Deutsch-Japanisches Wirtschaftsforum

KHI Activity for Hydrogen Supply Chain

Hydrogen Project Development Center
Corporate Technology Division
Kawasaki Heavy Industries, Ltd.

Kawasaki
Powering your potential

Kawasaki Heavy Industries

Kawasaki Heavy Industries, Ltd.

- Ships & Offshore Structure Company 
- Rolling Stock Company 
- Aerospace Company 
- **Energy System & Plant Engineering Company**
- Motorcycle & Engine Company 
- Precision Machinery Company 

- Kawasaki Gas Turbine Europe GmbH (Germany)
- Kawasaki Gas Turbine Asia Sdn. Bhd. (Malaysia)
- Kawasaki Gas Turbine Asia Sdn. Bhd. - Jakarta Representative Office
- Kawasaki Heavy Industries, LTD - Bangkok Office

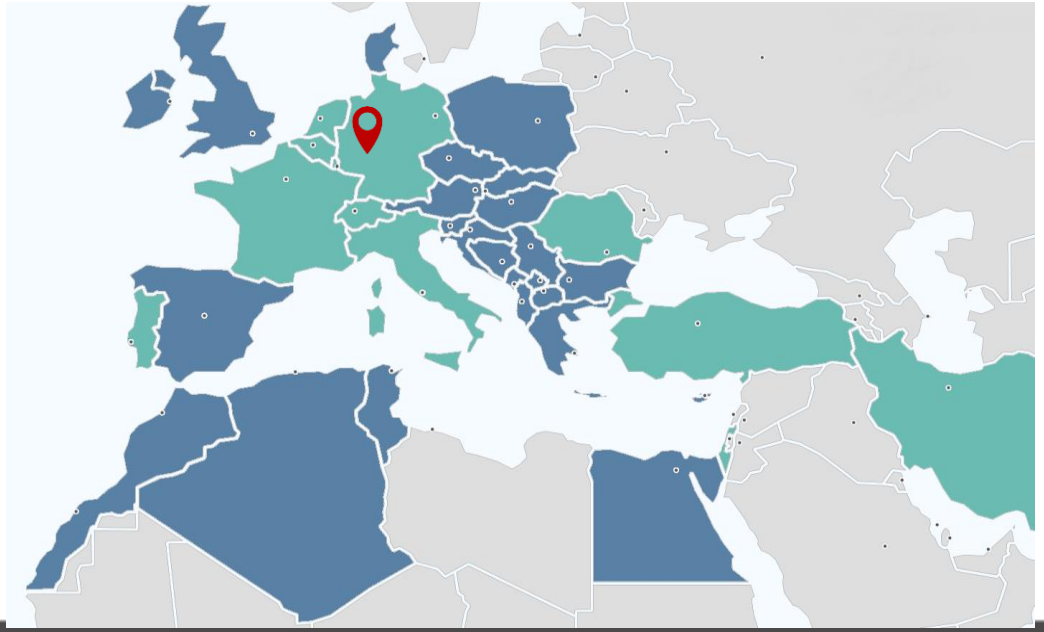
Kawasaki Products & Services

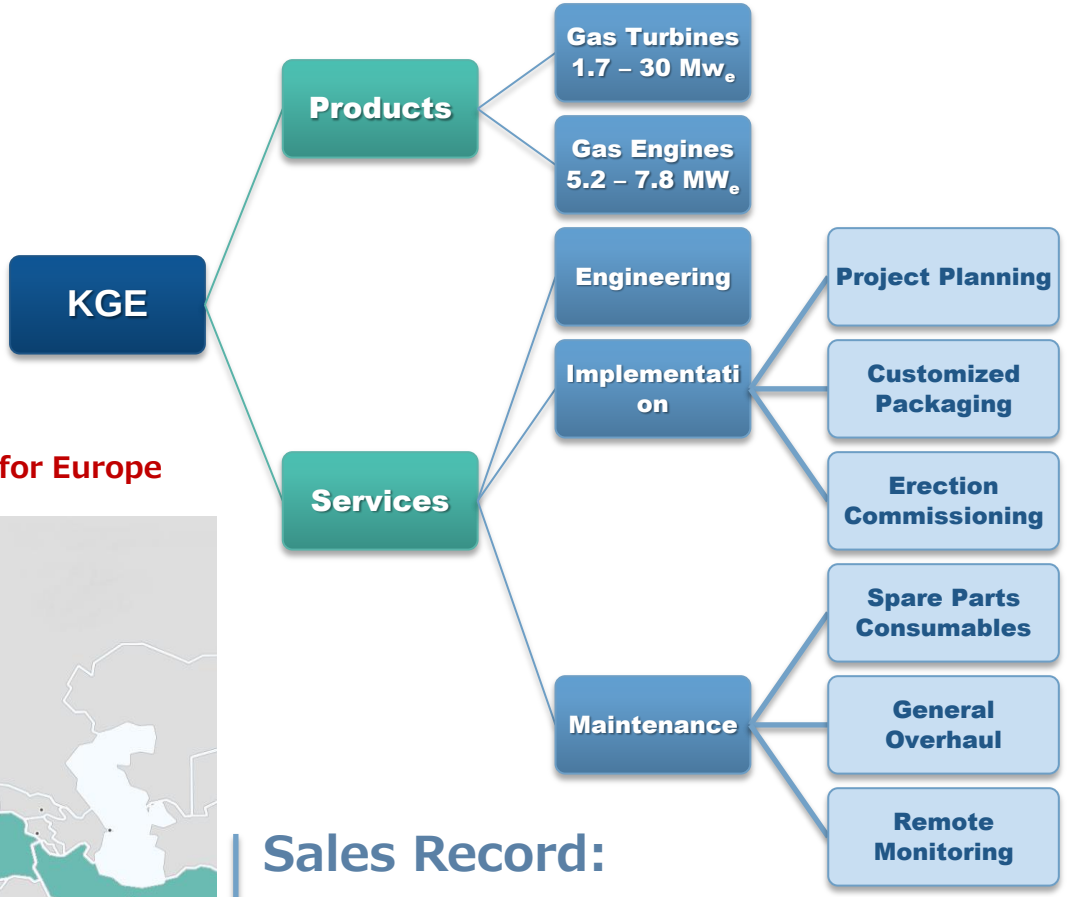
Kawasaki Gas Turbine Europe GmbH

Location
Bad Homburg
(close to Frankfurt)

Number of Employees
69

Sales office, Production Site, and Service Centre for Europe





Sales Record:

Number of Units > 140 Units

Total Capacity > 400 MW

Countries > 15 pcs

Contents

