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# Initiatives of international Liquefied Hydrogen Supply Chain

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 **Kawasaki**  
Powering your potential

29, Feb, 2024

# Products of Kawasaki Heavy Industries

Ship & Offshore Structure



Rolling Stock



Aerospace Systems



Energy System & Plant Engineering



Motorcycle & Engine



Precision Machinery & Robot

# KHI Group Hydrogen Products



Hydrogen Gas Engine



Hydrogen Gas turbine



Hydrogen Boiler



Fertilizer Plant



Water Electrolysis System



Liquefier Plant



Liquefied Hydrogen Tanks



Liquefied Hydrogen Loading Arm



© : HySTRA

Liquefied Hydrogen Carrier



Fuel Cell Train



High pressure Hydrogen Gas Valve



Compressed H<sub>2</sub> Trailer Trucks



Liquefied Hydrogen Container



# Liquefied Hydrogen

## Large-scale Transport Methods for Hydrogen

### Characteristics of liquefied hydrogen

- Extremely low temperature (-253 degrees C)
- 1/800 the volume of hydrogen gas
- Transport medium of proven practical use in industry and as rocket fuel
- High purity = no need for refinement (can be supplied to fuel cells by evaporation alone)
- Non-toxic



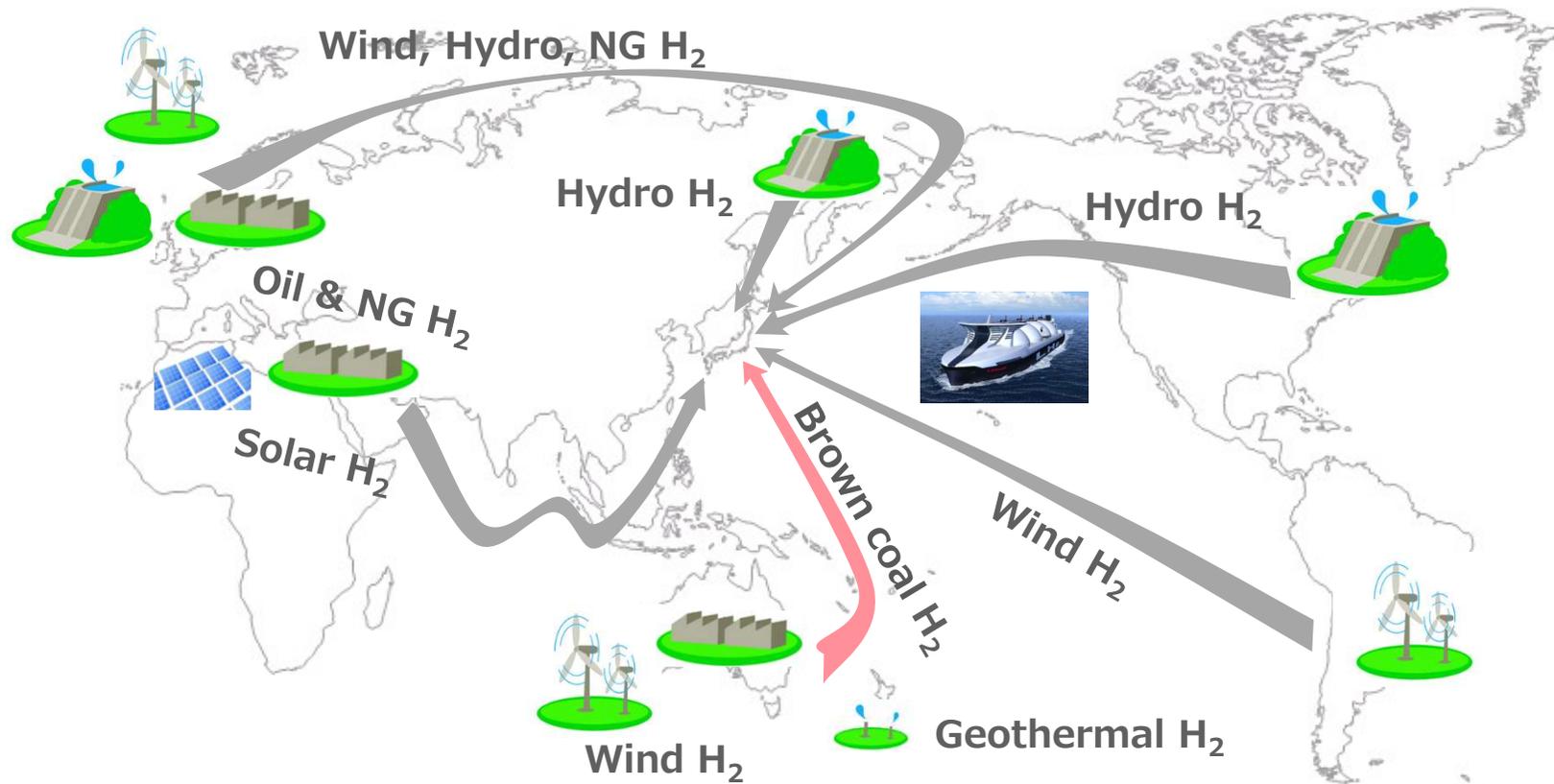
JAXA

The second largest liquefied hydrogen tanks in Japan  
(Tanegashima Rocket Base)



JAXA

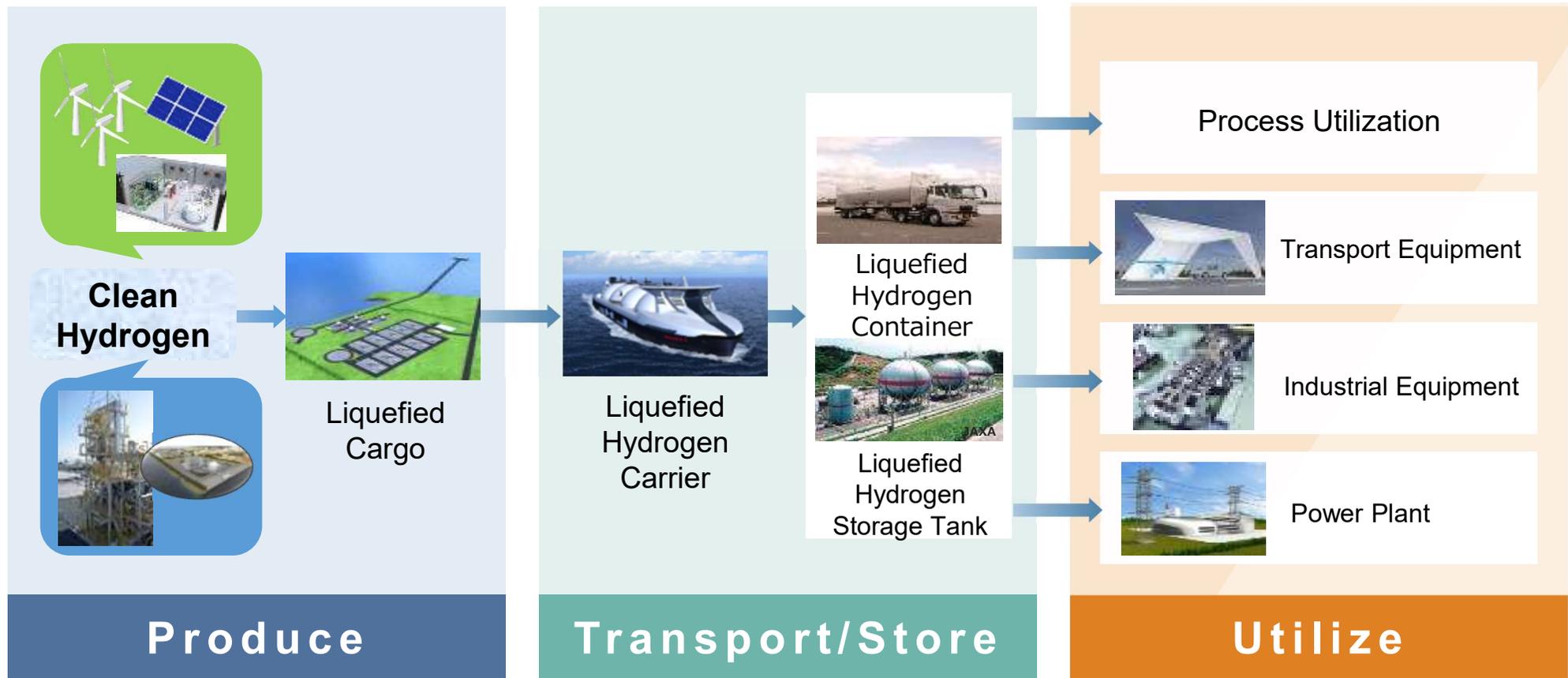
# Expected CO<sub>2</sub>-free H<sub>2</sub> Supply chain



