Contents By Builder By Ship Type

Liquefied Hydrogen Carrier -SUISO FRONTIER- Receives Classification from Nippon Kaiji Kyokai

91

© HySTRA

Kawasaki Heavy Industries, Ltd. announced that its world's first liquefied hydrogen carrier -the SUISO FRONTIER- has received a classification from Nippon Kaiji Kyokai (ClassNK), recognizing that it complies with International Maritime Organisation（IMO）standards.

The SUISO FRONTIER can carry 75 tonnes of liquefied hydrogen in one trip. The liquefied hydrogen is produced by cooling gaseous hydrogen to minus 253° C therefore reducing its volume to 1/800.

The vessel was inspected for its hull structure, machinery, onboard equipment and materials and more, in accordance with its class rules and the requirements for the safe transport of hydrogen by sea, formulated by ClassNK, based on the provisional recommendations of IMO. The vessel was then added to ClassNK's register on 3 December, 2021.

Hydrogen is a clean energy source that emits no CO^2 when burned, and when used as a fuel it can generate power, cars, motorcycles, ships and aircrafts. Various initiatives are underway in many countries to build a supply chain for the realization of a hydrogen society.

In order to realize a future in which hydrogen is used as commonly as oil and natural gas, Kawasaki aims to build a supply chain that produces, stores, transports and uses hydrogen in cooperation with various partners.

Kawasaki Heavy Industries, Ltd.

Dawn of Australia's Hydrogen Industry 92

Contents By Builder By Ship Type

Arrival of the world's first liquified hydrogen carrier on January 21,2022, the Suiso Frontier, in Victoria marks the success of the Hydrogen Energy Supply Chain(HESC) Pilot Project and the dawn of the Australis's hydrogen industry.

HESC's vision is to produce carbon neutral hydrogen through extraction from a mix of Latrobe Valley coal and biomass, capturing and storing CO_2 via CarbonNet and optimizing energy efficiency in the ZHESC supply chain. The 225,000 tonnes of carbon neutral liquefied hydrogen (LH2) produced by HESC in a commercial phase will contribute to reducing global CO_2 emissions by some 1.8 million tonnes per year (equivalent to the emission of about 350,000 petrol-driven cars), while providing valuable infrastructure for other hydrogen projects in the region.

In a commercial phase, the project will create 30,000 full-time jobs across the Gippsland and Mornington Peninsula regions over the life of the project. During the Pilot Project, 99.999% pure hydrogen has been produced from Latrobe Valley coal and biomass via gasification, trucked to Hastings, cooled to -253 degrees and subsequently liquified to less than 800 times its gaseous volume to create highly valuable liquefied hydrogen.

The loading of liquefied hydrogen onto the Suiso Frontier for the return journey to Kobe, Japan, makes the HESC Project the most advanced and scalable hydrogen project in Australia and the first project in the world to make, liquefy and transport liquid hydrogen by sea to an international market.

The Australia-Japan HESC partnership is at the cutting edge of creating new technology, cleaner energy, and jobs for both countries. The learnings from the Pilot will form the basis for further work towards delivering HESC at a commercial scale. Specifically, the team will undertake extensive research and development into the technical and operational requirements that delivery of a commercial-scale project will entail.

Activities that will be undertaken include:

- Continuing to test and demonstrate the transport of liquid hydrogen across the ocean with further return trips of the Suiso Frontier between Australia and Japan.
- Undertaking regulatory approval activities.
- Ongoing discussion and monitoring of CarbonNet.
- Investigations on the economics of the commercial-scale project and its business model.
- Engagement with potential 'off-takers' in Australia and Japan.
- Further refining and testing of biomass feed stock for hydrogen production (blending with Latrobe Valley coal).
- Improving technologies to reduce costs and carbon intensity across the supply chain. This includes further development of the ortho-para conversion catalyst for creating LH2 in partnership with CSIRO.
- mplementing a comprehensive stakeholder engagement program to continue building social licence among impacted communities.

The HESC Project Partners are: Kawasaki Heavy Industries, Ltd (KHI), Electric Power Development Co., Ltd. (J-POWER), Iwatani Corporation (Iwatani), Marubeni Corporation (Marubeni), AGL Energy (AGL) and Sumitomo Corporation (Sumitomo). Royal Dutch Shell (Shell), ENEOS Corporation and Kawasaki Kisen Kaisha, Ltd. (K-Line) are also involved in the Japanese portion of the project.