COP21 (Paris Agreement) Dec. 2015

- **Shifted from Low-carbon to de-carbonation society (Global temperature rise less than 1.5℃ at most effort, as well as 2℃ target)**
- **Became effective after 4th, Nov. 2016**
  170 nations and countries signed
  (as of 1st, Dec. 2017)
- **Target of CO_2 Reduction:**
  Japan "26% by 2030"
  Advanced Nations including Japan "80% by 2050"

Actions in Japan for COP21 (Paris Agreement)

- In order to achieve the CO_2 target at 2030, proportion of CO2 free power, i.e. nuclear and renewable energies, in the total power generation should be 44% or more
- Power retailers have to achieve the above composition ratio by law
- Creation of low-carbon power (non-fossil value) market is under consideration

Contents

Basic Hydrogen Strategy
(Ministries cooperation Common scenario)

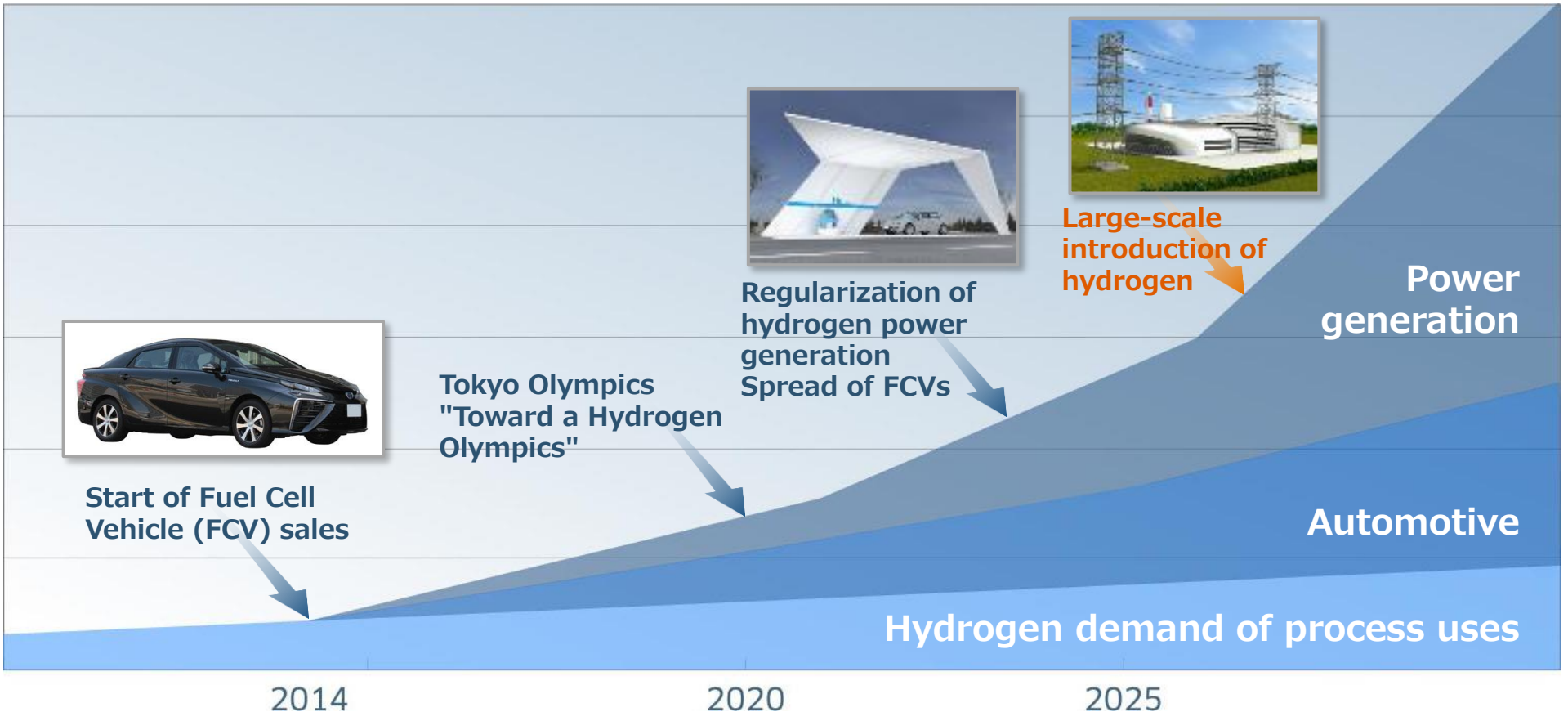
On December 26, 2017, the Ministerial Council on Renewable Energy, Hydrogen and Related Issues held its second meeting and decided on a Basic Hydrogen Strategy to accomplish a world-leading hydrogen-based society