# Major Technological Developments for Hydrogen Supply Chain

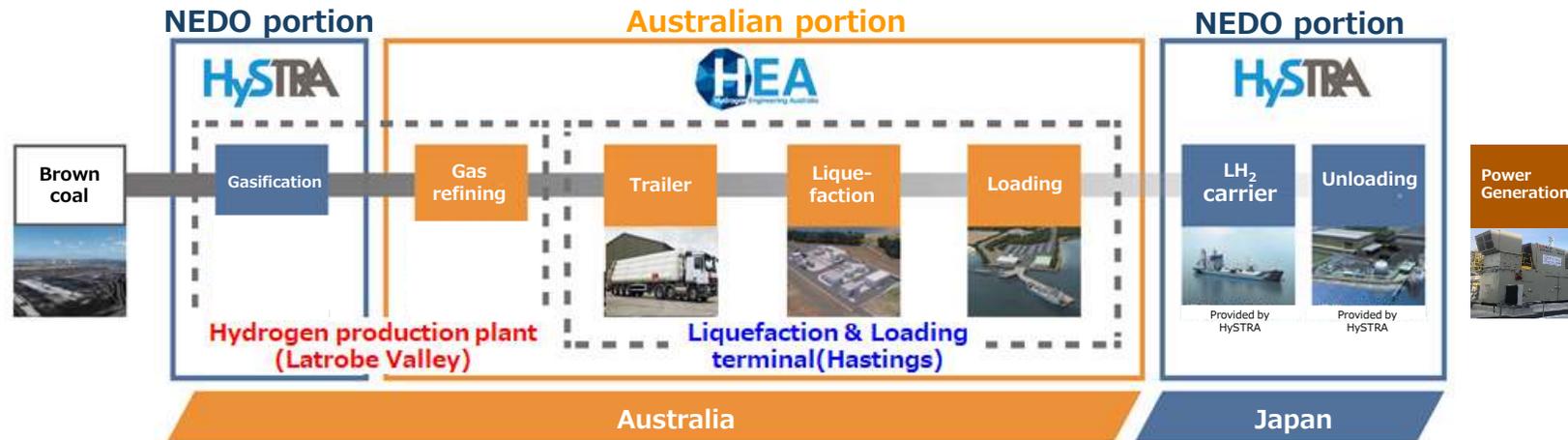


Stable Energy Supply while Reducing CO<sub>2</sub> Emissions



# Pilot Demonstration Structure

\*NEDO : New Energy and Industrial Technology Development Organization



## 【CO<sub>2</sub>-free Hydrogen Energy Supply-chain Technology Research Association】

Member : Iwatani Corporation, KHI, Shell Japan, J-Power, Marubeni Corporation, ENEOS Corporation \* As of the end of March 2023

Scopes : brown coal gasification, LH2 carrier, LH2 loading

supported by NEDO.



## 【Hydrogen Engineering Australia】

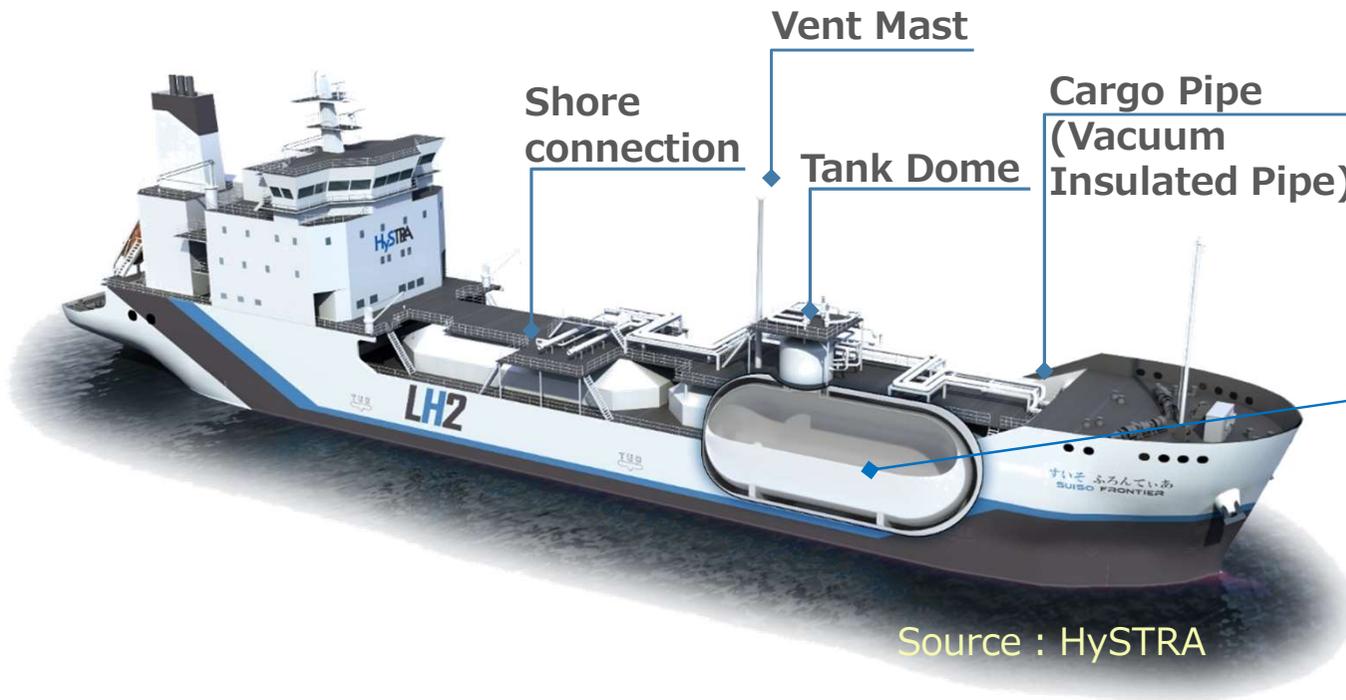
HEA is KHI's subsidiary cooperating with KHI, J-Power, J-Power Latrobe Valley, Iwatani Corporation, Marubeni Corporation, Sumitomo corporation and AGL.

