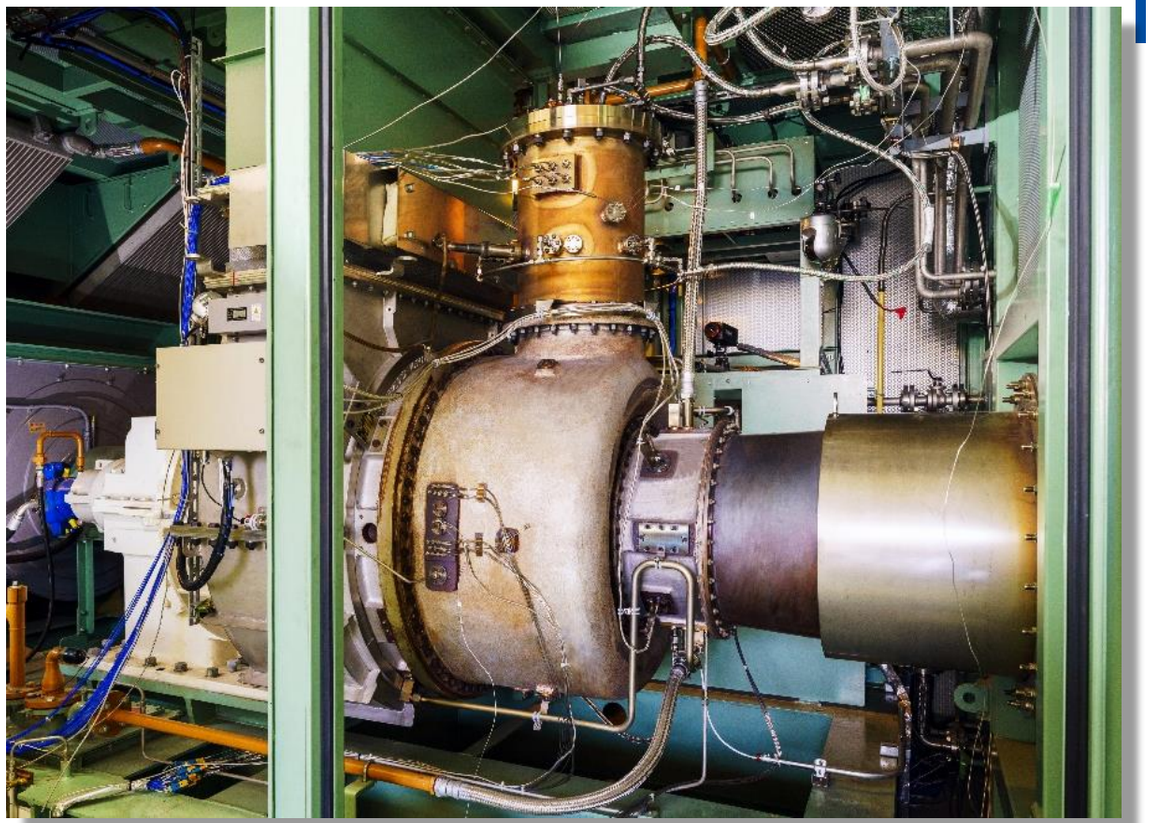


IHI IM270 gas turbine

Ammonia GT test facility & Fuel Supply System at IHI Yokohama

2,000kW-class gas turbine “IHI IM270”

Subsidized by NEDO(JPNP21020)



The long-term durability test using 100% ammonia fuel has been ongoing at IHI Aioi Works, in Hyogo, Japan, since July 2024.

The decarbonization value generated through the use of clean ammonia is provided to ***the 2025 Osaka-Kansai Expo***, contributing towards the realization of a carbon-neutral event.