From HP. of Prime Minister's Office

- Hydrogen is an option as important as renewable energies (R.E.)
- Mass production from low cost sources: utilizing brown coal and foreign R.E. (Develop international liquefied hydrogen supply chain)
- Promotion of furl cell vehicles and hydrogen refueling stations
- Commercialization of hydrogen power generation and mass consumption of hydrogen (hydrogen consumption 10 mill. t/year, Power generation capacity 30GW)
- Leading to growth strategy to leveraged Tokyo Olympic Paralympic Games

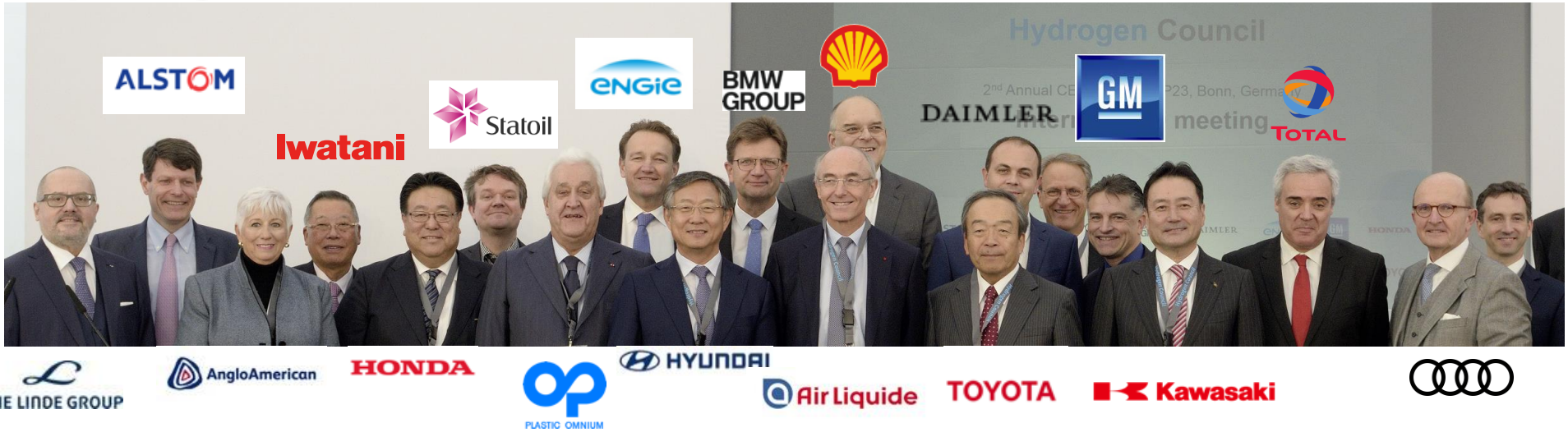
Expansion of Hydrogen Demand

Demand progresses in the order of “Processing" ⇒ "FCV" ⇒ “Power generation"



Initiative by Global Companies

Hydrogen Council



- Composed of 39 leading companies from energy, transportation, manufacturing industry and trading sectors: 24 steering members (above photo + 3M, Bosch, China Energy, Great Wall Motor, JXTG Energy and Weichai) and 15 associate members.
- A global initiative advocates long term target to move to hydrogen utilizing new energy economy
- With understanding of importance of hydrogen on energy transition, Hydrogen Council aims to create effective action plan with Governments and other stakeholders

Contents

Concept of CO_2-free Hydrogen Chains

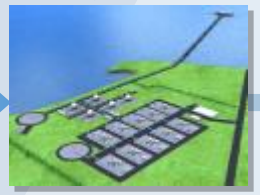
Stable energy supply while suppressing CO_2 emissions

