

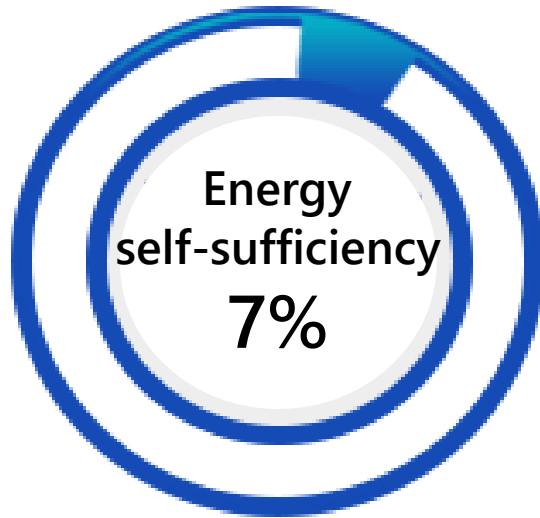
Japan's policies and actions toward hydrogen-based economy

KOYAMA, Masaomi, METI, Japan

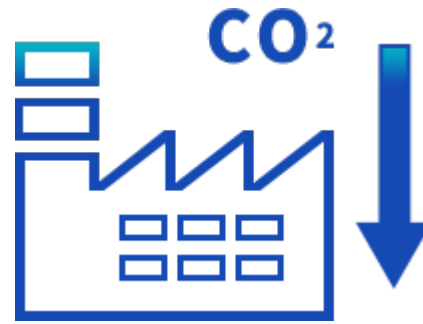


29 June 2021, Session 1: Light up & Power Africa, Third Japan-Africa Business Forum

Why hydrogen?



Energy Security



Decarbonising
Sectors



Economic
Impact

~A set of policies to guide our efforts toward hydrogen-based economy~

Basic Energy Plan

Hydrogen as a key contributor to:

- Decarbonisation
- Energy security
- Industrial competitiveness



Basic Hydrogen Strategy (Prime Minister Abe's Initiative)

- First comprehensive national strategy
- H₂ as a future energy option toward 2050
- Detailed strategy with numerical targets
(\$3/kg by 2030 ⇒ \$2/kg by 2050)

Strategic Roadmap for Hydrogen and Fuel Cells

Hydrogen and Fuel Cells Technology Development Strategy

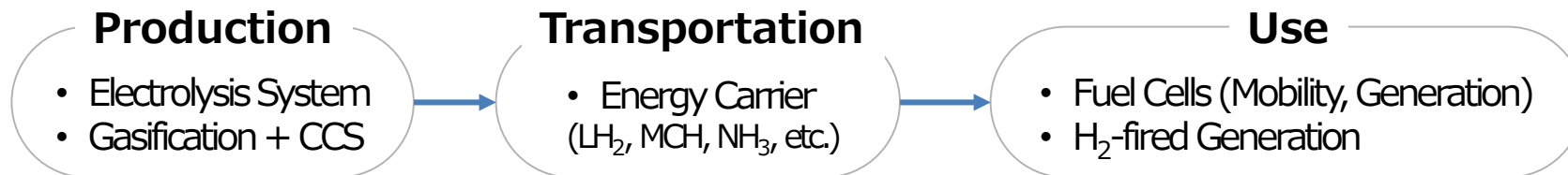
Basic Hydrogen Strategy

- “**Basic Hydrogen Strategy**” (Prime Minister Abe’s Initiative)
 - ✓ First comprehensive national strategy
 - ✓ H₂ as a future energy option toward 2050
 - ✓ Goals : making H₂ affordable
(\$3/kg by 2030 ⇒ \$2/kg by 2050)

