

June 22, 2021

Kawasaki Kisen Kaisha, Ltd.

Nippon Gas Line Co., Ltd.

Ochanomizu University

Engineering Advancement Association of Japan

Participation in R&D and demonstration project for CO₂ marine transportation

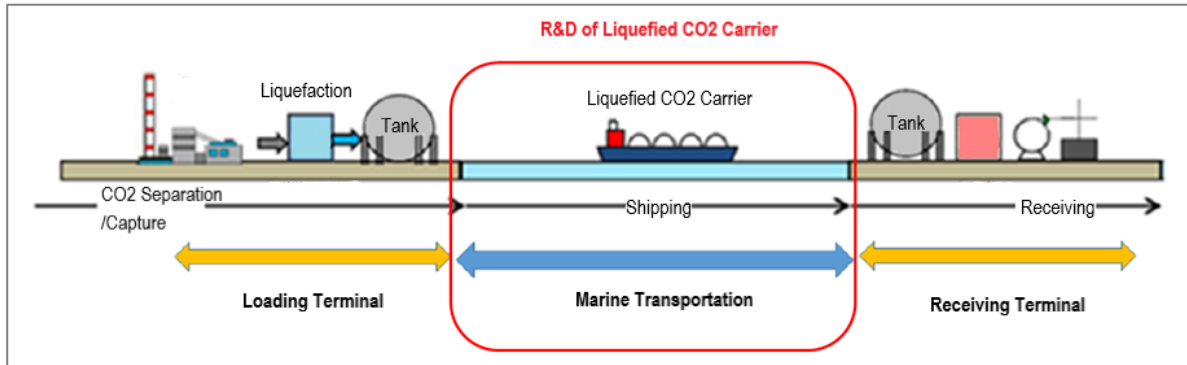
Kawasaki Kisen Kaisha, Ltd. (hereinafter "K" LINE), Nippon Gas Line Co., Ltd. (hereinafter NGL) and Ochanomizu University will participate in the New Energy and Industrial Technology Development Organization (NEDO) project, "CCUS R&D and Demonstration Related Project / Large-scale CCUS Demonstration in Tomakomai / Demonstration Project on CO₂ Transportation" on consignment from Engineering Advancement Association of Japan (hereinafter ENAA) and promote the development for social implementation of liquefied CO₂ maritime transportation.

CCUS (Carbon dioxide Capture, Utilization and Storage) is a technology that can capture, effectively utilize and store the CO₂ emissions from fossil power generation and industrial processes. CCUS is expected to play a key role in contributing to the achievement of Carbon Neutrality by 2050. "K" LINE, NGL, Ochanomizu University and ENAA will jointly develop technologies for liquefied CO₂ marine transportation and contribute to the realization of long-distance / large-scale CO₂ transportation enabling cost reduction through the development of CCUS technology in the demonstration project.

"K" LINE has a long history and diversified track-record in ownership and technical management of liquefied gas carriers. Utilizing our expertise in liquefied gas (LNG/LPG) transportation business and know-how accumulated over many years, we are committed to the safe operation of liquefied gas carriers and professional handling of liquefied gas cargoes. Additionally, "K" LINE is participating in "CO₂-Free Hydrogen Energy Supply-Chain Technology Research Association" (HySTRA) and is cooperating in domestic demonstration test of the world's first liquefied Hydrogen Carrier "SUIISO FRONTIER", as an initiative to realize a carbon-neutral society. Based on such extensive experience of safe navigation and cargo operation of liquefied gas carriers and demonstration project of HySTRA(R1), "K" Line will conduct a safety / environmental evaluation during navigation and cargo operation for the demonstration liquefied CO₂ carrier and establish technical guidelines.