Resourcing country (Australia)

Utilizing country (Japan)

Production of hydrogen at low costs from **unused resources (brown coal)** and/or abundant recyclable energy

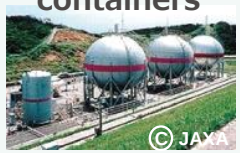
Affordable renewable energy



Liquefaction/ loading

Liquefied hydrogen ships

Liquefied hydrogen containers



Liquefied hydrogen storage tanks

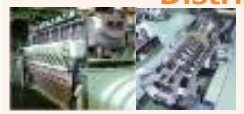
Lignite

CO_2-free H2

CCS (CO_2 capture/storage)

Process uses
Semiconductor and solar battery manufacture
Oil refinement, desulfurization, etc.

Transport equipment
Hydrogen stations
Fuel cell vehicles etc.



Distributed power plants
Hydrogen gas turbines
Hydrogen gas engines
Fuel cells etc.

Power plants
Combined Cycle power generators etc.

Hydrogen production

Hydrogen transport/storage

Hydrogen use

Contents

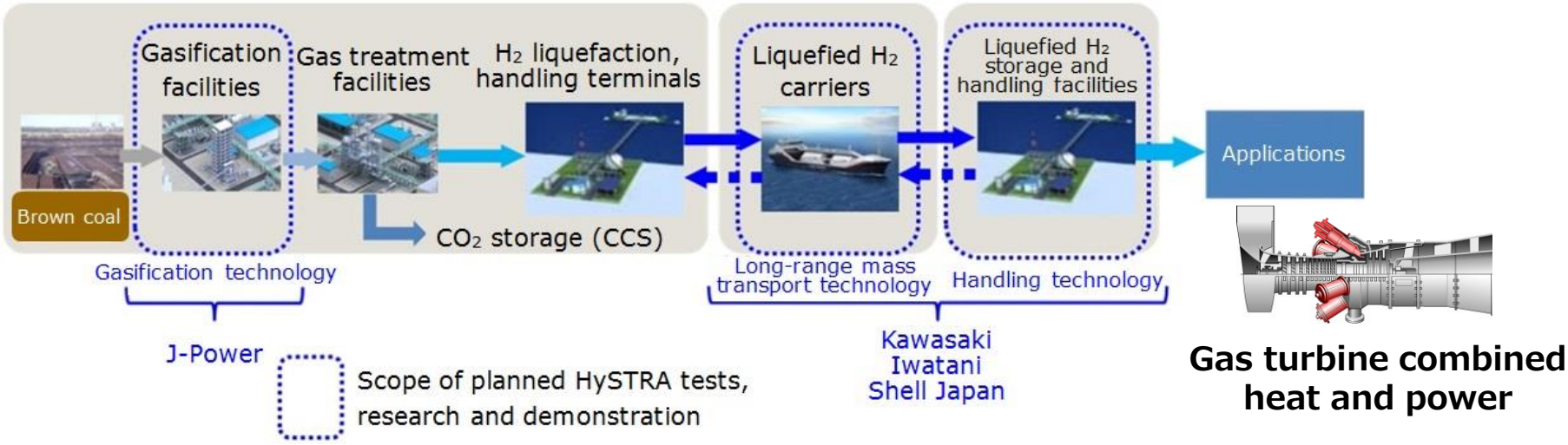
Established Technical Research Association

Technical research association(TRA) was founded to carry out the NEDO portion.

Name : CO2-free Hydrogen Energy Supply-chain technical Research Association (Abbreviation: HySTRA)