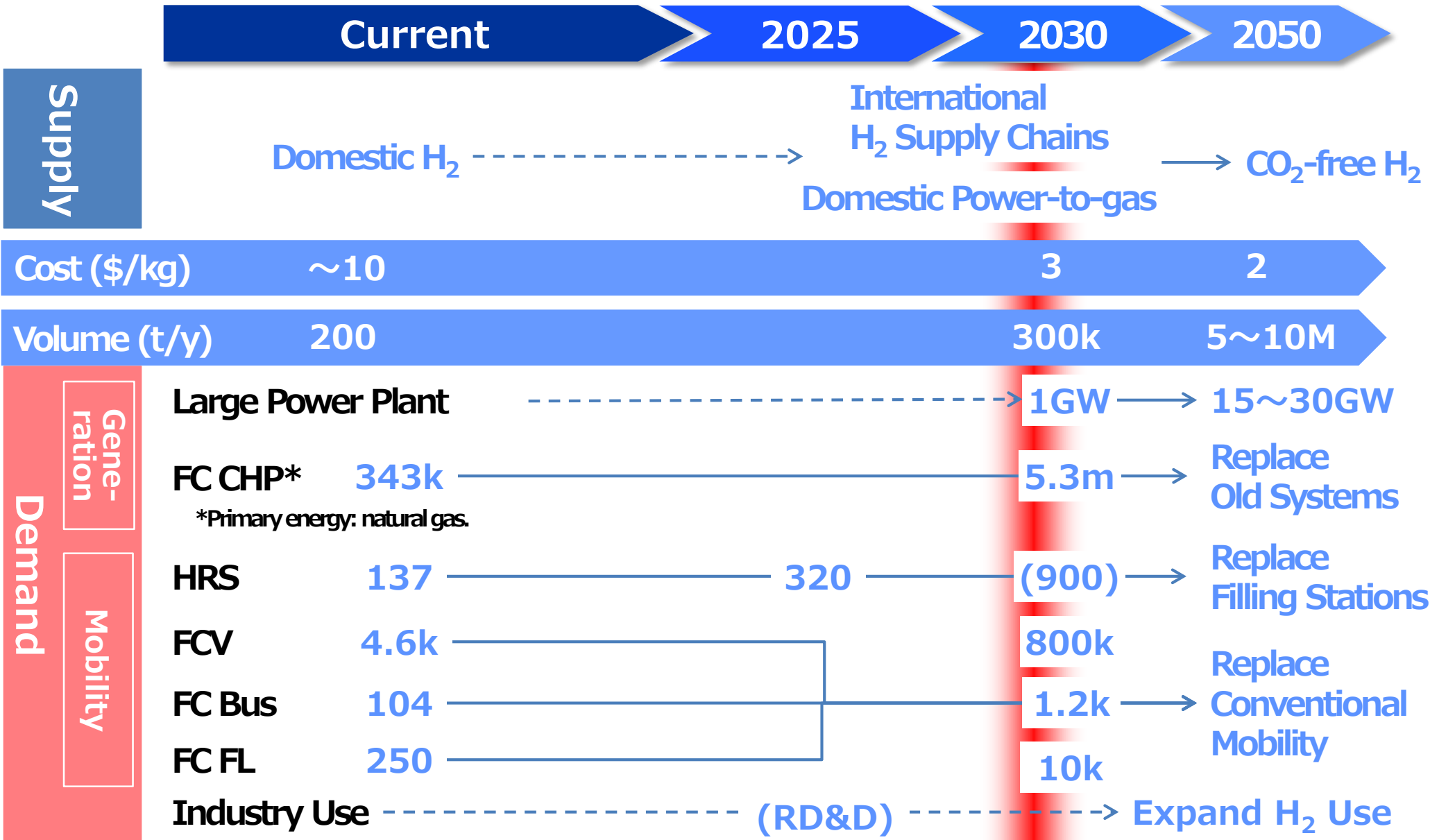
3 conditions for realising affordable hydrogen

- 【Supply】 { ① **Inexpensive feedstock** (unused resources, renewables)
 ② **Large scale H₂ supply chains**
- 【Demand】 ... ③ **Mass usage** (Mobility ⇒ Power Generation ⇒ Industry)

● Key Technologies to be Developed



Numerical targets toward hydrogen society



The Strategic Road Map for Hydrogen and Fuel Cells

~Industry-academia-government action plan to realize Hydrogen Society~ (overall)