Scopes : gas refining, land transportation, hydrogen liquefaction and LH2 loading supported by Australian governments

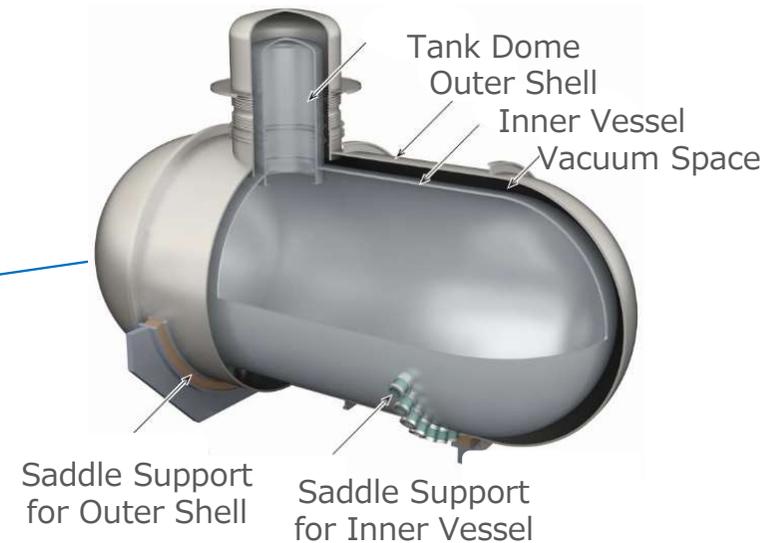
# Status of the Pilot Demonstration Project: Hydrogen Transportation



# The world's first LH<sub>2</sub> carrier "Suiso Frontier"



## Cargo Containment System (1,250m<sup>3</sup>)



## Vacuum Insulated Double Shell Structure

This presentation is based on results obtained from a project subsidized by the New Energy and Industrial Technology Development Organization (NEDO).

■ Length o.a.	116.0 m	■ Propulsion	Oil fired diesel electric
■ Breadth	19.0 m	■ Service speed	abt. 13 knots
■ Class/Flag	NK/Japan	■ Complement	25 persons

# Development of Scaling Up



Suiso Frontier: 1,250m<sup>3</sup>/tank



X 32  
X 4 tanks

Commercial ship tank: 40,000m<sup>3</sup>/tank x 4 tanks



Storage Tank at Hy touch Kobe: 2,500m<sup>3</sup>



X 20

Commercial tank: 50,000m<sup>3</sup>



# Expanding hydrogen fuel to Mobility

- Know-how to burn hydrogen safely and cleanly developed through hydrogen power generation
- Pursuing Kawasaki's combustion technology further, leading the world in mobility internal combustion engine