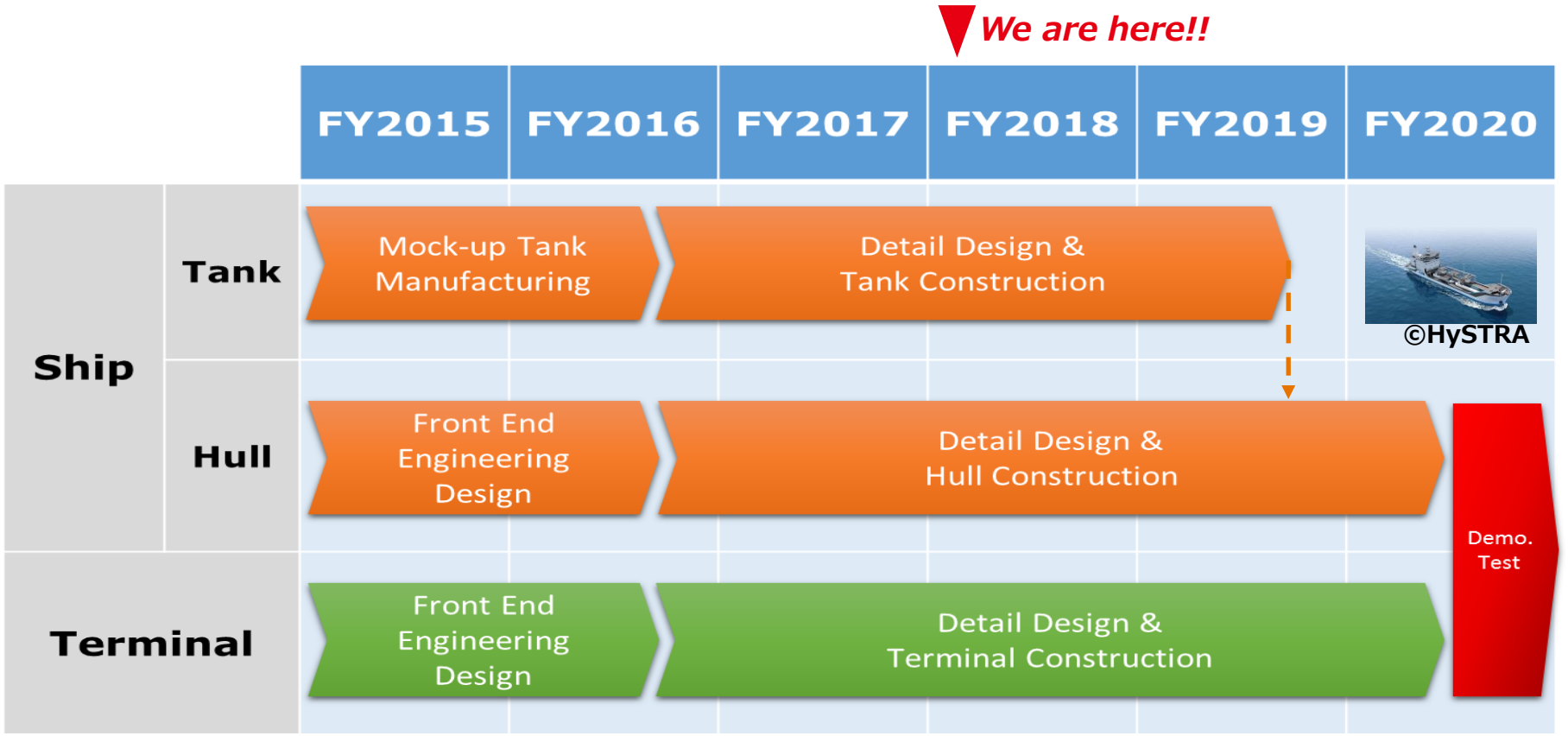
Foundation: February in 2016

Member : Kawasaki Heavy Industries(KHI), Iwatani Corporation, Shell Japan, J-Power