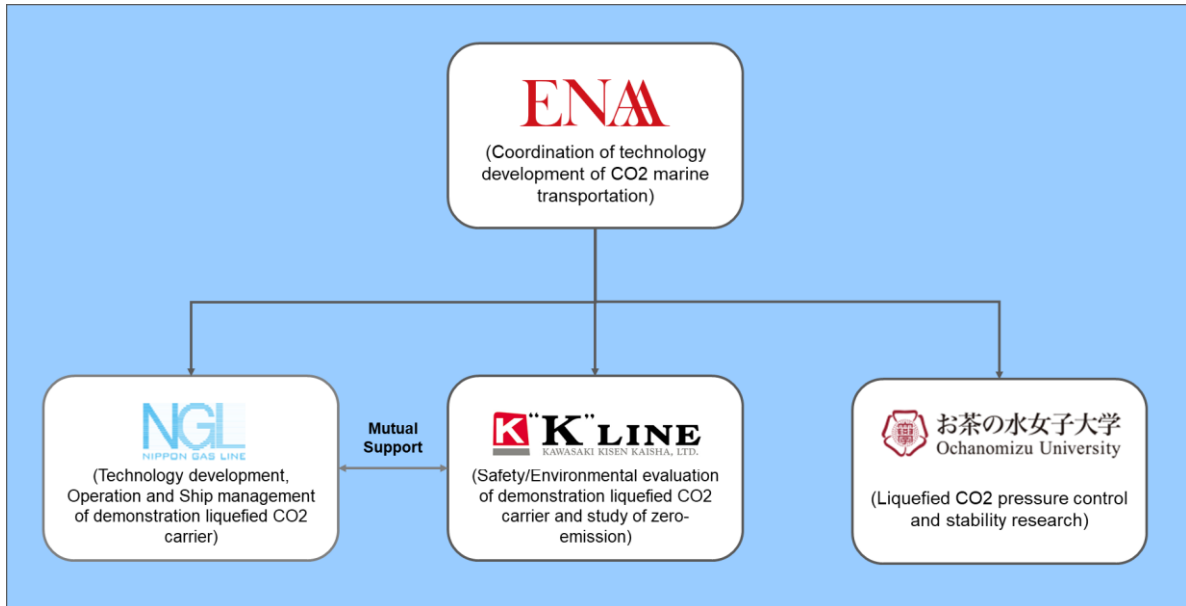
The "K" LINE Group is promoting its efforts to reduce greenhouse gas (GHG) emissions in accordance with its "K" LINE Environmental Vision 2050 and will contribute to the realization of a carbon-neutral society through this demonstration project of liquefied CO₂ marine transportation.

<Our scope of demonstration project>



* The figure is quoted from the materials of the Ministry of Economy, Trade and Industry.

<Our organization chart and role>



Organization name	Role
Engineering Advancement Association of Japan	<u>Coordination of R&D and demonstration project for CO2 marine transportation</u> Take charge of planning, evaluation, analysis and coordination of R&D and demonstration project of liquefied CO2 carrier based on advanced research of CO2 transportation technology, which started as the NEDO project "Conceptual design of CO2 transportation system" since 2008.
Nippon Gas Line Co.,Ltd.	<u>R&D of marine transportation, and Operation and Ship management of the demonstration liquefied CO2 carrier</u> Take charge of developing safe and efficient liquefied CO2 marine transportation technology, and operating and managing the demonstration liquefied CO2 carrier based on 60-year experience of pressurized liquefied gas carriers (as one of the largest domestic ship operator specialized in LPG carrier).
Kawasaki Kisen Kaisha, Ltd.	<u>Safety / environmental evaluation of the demonstration liquefied CO2 carrier</u> Promote R&D of the demonstration liquefied CO2 carrier with extensive experience of ocean-going liquefied gas vessels. Conduct a safety / environmental evaluation in consideration of regulatory surrounding international liquefied gas carriers and establish technical guidelines.
Ochanomizu University	<u>Research of liquefied CO2 pressure control and stability</u> Conduct basic research of CO2 physical properties under non-equilibrium conditions and dry-ice phenomenon during marine transportation with experience in studying non-equilibrium phenomena of reactive fluid.

<Reference 1>

December 19, 2019 release:

Participation in "CO₂-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA)" ~Towards the Realization of a Hydrogen Society, "K"LINE will be involved in the Demonstration of the World's First Liquefied Hydrogen Carrier ~

https://www.kline.co.jp/en/news/Liquefied_gas/Liquefied_gas6775753940900439662/main/0/link/20191219_en%20%20.pdf