NEWS RELEASE

March 27, 2025
ENEOS Xplora Inc.

ENEOS Xplora Inc.
Nippon Yusen Kabushiki Kaisha
Knutsen NYK Carbon Carriers AS
ClassNK

AiPs Obtained for Liquefied CO_2 Carrier Design and Floating Liquefied Storage Facility
-- Moving forward towards the realization of CCUS by significantly reducing costs and site area –

Knutsen NYK Carbon Carriers AS ("KNCC"), a subsidiary of Nippon Yusen Kabushiki Kaisha ("NYK") and Knutsen Group, has obtained Approval in Principle (AiP)* from Class NK for the design of liquified CO_2 carriers ("LCO_2-EP carrier") that uses the elevated pressure (EP) method to store and transport liquefied carbon dioxide (LCO_2) at ambient temperature. ClassNK has carried out a design review of this ship in accordance with the Rules for the Survey and Construction of Steel Ships, “Part N”, and has issued an Approval in Principle (AiP) after confirming that the ship meets the prescribed requirements.

The LCO_2-EP carrier uses ”LCO_2-EP Cargo Tank” ** technology developed by KNCC to transport LCO_2 in a stable state. Since there is no need to cool LCO_2 to cryogenic temperatures, it is easy to handle, and potentially reduces energy and costs during liquefaction.

NYK, KNCC, and ENEOS Xplora Inc. (ENEOS Xplora) have developed a Floating Liquefied Storage Unit (FLSU) that combines the LCO_2-EP Cargo Tank technology with the Isenthalpic Expansion Cooling & Liquefaction Process. This Process has been researched and developed in collaboration among the three companies. ClassNK has issued an AiP following a review based on the Rules for the Survey and Construction of Steel Ships, “Part PS”, “Guidelines for the Design of Floating Liquefied Natural Gas and Liquefied Petroleum Gas Production, Storage, Offloading and Regasification Units”, etc.

This FLSU is a pioneering concept that liquefies and temporarily stores CO_2 that has been collected and transported as gas in an onshore facility making it ready for further transport by LCO_2 carrier. By utilizing the features of the EP method, which has the potential to reduce the energy required for liquefaction, and

adopting the Process, which is expected to be simpler and more compact than conventional cooling methods, it has become possible to install a liquefaction plant on a floating structure.

Carbon Capture, Utilization and Storage (CCUS) **** is one area that is expected to play a certain role in achieving a carbon-neutral society. However, issues need to be addressed, such as reducing overall costs and securing land for liquefaction and storage facilities. By utilizing this FLSU, the cost of CO_2 liquefaction and the land area required onshore in the CCUS value chain can be reduced, expanding the possibilities for realizing CCUS.

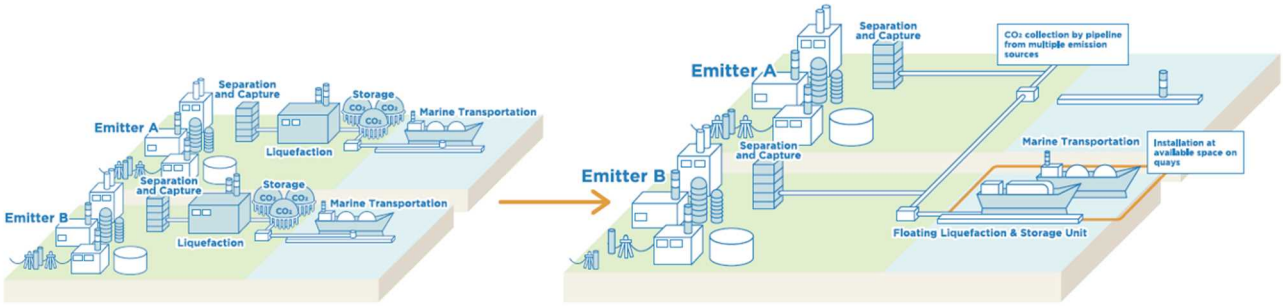
NYK, KNCC, ENEOS Xplora and ClassNK will continue to contribute to realizing a carbon-neutral society by examining various technologies and assessing their economic and safety aspects towards achieving a CCUS value chain.