Liquefied Hydrogen Carrier -SUISO FRONTIER- Wins PM Award at Japan Industrial Technology Awards 93

The world's first liquefied hydrogen carrier, developed and built by Kawasaki Heavy Industries, Ltd. (KHI), won the Prime Minister' Award at the 51st Japan Industrial Technology Awards on April 6, 2022.

The Japan Industrial Technology Awards, presented by The Nikkan Kogyo Shimbun, Ltd., boasts a long history as they were established in 1972. The awards are granted every year to products and others—such as large innovative industrial facilities and cutting-edge technologies—that are turned into practical application and contribute to industrial and/or social development.

The Suiso Frontier was constructed to establish a technology to transport hydrogen, a promising next-generation energy resource, efficiently and stably from overseas to Japan. Having highly insulated tanks of a total capacity of some 1,250 cubic meters, it can carry as much as 75 tons of liquefied hydrogen by refrigerating hydrogen to minus 253 degrees Celsius to diminishing it to one eight hundredths in volume.

The construction of the Suiso Frontier began in 2015 as a demonstration project to establish a supply chain for transporting unused brown coal-based hydrogen in large quantities by sea, which was promoted by the New

Then Education, Culture, Sports, Science and Technology State Minister Tanaka Hideyuki (left) and KHI President and CEO Hashimoto Yasuhiko (right)

President Imizu Haruhiko of The Nikkan Kogyo Shimbun (left) and KHI President and CEO Hashimoto Yasuhiko (right)

KHI President and CEO Hashimoto Yasuhiko gives an address as the Suiso Frontier receives the Prime Minister's Award.

Executive members of KHI's Suiso Frontier development team (*)

(*) From left: Manager Mizumukai Kentaro of the Hydrogen Strategy Division's Project Group; Chief Executive Staff Officer Komura Atsushi, General Manager Imamura Keigo and Deputy General Manager Motoi Tatsuya of the Ship and Offshore Structure Business Division; and Chief Executive Staff Officer Kameno Yuichi of the Hydrogen Strategy Division's Project Group

Contents By Builder By Ship Type

Liquefied Hydrogen Carrier -SUISO FRONTIER- Wins PM Award at Japan Industrial Technology Awards

93

Energy and Industrial Technology Development Organization (NEDO). In 2016, KHI joined forces with Iwatani Corp., Shell Japan Ltd. and Electric Power Development Co., Ltd. (J-POWER) to set up a joint venture, the CO_2-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA). The association then accelerated the Suiso Frontier development by beginning to review safety from a viewpoint of hydrogen users and so on. In fiscal 2017, full-scale design and construction work was kicked off. In December 2019, the liquefied hydrogen carrier newbuilding was launched at KHI's Kobe Works, and in December 2020, it obtained a ship classification from Nippon Kaiji Kyokai (ClassNK). KHI successfully conducted trial transport of liquefied hydrogen produced in Australia to the Port of Kobe from Dec. 24, 2021 to Feb. 25, 2022.

KHI has been developing hydrogen technologies for 35 years, or since 1987. For example, it has produced and manages tanks for storing liquefied hydrogen for rocket fuel at the Japan Aerospace Exploration Agency (JAXA)'s Tanegashima Space Center. KHI has also made it possible to transport large quantities of hydrogen in ships by developing cargo tanks for safely carrying liquefied hydrogen, which is extremely low in temperature at minus 253 degrees Celsius; a plumbing system for cargo handling; and so forth. Not only has it constructed the world's first liquefied hydrogen carrier, but KHI also has participated in the formulation of international standards for safely moving liquefied hydrogen as well. Developing a supply chain to safely transport hydrogen from overseas, KHI has been highly rated, as it will contribute considerably to realizing carbon neutrality, one of the world's social agendas.

To realize a hydrogen society, KHI will develop a much larger liquefied hydrogen carrier having a tank capacity of 160,000 cubic meters, 128 times as great as the Suiso Frontier's, and endeavor to reduce costs for supplying hydrogen. Hoping that hydrogen will be consumed as commonly as natural gas and petroleum in the future, it will strive to build larger liquefied hydrogen carriers by making the most of the technologies and know-how that it has gained from the construction of the Suiso Frontier. In partnership with various enterprises, KHI will build a supply chain to produce, transport, store and consume hydrogen, a next-generation energy resource.