		Goals in the Basic Hydrogen Strategy	Set of targets to achieve		Approach to achieving target
Use	Mobility	FCV 200k by 2025 800k by 2030	2025	<ul style="list-style-type: none">● Price difference between FCV and HV (¥3m → ¥0.7m)● Cost of main FCV system (FC ¥20k/kW → ¥5k/kW Hydrogen Storage ¥0.7m → ¥0.3m)	<ul style="list-style-type: none">• Regulatory reform and developing technology
		HRS 320 by 2025 900 by 2030	2025	<ul style="list-style-type: none">● Construction and operating costs (Construction cost ¥350m → ¥200m Operating cost ¥34m → ¥15m)● Costs of components for HRS (Compressor ¥90m → ¥50m Accumulator ¥50m → ¥10m)	<ul style="list-style-type: none">• Consideration for creating nation wide network of HRS• Extending hours of operation
		Bus 1,200 by 2030	Early 2020s	<ul style="list-style-type: none">● Vehicle cost of FC bus (¥105m → ¥52.5m) <p>※In addition, promote development of guidelines and technology development for expansion of hydrogen use in the field of FC trucks, ships and trains.</p>	<ul style="list-style-type: none">• Increasing HRS for FC bus
	Power	Commercialize by 2030	2020	<ul style="list-style-type: none">● Efficiency of hydrogen power generation (26%→27%) ※1MW scale	<ul style="list-style-type: none">• Developing of high efficiency combustor etc.
	FC	Early realization of grid parity	2025	<ul style="list-style-type: none">● Realization of grid parity in commercial and industrial use	<ul style="list-style-type: none">• Developing FC cell/stack technology
Supply	Fossil Fuel +CCS	Hydrogen Cost ¥30/Nm3 by 2030 ¥20/Nm3 in future	Early 2020s	<ul style="list-style-type: none">● Production: Production cost from brown coal gasification (¥several hundred/Nm3→ ¥12/Nm3)● Storage/Transport : Scale-up of Liquefied hydrogen tank (thousands m³→50,000m³) Higher efficiency of Liquefaction (13.6kWh/kg→6kWh/kg)	<ul style="list-style-type: none">• Scaling-up and improving efficiency of brown coal gasifier• Scaling-up and improving thermal insulation properties
	Green H2	System cost of water electrolysis ¥50,000/kW in future	2030	<ul style="list-style-type: none">● Cost of electrolyzer (¥200,000m/kW→¥50,000/kW)● Efficiency of water electrolysis (5kWh/Nm3→4.3kWh/Nm3)	<ul style="list-style-type: none">• Demonstration in model regions for social deployment utilising the achievement in the demonstration of Namie, Fukushima• Development of electrolyser with higher efficiency and durability

Japan Hydrogen Snapshot I

H₂ Mobility

H₂ Station Network

162 Stations



Source:Tokyo Gas



H2 station for FC bus opened

Joint Venture for H₂ Infrastructure Development



JHym
JAPAN H₂ MOBILITY



2018~

H₂ Applications

FC bus deployment

104 FC buses



FC Truck development



R&D



Next "MIRAI"

4679 FCV

FC train demonstration



Source:JR east

FC train



Source:HINO

FC Truck

2020~

Local/regional projects

Fukushima prefecture

10M electrolyser with 20M solar PV



Creating Hydrogen Hubs

"Hydrogen Utilization Study Group in Chubu"

2020

Sumitomo Corporation



and 7 companies

"Hydrogen Utilization Council in Kobe/Kansai area"

Iwatani Marubeni and 9 companies

Japan Hydrogen Snapshot II

International hydrogen supply chain

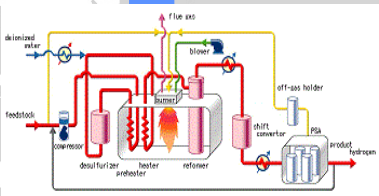
Japan-Brunai Pilot Project



Off-gas



Steam Methane Reforming



Hydrogenation (TOL→MCH)



Chemical Tanker



Dehydrogenation (MCH→TOL)



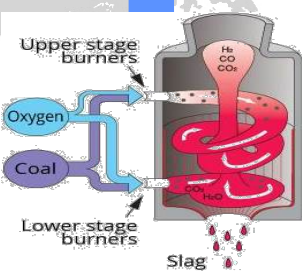
Japan-Australia Pilot Project



Brown Coal + CCS



Gasification



Liquefied H₂ Carrier



Loading Facility

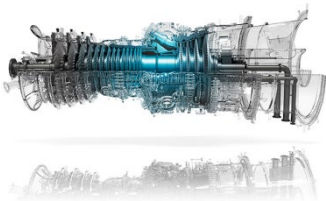


Hydrogen power generation

In Utah State in US, a power generation project started, with a 30% H₂ blending by 2025 and 100% H₂ by 2045.