International standardization for global ammonia utilization

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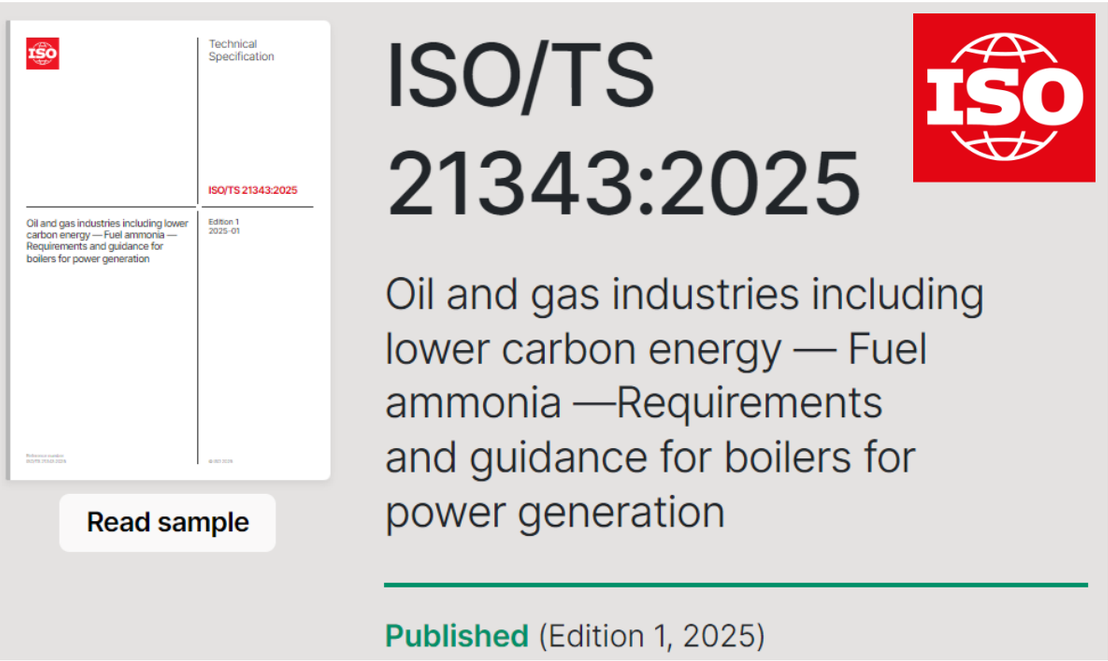
International Standardization Activities for Fuel Ammonia - Requirements and guidance for boilers for power generation: **Technical Specification (ISO/TS 21343)** was issued on January 14, 2025.



Japanese Organization
- IHI (Project Leader/Chair)
- Tohoku University (Co-Chair)
- Clean Fuel Ammonia Association
- Mitsubishi Heavy Industries

Participating Expert (Country)

ISO/TS 21343:2025 - Oil and gas industries including lower carbon energy — Fuel ammonia —Requirements and guidance for boilers for power generation

Next Action: **Reflecting the results of the Hekinan**, switch from **TS** to **IS.**

（Remarks : TS（Technical Standard / IS（International Standard）

IHI's Decarbonization Roadmap in Power Sector

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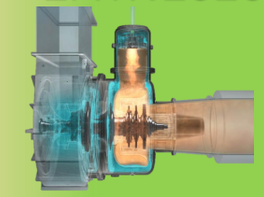
Gas Turbine

Ammonia 100% GT

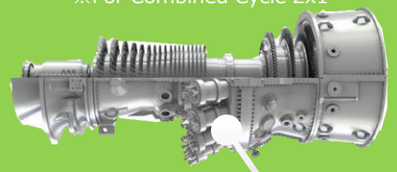
2MW:2026



IHI IM270 gas turbine

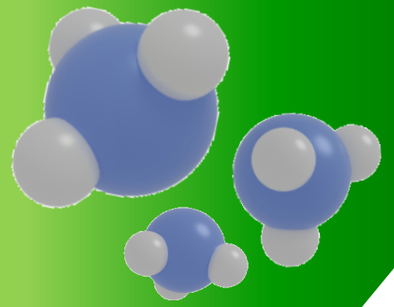
~889MW:2030

※For Combined Cycle 2x1



9F.04 : Source : GE Vernova

Ammonia



Zero carbon emission thermal Power Plant

Boiler

Co-combustion burner

20%:2024 >50%: 2028

GE Vernova and IHI are collaborating on a gas turbine combustor enabling fuel ammonia usage in utility-scale gas power plants.

GE VERNOVA

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2025 → 2030 → 2040 → 2050

Stepwise increase of combustion ratio toward zero CO_2 emissions

IHI's Decarbonization Roadmap in Maritime Sector

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NYK, Japan Engine Corporation, **IHI/IPS**, and **NIHON SHIPYARD CO., Ltd.** are working together to develop **an ammonia-fueled ammonia gas carrier (AFMGC)**, which is scheduled to be delivered in **November 2026**, also as part of **NEDO**'s Green Innovation Fund Project; "Development of vessels equipped with domestically produced ammonia-fueled engines".

NEDO will promote research and development of next-generation fuel vessels, including ammonia-fueled vessels, and will work towards achieving carbon neutrality in the shipping industry.

Subsidized by NEDO(JPNP21031)

Source: NYK Line

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