About The Nikkan Kogyo Shimbun's 51st Japan Industrial Technology Awards: **https://corp.nikkan.co.jp/p/honoring/nihonsangyogijyutsutaishou**

HySTRA celebrates completion of world's first liquefied hydrogen vessel voyage in Japan 94

Kawasaki Heavy Industries, Ltd.

Next Page

HySTRA celebrates completion of world's first liquefied hydrogen vessel voyage in Japan 94

A ceremony to mark the completion of the world's first maritime transport of liquefied hydrogen, including its loading and unloading has been held in Kobe, Japan.
The demonstration voyage by the world's first liquefied hydrogen carrier, Suiso Frontier, proved that an international liquefied hydrogen supply chain is possible, marking a significant step towards the utilization of hydrogen as a new energy source.
The HySTRA*1 joint venture, comprising Iwatani Corporation, Kawasaki Heavy Industries, Ltd., Shell Japan Ltd., Electric Power Development Co., Ltd.(J-POWER), Marubeni Corporation, ENEOS Corporation, and Kawasaki Kisen Kaisha, Ltd. with support from NEDO*2, is exploring the development of a large-scale marine transport supply chain.
Ceremony for completing the demonstration test
The joint venture developed technologies to produce and transport large volumes of liquefied hydrogen, conducting demonstration tests between Japan and Australia to establish processes around the safe loading, offloading and storage of hydrogen. Insights from the demonstration voyage will also guide the development of international safety standards and codes for transporting liquefied hydrogen.
Suiso Frontier, the world's first liquefied hydrogen carrier, departed Japan in December 2021 and arrived in Australia in January 2022. The ship was loaded with liquefied hydrogen produced from coal in Victoria, Australia, and returned to Japan in February 2022, unloading the cargo to a landside storage tank.
The HySTRA joint venture partners will continue to gather data and findings, and collaborate with various parties to promote this project and contribute to the development of a commercial hydrogen supply chain, as more industries explore hydrogen as a new energy source.

The HySTRA joint venture comprises:

Iwatani Corporation	Operation of Hy touch Kobe, a liquefied hydrogen cargo handling demonstration terminal
Kawasaki Heavy Industries	Design and construction of "Suiso Frontier", a liquefied hydrogen carrier, and the Hy touch Kobe, a liquefied hydrogen cargo handling demonstration terminal
Shell Japan	Operation and crewing of Suiso Frontier
J-POWER	Construction and operation of the facilities to produce hydrogen gas using Victorian coal in Latrobe Valley, Victoria
Marubeni	Examination of implementation of CO_2-free hydrogen supply chain technologies by leveraging knowhow cultivated as a general trading company
ENEOS	Feasibility study of CO_2-free Hydrogen Supply Chain
Kawasaki Kisen Kaisha	Assistance for safe transportation of liquid hydrogen by using its knowledge and experience acquired through the operation of LNG carriers.

The project had input from Japanese and Australian government agencies, including the Ministry of Economy, Trade and Industry and NEDO, and companies in Japan and Australia.

Japan-Australia Supply Chain Pilot Diagram

※HySTRA business supported by NEDO(New Energy and Industrial Technology Development Organization) is written in red.
※Consortium business supported by Commonwealth of Australia and Victoria State Government is written in white.
※KHI=Kawasaki Heavy Industries, Ltd.
※STASCO=Shell International Trading and Shipping Company Limited

*1 An abbreviation of the Japan CO_2 Free Hydrogen Energy Supply-chain Technology Research Association. The company was established by Iwatani, Kawasaki Heavy Industries, Shell Japan and J-POWER to establish and demonstrate technologies for hydrogen production using Victorian coal, transportation and storage for the commercialization of a CO_2-free hydrogen supply chain. Marubeni Corporation, ENEOS Corporation, and Kawasaki Kisen Kaisha joined the project later.

*2 New Energy and Industrial Technology Development Organization

Reference

In Australia, Iwatani Corporation, Kawasaki Heavy Industries Group, J-POWER Group, Marubeni Corporation, Sumitomo Corporation, and AGL Energy Limited formed a consortium to build a gas refining facility, hydrogen liquefaction and loading terminal with subsidies from the Australian and Victorian governments. A local industrial gas company oversees ground transportation of hydrogen.