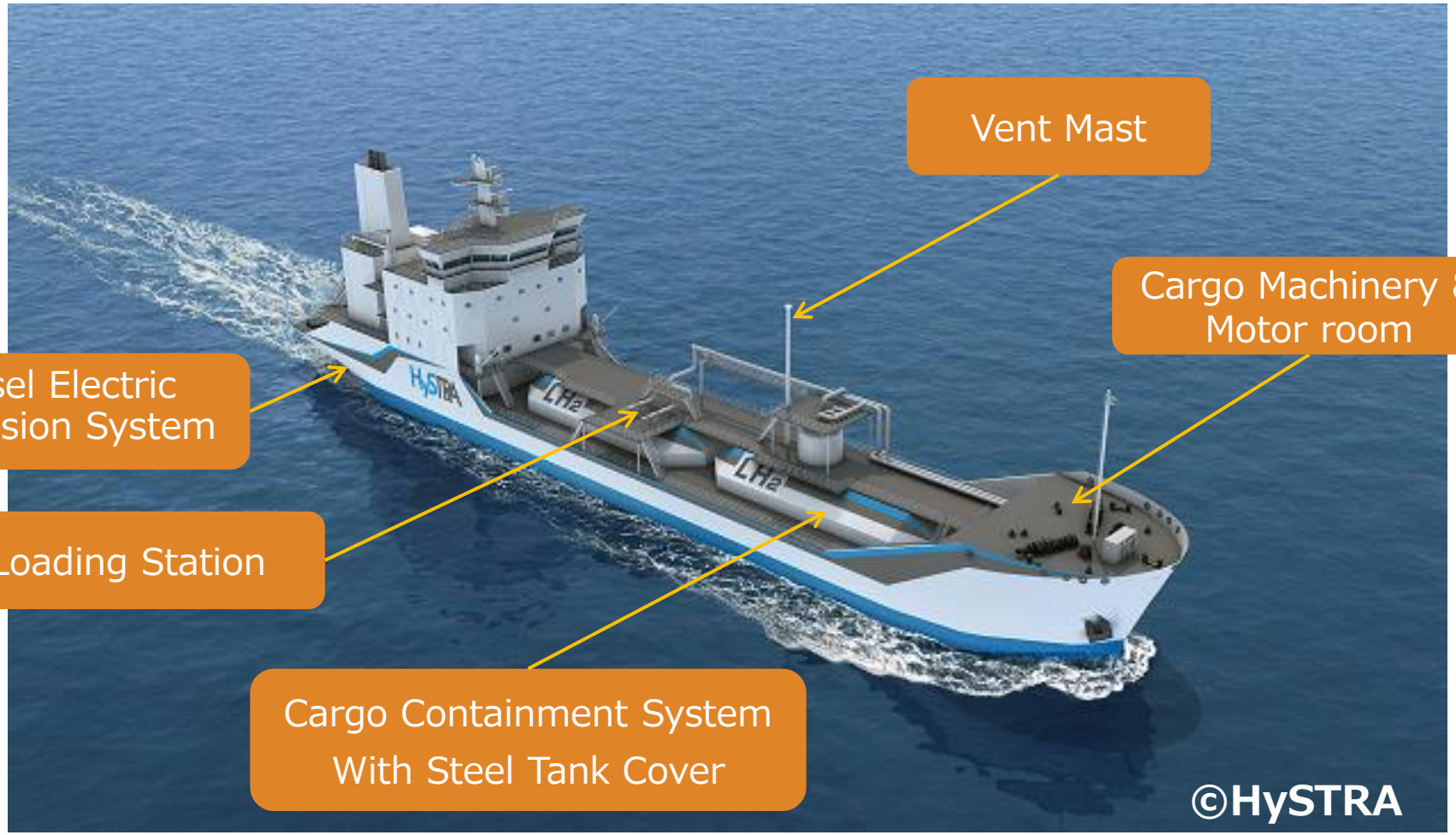


Pilot Demonstration Project Overview

Overall Schedule of Pilot HSEC Project



Liquefied Hydrogen Cargo Ships



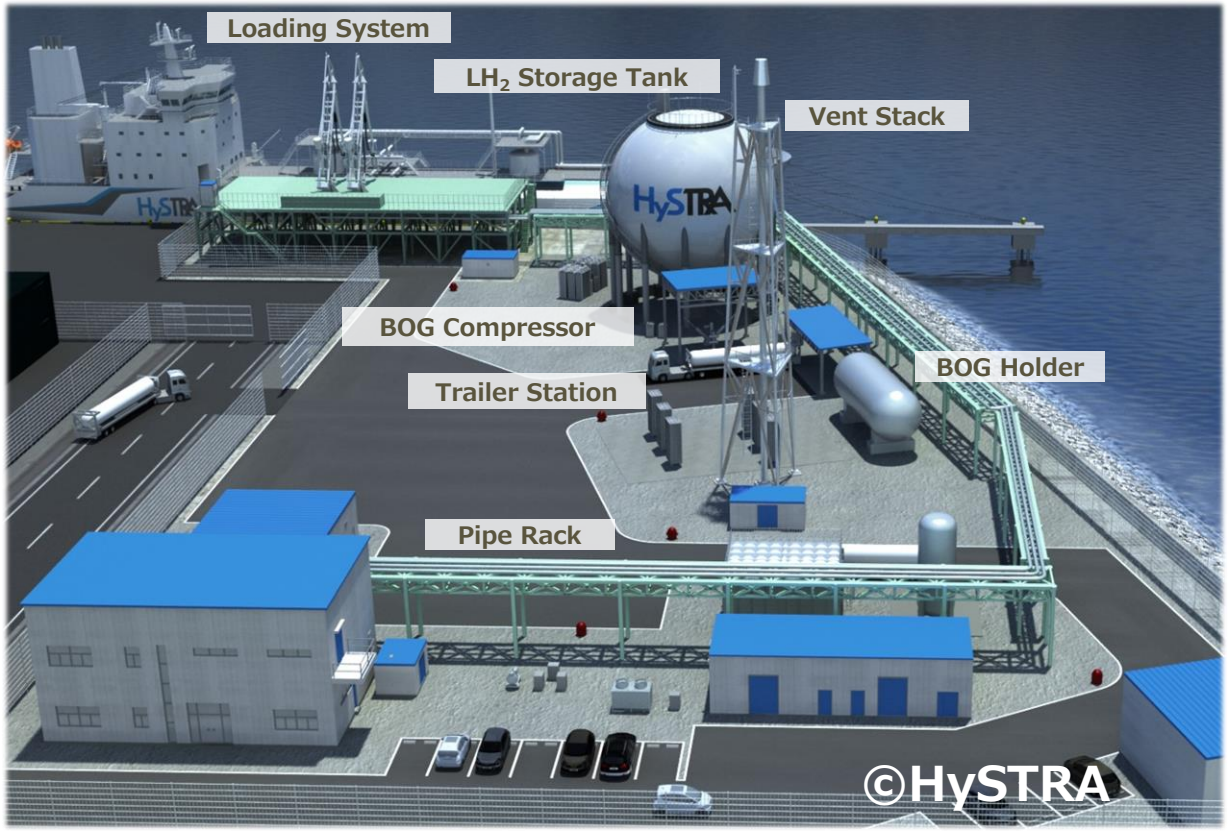
Approval of Safety Requirements

- Interim recommendations were discussed on safety requirements for offshore carriage of liquefied hydrogen in bulk proposed by Japan.
- IMO MSC(Maritime Safety Committee, Parent Committee of CCC3) was held from 21th to 25th Nov. , 2016 and approved the recommendations.
- Thus, IMO officially acknowledge the demonstration of liquefied hydrogen transportation between Japan and Australia.

