

Kawasaki Heavy Industries Liquefied Hydrogen Supply Chain Project

Sep. 2nd, 2024

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 **Kawasaki**
Powering your potential

Introduction of Kawasaki Heavy Industries, Ltd.



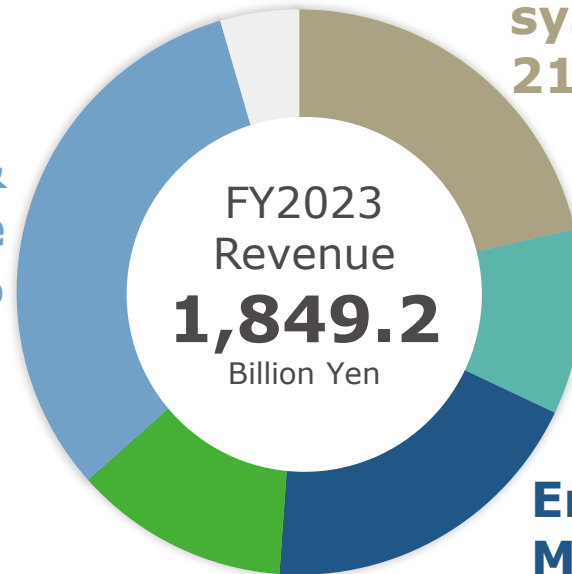
**Powersports &
Engine**
32.0%



Precision Machinery & Robot
12.3%



Others
4.5%



**Aerospace
systems**
21.4%



Rolling Stock
10.6%

**Energy Solution &
Marine Engineering**
19.1%



New Values



A Safe and Secure Remotely-Connected Society



Cross Over

Trustworthy Solutions for the Future



Energy and Environmental Solutions

Achieving Carbon neutrality



"Near-Future" Mobility

Frontier

Hydrogen introduction target in Japan (Government of Japan)

Government of Japan released “Basic Hydrogen Strategy” in 2017

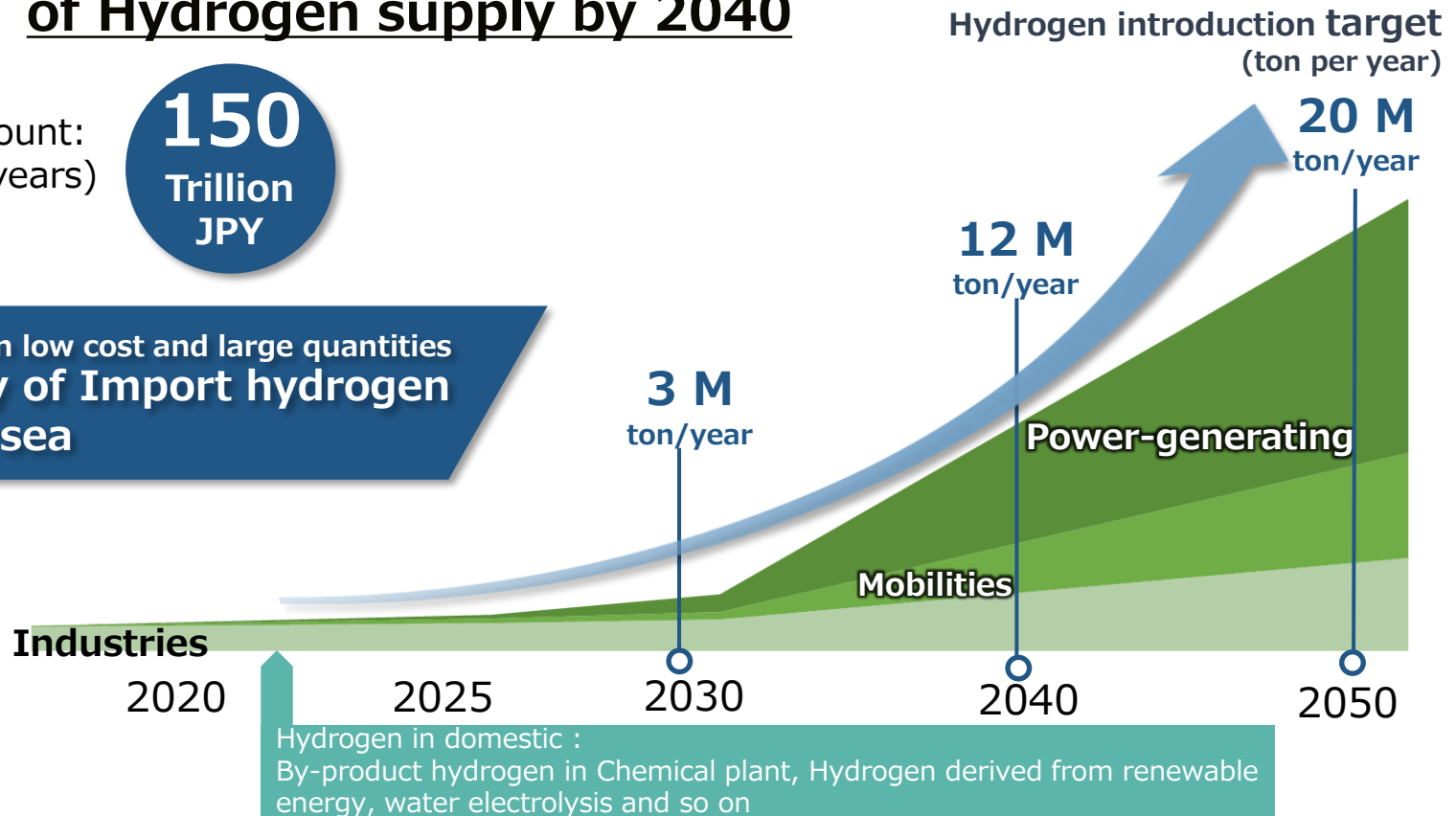
In 2023, revised “Basic Hydrogen Strategy”