Kawasaki Obtains AiP for Large, 160,000 m³ Liquefied Hydrogen Carrier 95

AiP issuance ceremony

ClassNK
NIPPON KAIJI KYOKAI

Document No. KF-22HE04387
Date: 19 April 2022

APPROVAL IN PRINCIPLE

160,000m3 Liquefied Hydrogen Carrier
developed by KAWASAKI HEAVY INDUSTRIES, LTD.

THIS IS TO CERTIFY THAT Approval in Principle is granted to KAWASAKI HEAVY INDUSTRIES, LTD.

The AiP is for the design concept of the captioned vessel including the following systems:

- Cargo Containment System
- Cargo Handling System
- Dual Fuel Main Boiler using Boil-Off Gas

The AiP is based on the current Society's Rules and Guidance for the Survey and Construction of Steel Ships (hereinafter "the Rules") and Guidelines *"Part N; Ships Carrying Liquefied Gases in Bulk"* incorporating *"the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)"*, *"Guidelines for Liquefied Hydrogen Carriers"* incorporating *"INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK (RESOLUTION MSC.420 (97))"* and other relevant requirements as applicable.

The documents/drawings specified in the Annex to this letter have been reviewed and it is examined that the conceptual design of the systems is feasible for the intended application.

Conditions on this approval are set out in the Annex to this letter.
For final approval of the vessel, a complete set of documentation is to be approved by the Society in accordance with the relevant Rules.

(Akio Usami
General Manager of Hull Department
NIPPON KAIJI KYOKAI

AiP certificate

April 22, 2022 — Kawasaki Heavy Industries, Ltd. announced its obtainment of approval in principle (AiP) from Nippon Kaiji Kyokai (ClassNK) for a large, 160,000 m³ liquefied hydrogen carrier.

The liquefied hydrogen carrier that received the AiP is a large-sized vessel equipped with a cargo containment system ("CCS") comprising four liquefied hydrogen tanks having a combined capacity of 160,000 m³. The CCS received its own AiP in April 2021. The carrier is designed to transport cryogenic liquefied hydrogen, cooled down to a temperature of –253° C and reduced to one eight-hundredth its initial volume, by sea in large amounts on each voyage, helping to reduce hydrogen supply costs. In order to build this large-sized carrier, Kawasaki leveraged design and shipbuilding technologies as well as safety-related technologies and knowledge utilized in the construction of the globally pioneering, 1,250 m³ liquefied hydrogen carrier SUISO FRONTIER,*1 while also calling upon its many years of experience in building liquefied natural gas (LNG) carriers and other liquefied-gas transport vessels.

This vessel's AiP was issued by ClassNK following examinations to confirm that the vessel satisfies the IGC Code*2 and the International Maritime Organization (IMO) Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk,*3 and also clears Class regulations as well as a risk assessment based on Hazard Identification Study (HAZID)*4 methods.

The main features of Kawasaki's carrier are as follows.

1. The vessel contains four 40,000 m³ liquefied hydrogen carrying tanks for a combined total capacity of 160,000 m3. These tanks utilize a newly developed, high-performance insulation system that minimizes boil-off gas (BOG), which occurs in response to heat ingress, in order to enable large-quantity transport of cryogenic liquefied hydrogen.
2. The propulsion system includes a boiler and steam turbine plant capable of operating using hydrogen as fuel, and a dual-fuel propulsion system that makes use of natural BOG as fuel to power the ship. Utilizing hydrogen, which does not emit CO_2 during combustion, as a fuel for propulsion contributes to reduced CO_2 emissions from liquefied hydrogen transport operations. Furthermore, the vessel is equipped with a hydrogen-gas-fuel supply system comprising hydrogen gas compression equipment, hydrogen gas heat exchanger equipment and other components in order to enable supply of BOG from the CCS to the propulsion system.
3. The vessel uses a cargo handling system designed to load large amounts of liquefied hydrogen onto the vessel in just a short time, and it is equipped with vacuum insulated double wall pipes in order to efficiently and safely transfer hydrogen in its cryogenic, liquefied state from

Kawasaki Obtains AiP for Large, 160,000 m³ Liquefied Hydrogen Carrier 95

onshore storage facilities to the vessel tanks minimizing vaporization.

4. The hull and draft of the vessel were designed with consideration for the low specific gravity of the liquefied hydrogen cargo, and horsepower required for propulsion was kept low in response, resulting in higher-efficiency propulsion performance. Moreover, risk assessments were carried out for the vessel's propulsion system, cargo handling system and other elements in relation to liquefied hydrogen, and suitable safety measures were implemented in response. This eliminates liquefied-hydrogen-caused risk to the ship's crew, the ship environment, structural strength, and overall ship soundness while ensuring safety.