AiP presentation ceremony

Front row, from left,
Masaki Matsunaga, Executive Vice President, ClassNK
Tetsuo Yamada, Executive Vice President, ENEOS Xplora
Synnøve Seglem, Director, KNCC
Tsutomu Yokoyama, Executive Officer, NYK
Second row, from left,
Akio Usami, General Manager of Hull Department, ClassNK
Michitaka Miyama, General Manager, CCS Project Department, ENEOS Xplora
Jorunn Seglem, Deputy Director, KNCC
Anders Lepsøe, Managing Director, NYK Group Europe Norway
Oliver Hagen-Smith, CEO, KNCC
Jarle Østenstad, Director, KNCC

FLSU image

Hub concept using FLSU



Comments from each company

Tetsuo Yamada, Executive Vice President, ENEOS Xplora Inc.

The Floating Liquefaction Storage Unit concept was developed with the aim of assisting in resolving the challenges faced by many emitters, such as land use constraints and costs associated with liquefaction, in the realization of CCUS. In August of 2024, we successfully conducted a demonstration test of the Isenthalpic Expansion Cooling & Liquefaction in collaboration among the three companies and have now obtained Approval in Principle for this concept. This achievement allows us to take another significant step forward in the development of this innovative concept and, ultimately, in the societal implementation of CCS. We will continue to work on optimizing the large-scale transportation of CO_2 through collaboration with NYK and KNCC. At the same time, we will explore various business developments centered around CCUS to contribute to the realization of a sustainable society.

Tsutomu Yokoyama, Executive Officer, NYK Line

In August 2024, NYK, KNCC, and ENEOS Xplora succeeded in the demonstration experiment to study the CO_2 liquefaction process and have continued further discussions toward social implementation. This FLSU has the potential to be a game changer, significantly contributing to the reduction of costs and land area required for the liquefaction and storage process, which is a challenge for the commercialization of CCUS. Based on this achievement, we will strengthen our collaboration with ENEOS Xplora Inc. and KNCC, and continue our efforts towards realizing a decarbonized society through the promotion of CCUS commercialization both domestically and internationally.

Oliver Hagen-Smith, CEO, Knutsen NYK Carbon Carriers AS

I am delighted with this achievement and the continual collaboration with ENEOS Xplora. The design of this FLSU is based on Japanese local regulations and design conditions, this demonstrates the flexibility, adaptability and scalability of EP value chains that may be deployed at various and numerous locations around the globe.

The completed demonstration of the EP liquefaction process provides a solid foundation to the technology as well as the use of an EP value chain. This FLSU concept combining the LCO_2-EP Cargo Tank and the EP liquefaction process, reaffirms that KNCC and its partners will contribute to the expansion of CCUS possibilities by providing optimized, economical, flexible, and diverse solutions to the global CCUS industry.

Masaki Matsunaga, Executive Vice President, ClassNK

We are honored to be able to issue Approval in Principle (AiP) for the innovative initiatives of three leading companies and would like to express our respect for the efforts of all involved parties.

In response to the innovative concept of carrying out CO_2 liquefaction and storage at sea instead of on land, we have conducted a design review of the vessel and floating structure based on the knowledge we have gained from design reviews of liquefied gas carriers and offshore structures, and have confirmed the technical feasibility. We will keep contributing to the safe societal implementation of this solution, which has the potential to be pivotal in building the CCUS value chain.

<ENEOS Xplora Inc.>
Head office: Tokyo, Japan
Representative: Toshiya Nakahara, President and CEO
Website : https://www.eneos-xplora.com/english/

<Nippon Yusen Kabushiki Kaisha (NYK)>
Head office: Tokyo, Japan
Representative: Takaya Soga, President
Website: https://www.nyk.com/english/

<Knutsen NYK Carbon Carriers AS>
Head Office: Haugesund, Norway
Representative: Oliver Hagen-Smith, CEO
Website: https://www.kn-cc.com

<ClassNK>
Head Office: Tokyo, Japan
Representative: Hayato Suga, President & CEO
Website: https://www.classnk.com/hp/en/index.html

* Approval in Principle (AiP) indicates that the basic design has been reviewed by a certification body and approved as meeting technical requirements and safety standards.
** LCO_2-EP Cargo Tank has been developed by KNCC to transport LCO_2 at ambient temperatures and elevated pressures (0 to 10 degC / 34 to 45 barG).
*** The isenthalpic expansion cooling & liquefaction method adopted in this Process takes advantage of the temperature drop caused by depressurizing the captured CO_2 to form a liquefied CO_2 suitable for marine transport.
**** CCUS (Carbon Dioxide Capture, Utilization and Storage) includes a process in which the CO_2 emitted from power plants and factories are collected and either used in the production process of crops, chemicals, construction materials, etc. or stored in stable underground geological formations.