New target : 12 million tons per year (Six times current)
of Hydrogen supply by 2040

Investment amount:
(in the next 10 years)

150
Trillion
JPY

To introduce in low cost and large quantities
**Necessary of Import hydrogen
from overseas**

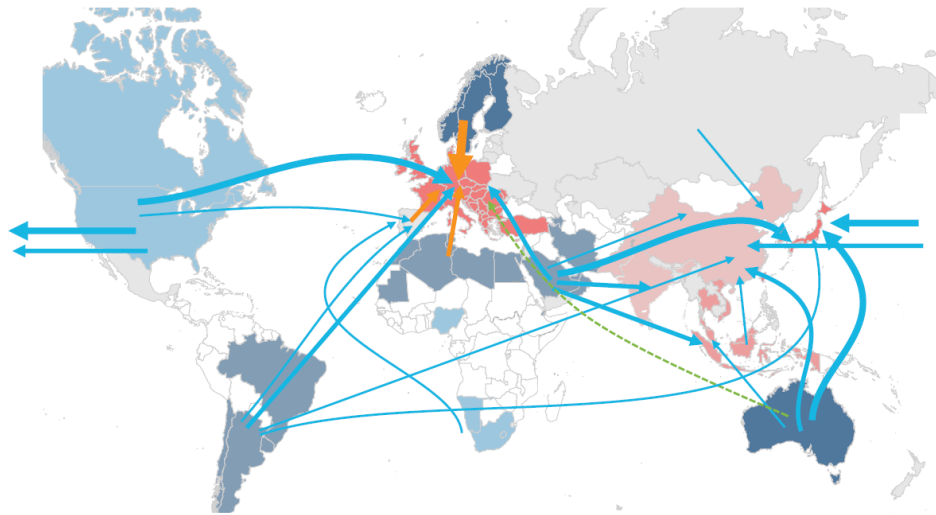


KHI created based on Ministry of Economy, Trade and Industry “Basic Hydrogen Strategy” (June 6th, 2023) etc.

Vision for the global liquefied hydrogen supply chain

By 2050, extensive and deep trade links will connect the globe

Main Interregional flows of hydrogen and derivatives 2050 – Further Acceleration, mtpa H₂ equivalent



Trade flows in 2050 from study by McKinsey & Company in Nov. 2023

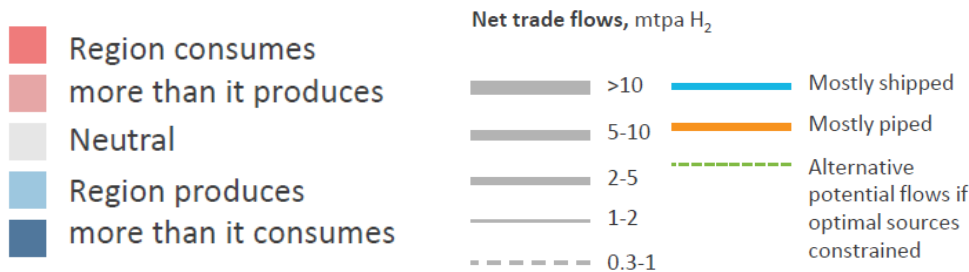
- Europe : mostly pipeline
- Other : mostly sea transport



Hydrogen carrier will play an important role

"Hydrogen Council and McKinsey & Company" Global Hydrogen Flows: Hydrogen trade as a key enabler for efficient decarbonization, Nov. 2023