IMO: International Maritime Organization
CCC: Carriage of Cargoes and Containers

Arrangement of The Terminal

* LH_2: Liquefied Hydrogen



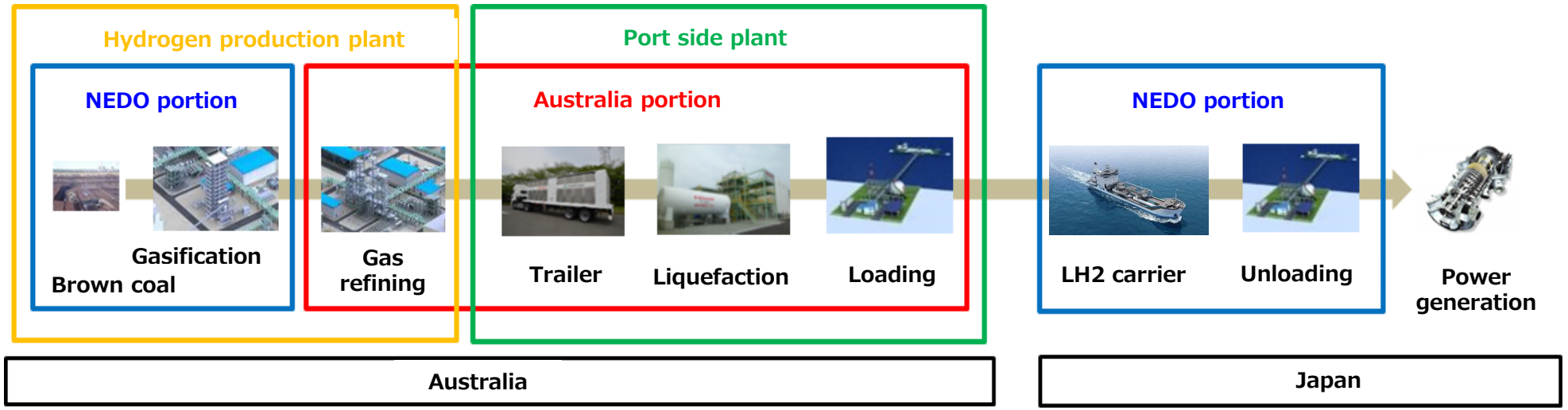
Specifications of the LH_2 Terminal	
LH_2 Storage Tank	Vol. 2,500m^3 Dia. 19m Vacuum double shell
Loading System	Dia. 6inch Vacuum double wall Emergency release system
BOG* Treatment	BOG compressor BOG holder Vent stack

*BOG: Boil Off Gas

Computer Graphic of Liquefied Hydrogen Terminal in Kobe Air Port Island

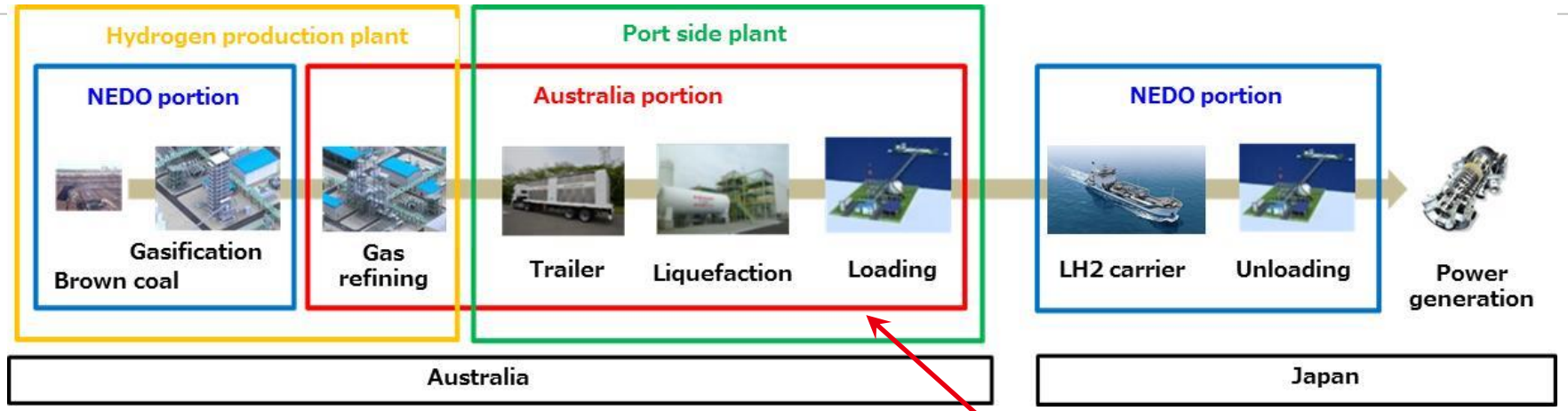
Supported by NEDO

Pilot Demonstration Structure



- NEDO portion: consisting of gasification in Australia, H2 carrier and unloading terminal in Japan supported by NEDO, performed by HySTRA
- Australia portion: consisting of gas refining and loading terminal in Australia supported by Australian Governments
- Hydrogen Production Plant: consisting of gasification and gas refining in Latrobe Valley
- Port side plant: consisting of trailer, liquefaction and loading terminal in Hastings