## Development of Hydrogen-Fueled Vessel Propulsion System \* 1

Complete lineup for various applications by around 2026



## Hydrogen Aircraft Core Technology Development Project\* 2

Promote development in anticipation of full-scale launch after 2035



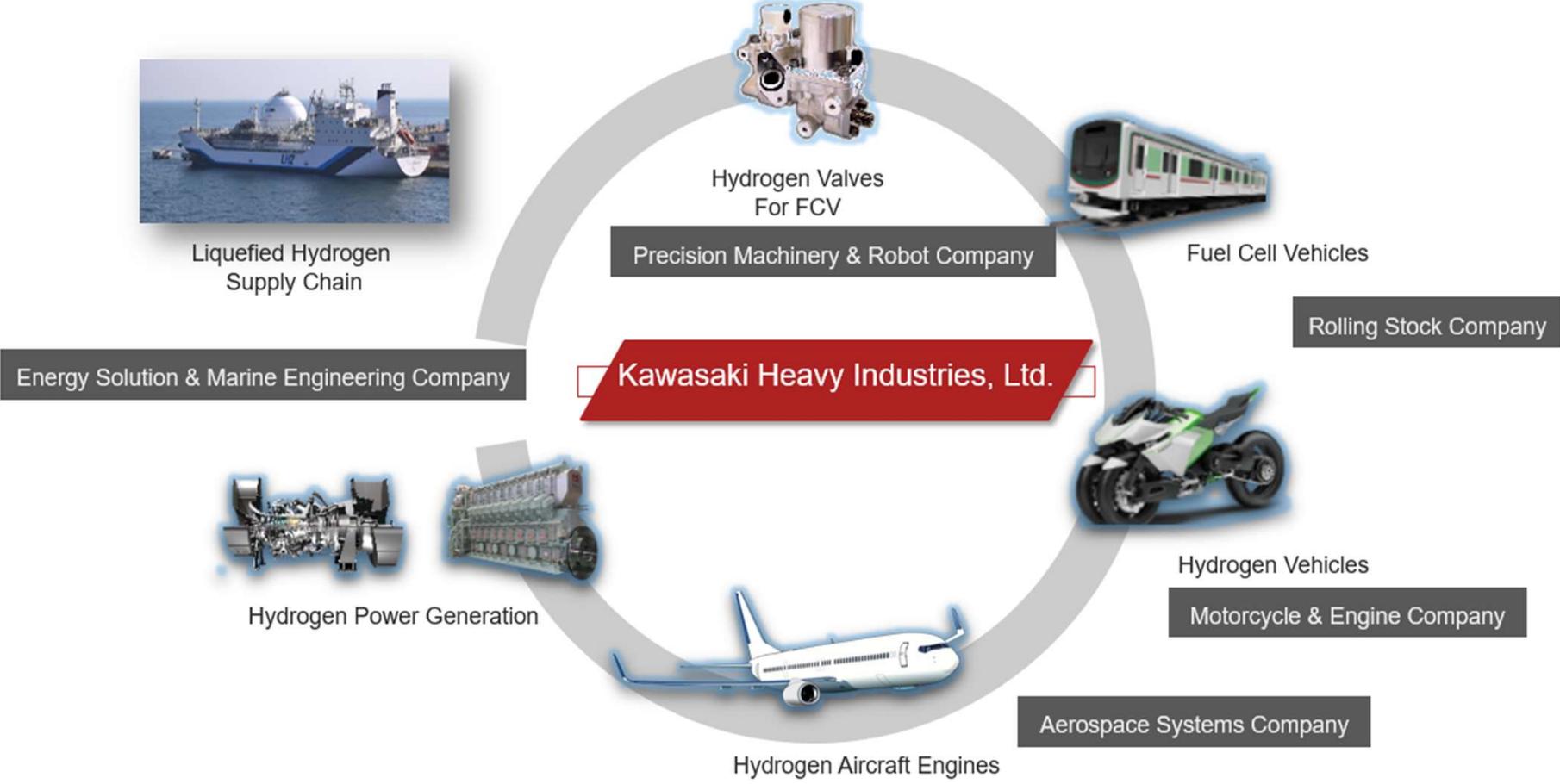
## Joint Research on Hydrogen Engines

Domestic two- and four-wheel manufacturers collaborate to develop hydrogen engine

\*1 NEDO Green Innovation Fund Project "Development of a Hydrogen Fuel Ship Propulsion System" (about 21.9 billion yen in subsidies) (Yanmar Power Technologies to be Adopted in Consortium with Japan Engine Corporation)

\*2 NEDO Green Innovation Fund Project "Core Technology Development for Hydrogen Aircraft" (grant: about 18 billion yen)

# Further Development of Hydrogen-Related Products/Businesses





**Kawasaki**  
**Powering your potential**