Note: Arrows show trade flows between 13 regions (i.e., Latin America, North America, core Europe, peripheral Europe, North Africa, Sub-Saharan Africa, Middle East, CIS, India + Pakistan, China, Northeast Asia, Southeast Asia and Australia)
Source: McKinsey Global Hydrogen Flow Model



Why Kawasaki Heavy Industries chooses liquefied hydrogen

LNG : -162°C

Liquefied hydrogen : -253°C

Experience of LNG carrier

“Transport” “Storage” for Liquefied hydrogen : 40-year Kawasaki pride

1978

Install Liquefied hydrogen tank for Combustion test facility of Liquefied hydrogen Rocket engine in Noshiro, Akita city



LNG carrier (Japan's first)

1981



1987

Construct Liquefied hydrogen Storage tank(600m³) at JAXA (Japan Aerospace Exploration Agency)'s Tanegashima Space Center rocket launch facilities

2010

Released Hydrogen energy strategy in Kawasaki Business vision 2020

2020

the world's first liquefied hydrogen carrier "SUISEO FRONTIER"



2022

The world's first demonstration test of marine transport (from AUS to JPN)

Apr. 9th in 2022 : Ceremony for completing the demonstration test



Prime Minister, Mr. Kishida

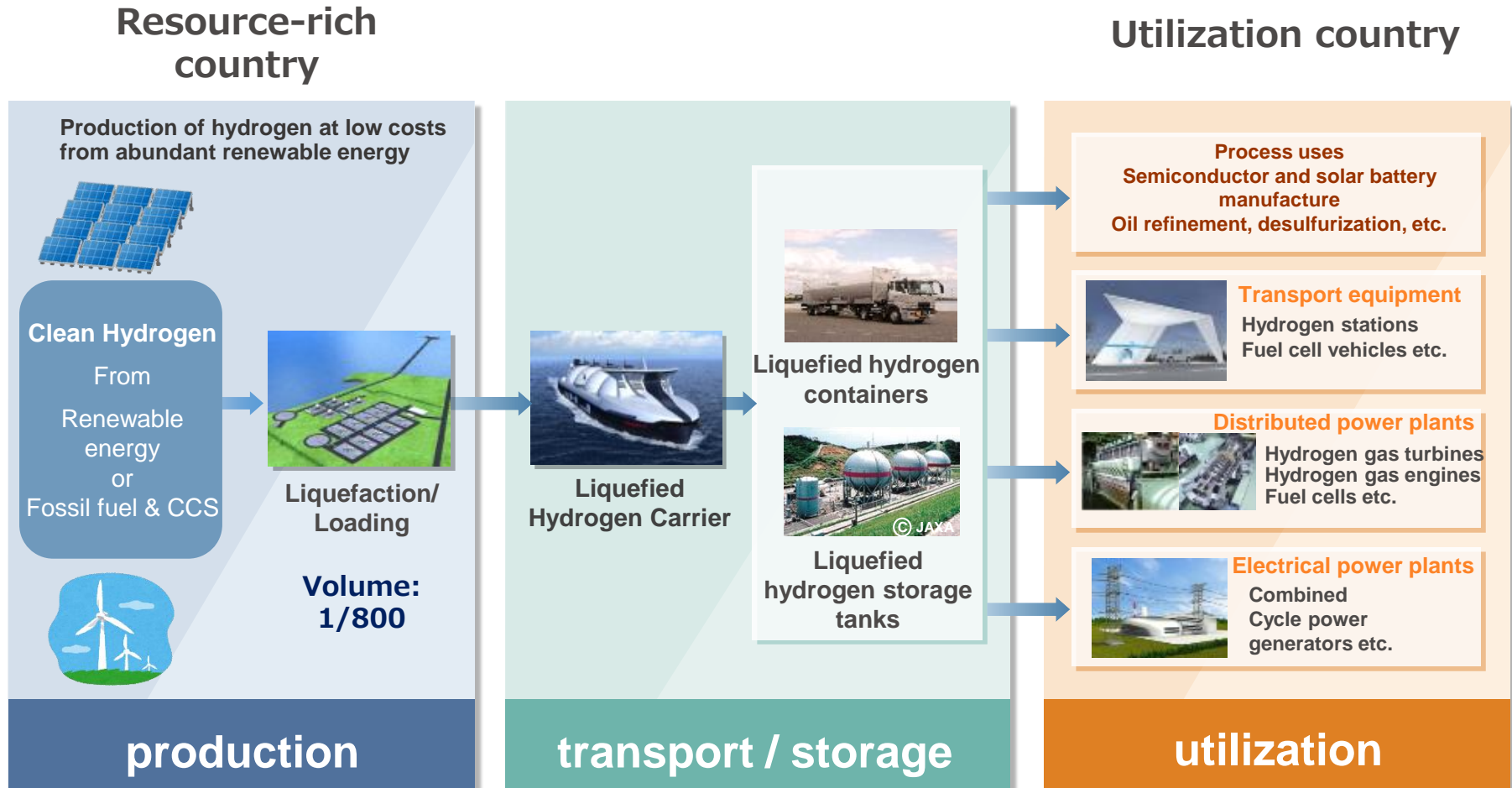
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Supported by NEDO(New Energy and Industrial Technology Development Organization)