Australian Portion Launched



- Australian portion subsidization was announced in Latrobe Valley on 12, April
- Prim minister Turnbull and ministers were attended the event.
- Hiraki Parliamentary Secretary from METI was attended the event and Seko Minister of METI commented by video message
- Kawasaki Heavy Industries, J-POWER, Iwatani Corp, Marubeni and AGL were attended from private sector

Progress of Hydrogen Project

2014

2020

Tokyo Olympics & Paralympics

2030

Technologies also in the possession of this company

LNG technology

Liquefied hydrogen technology

"Strategic Energy Plan"

2018 Kobe Hydrogen Gas Turbine Co-generation

Pilot demonstration

Commercial chain

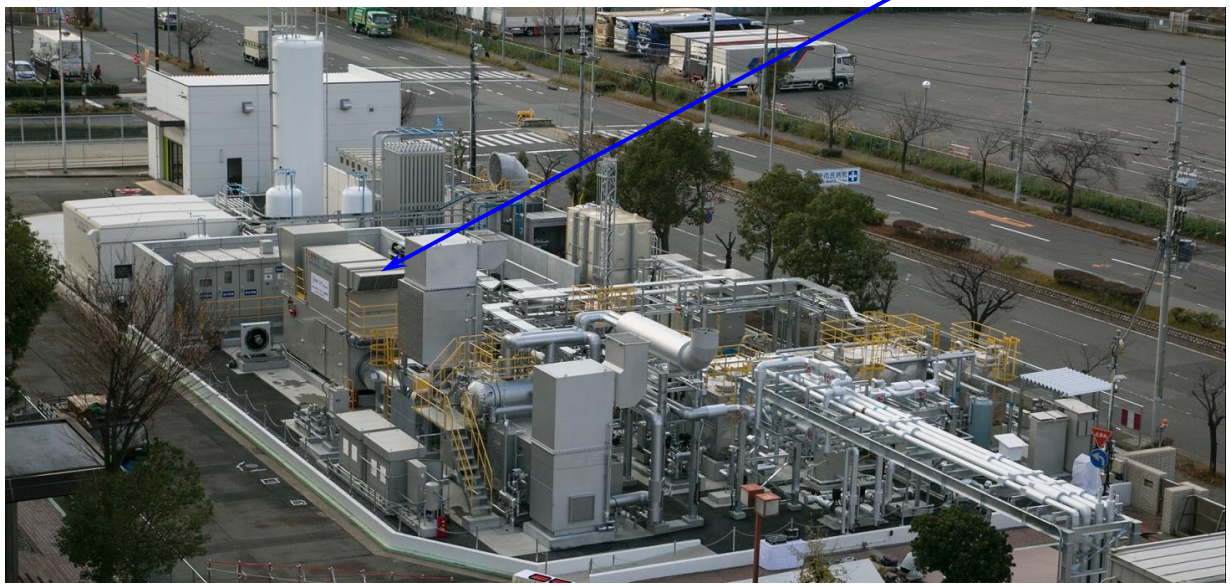
Contents

Hydrogen Power Station in Kobe

Power and heat management system using hydrogen as a fuel.

Power Generation: 1.1 MW
Partners: Obayashi (Leader), Kawasaki, Kobe City, KEPCO, Iwatani, Osaka University

Supported by NEDO



Role and Effect of CO_2-free Hydrogen Chains

1 Stable Supply

- Hydrogen from fossil fuel linked with CCS will realize vast and affordable energy supply

  → Contribute energy security (Australian brown coal corresponds 240 years of gross generation in Japan)

2 Environmental

- No CO_2 emissions when used (only water is emitted)

  → "Ultimate clean energy"

3 Improvement of Industrial Competitiveness

- Wide use of hydrogen brings Industrial growth → Deployment of Infrastructure export
- Hydrogen production started from fossil fuel gradually shifted to the renewables → Sustainability!

Thank you for listening

Kawasaki, working as one for the good of the planet

“Global Kawasaki”

We have a booth in Hall 11 E55

Kawasaki Heavy Industries, Ltd. **Corporate Technology Division**
1-14-5, Kaigan, Minato-ku, Tokyo 105-8315
Tel: 03-3435-2259 Fax: 03-3435-2081
http://www.khi.co.jp