Plans have also been launched in other states in the United States (NY, VA, OH) and Singapore.



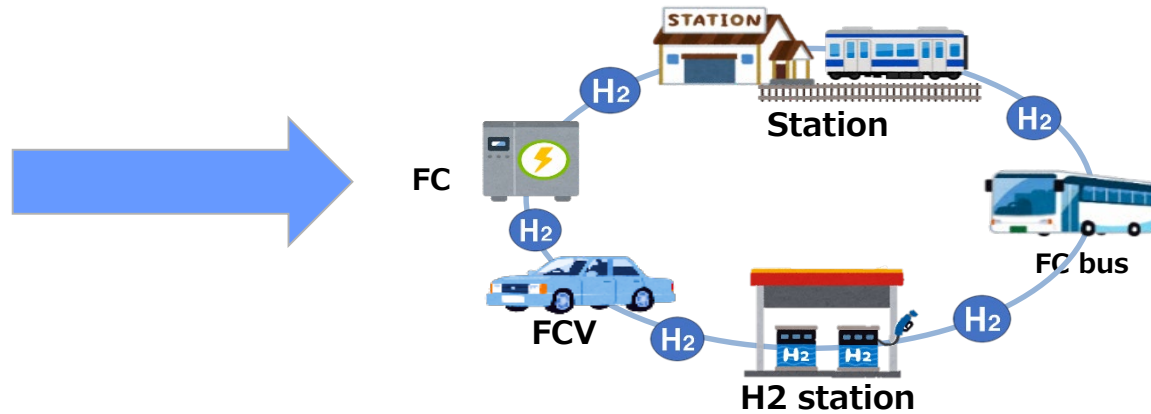
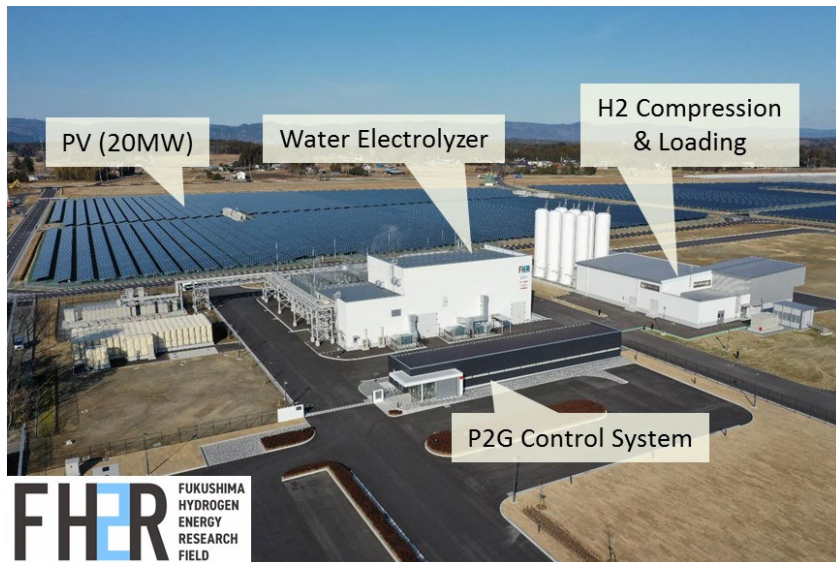
Source: Mitsubishi Power

Stationary Fuel Cells at home

FC CHP for home use: More than 300,000 units installed.