Kawasaki developed this vessel as part of a subsidized project by NEDO*5 and is currently carrying out more in-depth design with an eye to commercial operations starting in the mid-2020s. Amid global calls for the early achievement of carbon neutrality targets, the company is striving to achieve large-volume transport of liquefied hydrogen—for which demand is expected to grow as a clean energy source—in order to promote the use of hydrogen energy and thus help achieve decarbonization, working as one for the good of the planet.

Main Specifications of Kawasaki's Large, 160,000 m³ Liquefied Hydrogen Carrier

Length: approx. 346 m; width: approx. 57 m; draft: 9.5m
Cargo tank capacity: 160,000 m³ (40,000 m³ × 4 tanks, enabling carrying of approx. 10,000 tons of liquefied hydrogen)

Simulated appearance of the completed 160,000 m³ liquefied hydrogen carrier

*1 Constructed by Kawasaki as a member of the CO_2-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA; website: http://www.hystra.or.jp/en/), as part of the Demonstration Project for Establishment of Mass Hydrogen Marine Transportation Supply Chain Derived from Unused Brown Coal by the New Energy and Industrial Technology Development Organization (NEDO).

*2 International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk. A set of international regulations governing the constructions and equipment of such ships. All ships that carry liquefied gases and that were built in or after 1986 are required to adhere to the code, and ClassNK incorporates the code as part of its Rules and Guidance for the Survey and Construction of Steel Ships.

*3 Provisional recommendations adopted by the IMO for bulk transport of liquefied hydrogen.

*4 Method of assessing risk, which is determined by experts based on the frequency with which potential hazards in a system arise, and aimed at identifying ways to minimize that frequency.

*5 NEDO Technology Development Project for Building a Hydrogen-based Society / Technology Development Project for Large-Scale Utilization of Hydrogen / Project for Enlargement of Liquefied Hydrogen Cargo Tank Facilities and Development of Unloading Terminal Equipment.

Contents By Builder By Ship Type

Liquefied Hydrogen Carrier -SUISO FRONTIER- Chosen for Ship of the Year 2021 96

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Kawasaki Heavy Industries, Ltd.

Next Page

Liquefied Hydrogen Carrier -SUISO FRONTIER- Chosen for Ship of the Year 2021 96

From left: Chief Executive Staff Officer Muragishi Osamu of KHI's Ship and Marine Structure Business Division, General Manager Harada Eiichi of KHI's Hydrogen Strategy Division, then JASNAOE President Fujikubo Masahiko, KHI President and CEO Hashimoto Yasuhiko and General Manager Imamura Keigo of KHI's Ship and Offshore Structure Business Division

The world's first liquefied hydrogen carrier, developed and constructed by Kawasaki Heavy Industries, Ltd. (KHI), was chosen for the Ship of the Year 2021 on July 25, 2022 at the 32nd Ship of the Year Awards, presented by the Japan Society of Naval Architects and Ocean Engineers (JASNAOE). The Ship of the Year award, the highest honor for the domestic shipbuilding industry, is given every year to the most prominent product in accordance with technical, artistic and social considerations about high-profile ships built in Japan.

The Suiso Fronter was developed in a demonstration experiment to handle and transport brown coal-based hydrogen by sea on a liquefied hydrogen carrier between Japan and Australia. The project was conducted by the CO_2-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA)*1 in a demonstration project to establish a supply chain for transporting unused brown coal-based hydrogen in large quantities by sea, which was promoted by the New Energy and Industrial Technology Development Organization (NEDO). The Suiso Frontier left Japan in December 2021; arrived in Australia in January 2022, where it was loaded with hydrogen produced from brown coal; and returned to Japan in February 2022.

In receiving the Ship of the Year award, the Suiso Frontier was highly rated as it had been developed and constructed ahead of the rest of the world as a liquefied hydrogen carrier prototype for transporting hydrogen, a promising next-generation energy resource that does not emit CO_2, by liquefying it at a temperature of minus 253 degrees Celsius and reducing it to one eight hundredths in volume. Other reasons for which it was acclaimed were the facts that it had attained success in transporting hydrogen from Australia and that it would lead to the development of larger freighters. The award review committee recommended by an overwhelming majority that the Suiso Frontier be the Ship of the Year.