Challenge to Construction of Liquefied hydrogen carrier with Low cost

Concept of CO2-free Global Liquefied Hydrogen Supply Chain

Stable energy supply while reducing CO₂ emissions



Pilot demonstration contributes to Commercialization

Pilot carrier tank: 1,250m³



Commercial carrier tank:



160,000m³ class



40,000 - 80,000m³ class

Pilot receiving terminal tank: 2,500m³



50,000m³ class



200,000m³ class

Development of major commercial-scale equipment - Cargo tanks for large liquefied hydrogen carriers

Jun. 2023 **Completed technological development**

of cargo tank for large liquefied hydrogen carriers (granted by NEDO (New Energy and Industrial Technology Development Organization))
Completing the technical challenges of increasing size and verifying tank operation technology



Large liquefied hydrogen carriers are planned to be Zero-Emission powered carriers using boiled-off hydrogen as fuel for maritime transportation.

The government of Japan and our company are leading the revision of the international regulations on transport requirements for liquefied hydrogen to be adopted by the IMO_MSC108 (Maritime Safety Committee) in May of 2024

Superior thermal insulation performance of liquefied hydrogen storage tank

Both BORs have achieved the same level of performance as LNG carriers and storage tanks of the same class

BOR (Boil off Rate) : Ratio of liquid evaporated per day by external heat

"Suiso Frontier" BOR 0.3%/day

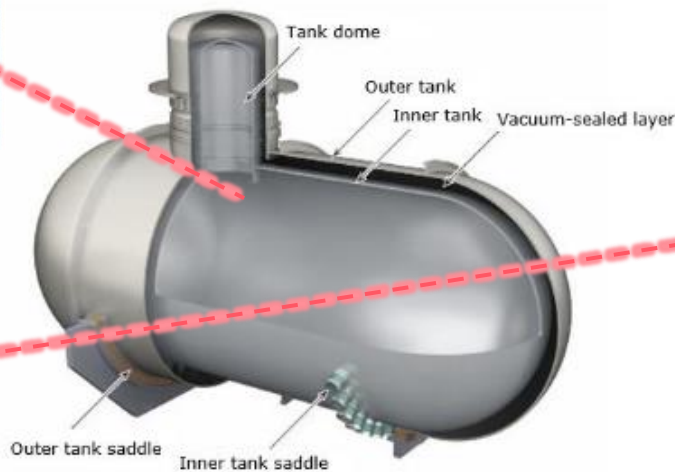
"Hy touch Kobe" BOR 0.06%/day



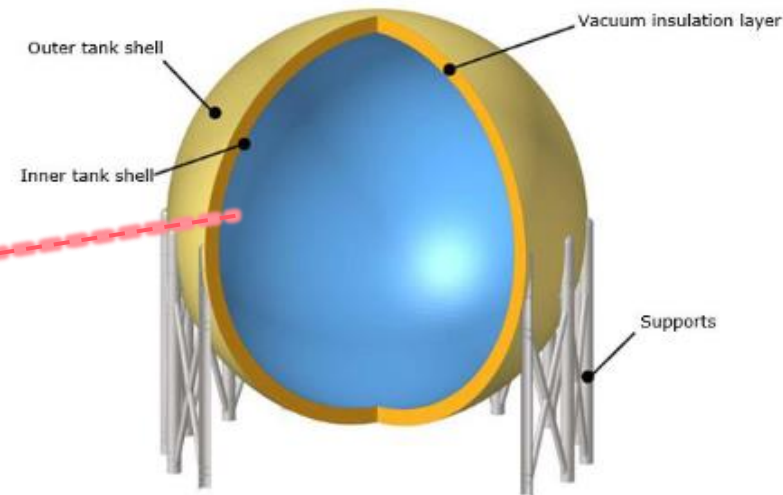
Suiso Frontier



Hy touch Kobe



Tank used on the *SUISO FRONTIER*



Tank used at Hy touch Kobe

CG-rendered images of the double-shell vacuum-insulation structure

Introduction of Movie

The world's first demonstration test of marine transport in 2022
(from AUS to JPN)

On February 25, 2022,

2022年2月25日