◆ Support the demonstration project at Fukushima Hydrogen Energy Research Field



- A 10MW electrolyser with 20MW solar PV started in Fukushima
- Intensive support for large-scale production and implementation of superior elemental technologies in equipment
- Provide an environment to evaluate the performance of the equipment
- Expand the use of the produced hydrogen in the region

Establishing International Hydrogen Supply Chain

◆ Hydrogen Energy Supply Chain Project



- The World's first liquefied Hydrogen carrier ship launched in December 2019.
- The LH2 carrier ship plans to transport hydrogen to Japan in 2021~
- The development of large-scale equipment needed for the commercialisation.



Launching "SUISO FRONTIER"
in Kobe



LH2 storage tank for marine
transportation

- Suiso Frontier Video:
<https://www.youtube.com/watch?v=WGPkSuIH7uA&feature=youtu.be>
- Project Video :
<https://www.youtube.com/watch?v=h8Dg9AWTDsk&feature=youtu.be>

◆ CO2-free hydrogen supply chain project in Malaysia



Sumitomo Corporation



- Consider the collaboration for the establishment of a CO2-free hydrogen supply chain using renewable energy.
- A feasibility study will start in January 2021.

Industry Alliances

~Companies have formed alliances to tap the hydrogen potential~

Japan Hydrogen Association *195 Members as of March 2021



JAPAN HYDROGEN ASSOCIATION

Members include:

- K LINE, DBJ, TOYO ENGINEERING, 大阪ガス, 三井不動産, CHIYODA CORPORATION, AISIN, YANMAR, 日本郵船, エネルギー・フロンティア, TAKENAKA
- ENEOS, TOYOTA, Hitz, AICHI STEEL, SEINO, TOHO GAS
- AsahiKASEI, Denyo, Iwatani, COMS4S, 中部電力, 三菱商事株式会社
- MITSUBISHI E&S, JBIC, Panasonic, Asahi, HINO
- HONDA, FUSO, KUBOTA, 住友電工, MUFG
- KOBELCO, 丸一鋼管, ClassNK, 豊田自動織機
- その他: MIZUHO, INPEX, NOMURA, Air Liquide, TOKUYAMA, KIRIN, IHU, SMBC, Nitto, Marubeni, SPARX, NIPPON STEEL, 関西電力, MS&AD, 北陸電力

Hydrogen Utilization Council in Kobe/Kansai area



Iwatani Marubeni Kawasaki
Powering your potential

Members include:

- MITSUBISHI POWER, POWER, 関西電力, ENEOS
- K LINE, KOBELCO, Panasonic, OBAYASHI

Hydrogen Utilization Study Group in Chubu area



SMBC 住友商事 TOYOTA

Members include:

- Air Liquide, MITSUBISHI CHEMICAL, 中部電力, TOHO GAS
- ENEOS, idemitsu, Iwatani

Hydrogen Energy Ministerial Meeting ~Promoting global cooperation~

2018

21 countries, region and organizations
300 attendees



TOKYO STATEMENT

- Harmonisation of Regulation, Codes and Standards
- Joint Research and Development
- Study and Evaluation of Hydrogen's Potential
- Education & Outreach

2019

35 countries, region and organisations
600 attendees



GLOBAL ACTION AGENDA

2020

(On-line Special Event)

23 representatives from countries, region and organisations
2800 registrations/**+10,000** views



GLOBAL ACTION AGENDA PROGRESS REPORT

Green Growth Strategy Through Achieving Carbon Neutrality

Goals

- ✓ Cost (\$/kg): \$3/kg by 2030 & less than \$2/kg by 2050
- ✓ Hydrogen demand : up to 3 Mts by 2030 & around 20 Mts by 2050

Hydrogen utilization

- ✓ FC Truck development and demonstration
- ✓ Hydrogen Power generation demonstration
- ✓ Zero-carbon Steel
- ✓ Fuel Cells development to reduce cost and efficiency



FC Truck



Hydrogen Gas Turbines



Zero-carbon steel



SOFC



Prime Minister Suga

Production

- ✓ Scale up electrolyzers & R&D to reduce cost (PEM & AEM)
- ✓ Innovative R&D to further reduce cost of hydrogen



Power to Gas

Transportation

- ✓ Commercialise international hydrogen supply chain



Liquefied hydrogen carrier



MCH carrier

Cross- cutting

- ✓ Create regional models through demonstration projects
- ✓ International collaborations