The technologies for handling liquefied hydrogen, assessing risks, ensuring safety and so on that have been obtained from the development of the Suiso Frontier are being applied to the ongoing development of a 160,000-cubic-meter-capacity liquefied hydrogen carrier, which is being advanced to transport hydrogen in large quantities. Nippon Kaiji Kyokai (ClassNK) approved its basic design in April 2022.

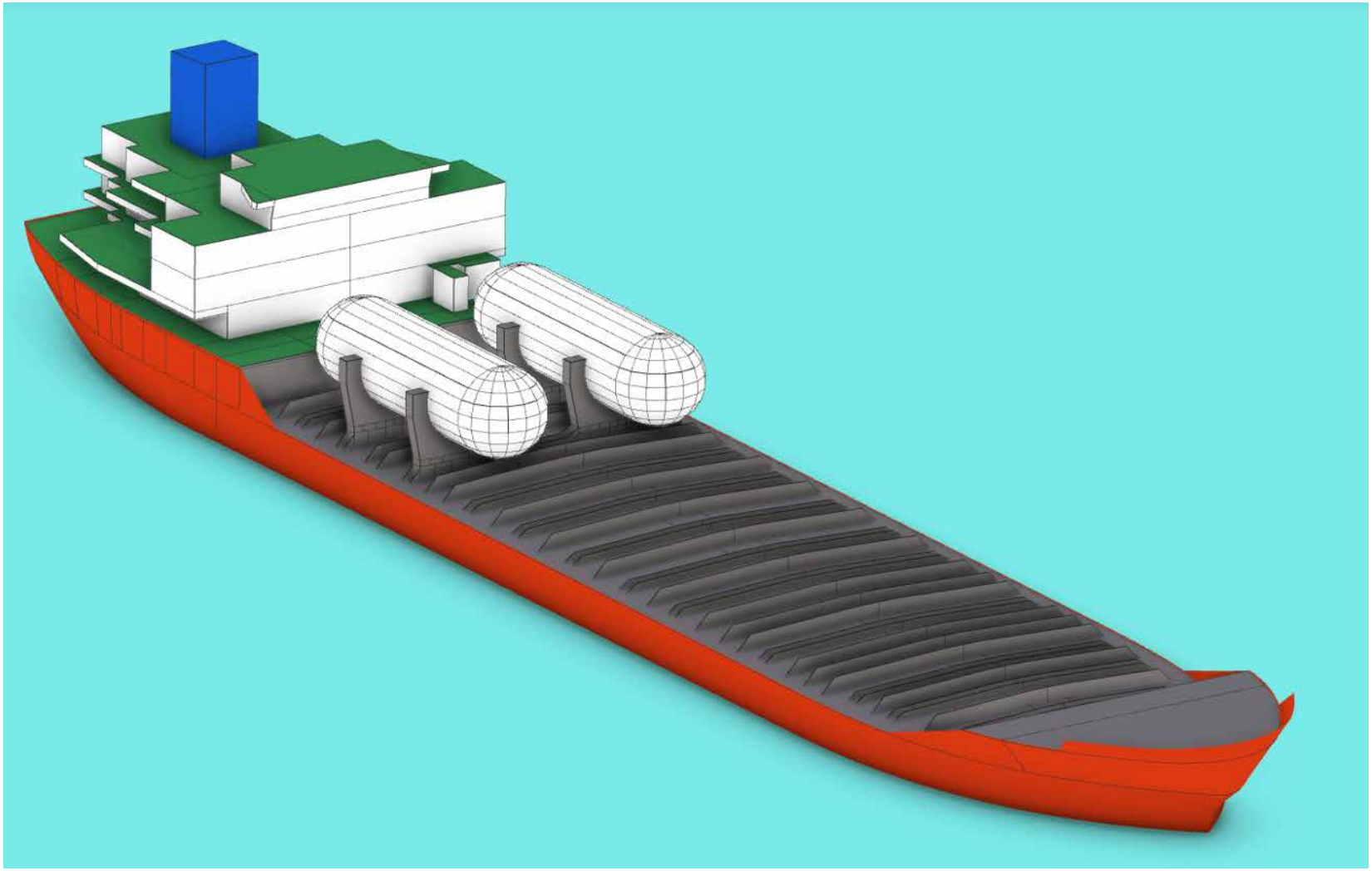
Hoping that hydrogen will be consumed as commonly as natural gas and petroleum, KHI will work to establish a supply chain to produce, transport, store and use hydrogen, a next-generation energy resource by making the most of the technologies and know-how that we have gained from the construction of the Suiso Frontier and cooperating with various partners.

***1 The CO_2-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA) was set up by KHI together with Iwatani Corp., Shell Japan Ltd. and Electric Power Development Co., Ltd. (J-POWER) mainly to develop technologies to produce hydrogen from brown coal; transport and store it; and conduct verifications to establish and commercialize a CO_2-free supply chain. Marubeni Corp., ENEOS Corp. and Kawasaki Kisen Kaisha, Ltd. ("K" Line) have since joined HySTRA.**

About the 32nd Ship of the Year Awards, presented by the JASNAOE : **https://www.jasnaoe.or.jp/soy/2021.html**

Shin Kurushima Dockyard group obtains ClassNK's GDA for LNG-fueled chemical tanker and FGSS

Chemical tanker, IMO Type II & III 97



Shin Kurushima Dockyard Co.,Ltd. (SKDY) has received General Design Approval (GDA) for 26,000 DWT-class LNG-fueled chemical tankers as well as the fuel gas supply system (FGSS) from the Nippon Kaiji Kyokai (ClassNK) for contributing to further reduction of greenhouse gases (GHG).

The marine transport industry has been becoming more active to achieve GHG reduction for conservation of the environment. Under such circumstances, SKDY has so far been tackling development of new ships to cope with reduction of GHG, and has built Japan's fi¬rst LNG-powered pure car carrier (PCC). In use of ammonia as a main fuel, one of next-generation fuels, the company has also obtained AiP for building ammonia-combustion PCC from ClassNK.

In this time, the SKDY group has completed the design of the LNG fueled chemical tanker and FGSS by conducting discussions and studies in cooperation with Shin

Shin Kurushima Dockyard group obtains ClassNK's GDA for LNG-fueled chemical tanker and FGSS

Chemical tanker, IMO Type II & III 97

Kurushima Sanoyas Shipbuilding Co., Ltd. (Shin Kurushima Sanoyas), an SKDY group company and FGSS manufacturer. As a result, ClassNK has granted SKDY and Shin Kurushima Sanoyas the GDAs for the chemical tanker and FGSS, respectively.

Acquisition of the GDA means that SKDY's chemical tanker and FGSS have been acknowledged as being equivalent to the detailed design condition, differing from AiP conditions. Therefore, this 26,000DWT-class chemical tanker design including FGSS has cleared various problems that would happen in an actual designing process, and smooth actual design work after receiving a shipbuilding order is possible. Thus, the SKDY group can design and construct not only LNG-fueled ships but also a complete FGSS that covers LNG-fuel supply from LNG fuel tanks to consumer installations. This allows SKDY to meet flexibly requirements of ship owners.

The LNG-fueled ship obtained GDA this time is a SKDY's major series of 26,000DWT-class chemical tanker designed in accordance with the design concept of a 49,000DWT chemical tanker provided with AiP in 2020, and has designed to have two LNG fuel tanks on the upper deck, which are the Independent Type C tank without secondary barrier.

In general, chemical tankers have the unique upper deck on which many pipelines are laid extendedly. So, when installing LNG fuel tanks, some problems may arise to arrange appropriately the fuel tanks on the deck. Incooperation with Shin Kurushima Sanoyas, SKDY has developed a FGSS-installing procedures provided with the conventional functions as a chemical tanker intact.

In addition, a gas preparation room is arranged between the engine room under the superstructure and the cargo tanks, and this arrangement optimizes reaches of fuel-gas piping from the fuel tanks as well as the bunker station to the engine room, and makes it possible to supply LNG fuel to the main engine, generator engines, and auxiliary boilers without a hitch. Under the gas preparation room, various tanks and a room for ballast pumps are disposed, not to make wasteful space.

The Shin Kurushima Dock group says that they will continue to develop and construct vessels corresponding to increasing requirements for the environment conservation, utilizing the environment-load-reduction technology based on their experiences in engineering and construction of vessels and marine machinery and equipment.

PRINCIPAL PARTICULARS

Length (o.a.)	149.50 m	Gross tonnage	18,900
Breadth (mld.)	28.40 m	Deadweight	26,500 t
Depth (mld.)	14.60 m	Speed (service)	14.7 knots
Draft (mld.)	10.25 m	Builder:	Shin Kurushima Dockyard Co., Ltd.