Japan’s vision and actions toward hydrogen-based economy

Hydrogen and Fuel Cell Strategy Office

METI

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

Basic Energy Plan

Hydrogen as a key contributor to:

- **Decarbonization**
- **Energy security**
- **Industrial competitiveness**

Basic Hydrogen Strategy (Prime Minister Abe's Initiative)

- **First comprehensive national strategy**
- **H_2 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

Japan Hydrogen Snapshot I

H_2 Mobility

H_2 Station Network

*167 Stations

H2 station for FC bus opened

H_2 Applications

FC bus deployment
106 FC buses

FC Truck development

R&D

6427 FCV

FC train demonstration

FC train

ISUZU HONDA The Power of Dreams
HINO TOYOTA

FC Truck

Joint Venture for H_2 Infrastructure Development

Local/regional projects

Fukushima prefecture

a 10M electrolyser with 20M solar PV started

Creating Hydrogen Hubs

"Hydrogen Utilization Study Group in Chubu"

2020

Sumitomo Corporation
TOYOTA
SMBC
and 7 companies

"Hydrogen Utilization Council in Kobe/Kansai area"

Iwatani Marubeni and 9 companies

Japan Hydrogen Snapshot II

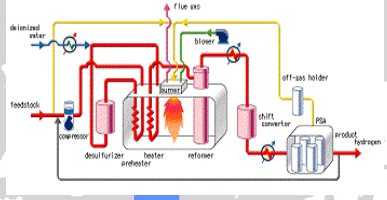
International hydrogen supply chain

Japan-Brunai Pilot Project

AHEAD

Off-gas

Steam Methane Reforming



Hydro-genation*
(TOL→MCH)

Chemical Tanker

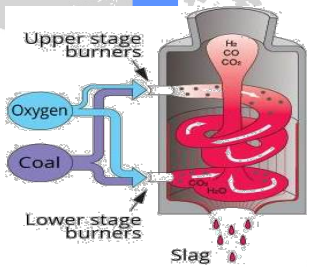
Dehydro-genation*
(MCH→TOL)

Japan-Australia Pilot Project

HySTRA

Brown Coal +CCS

Gasification



Liquefied H_2 Carrier*

Loading Facility*

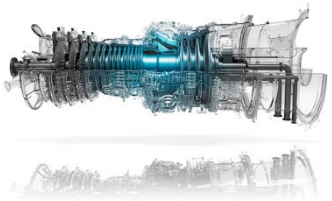
Hydrogen power generation

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

LA DWP Los Angeles Department of Water & Power

MITSUBISHI POWER

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 400,000 units installed

2050 Carbon-Neutral Declaration and 2030 Climate Goal

- In October 2020, Prime Minister Suga declared that **by 2050 Japan will aim to reduce greenhouse gas emissions to net-zero,** that is, to realise a carbon-neutral, decarbonised society.
- At Leaders Summit on Climate in April 2021, Prime Minister Suga announced that **Japan aims to reduce its GHG emissions by 46 percent in FY 2030 from its FY 2013 levels**.

Prime Minister's remarks at Leaders Summit on Climate

Japan aims to reduce its greenhouse gas emissions by 46 percent in fiscal year 2030 from its fiscal year 2013 levels, setting an ambitious target which is aligned with the long-term goal of achieving net-zero by 2050.

Furthermore, **Japan will continue strenuous efforts in its challenge to meet the lofty goal of cutting its emission by 50 percent**.

14 Growth Sectors

Energy

Offshore wind power
Wind turbines, parts, floating wind turbines

Fuel ammonia
Combustion burner (as fuel in transition period to hydrogen-powered society)

Hydrogen
Turbines for power generation, hydrogen reduction steel-making, carrier ships, water electrolyzers

Nuclear power
SMR (Small Modular Reactor), nuclear power for hydrogen production

Transport/Manufacturing

Mobility and battery
EV (electric vehicle), FCV (fuel cell vehicle), next generation batteries

Semiconductor and ICT
Data centers, energy-saving semiconductors (demand-side efficiency)

Maritime
Fuel-cell ships, electric propulsion ships, gas-fueled ships

Logistics, people flow and infrastructure
Smart transportation, drones for logistics, fuel-cell construction machinery

Foods, agriculture, forestry and fisheries
Smart-agriculture, wooden skyscrapers, blue carbon

Aviation
Hybrid electric, Hydrogen-powered Aircraft

Carbon Recycling
Concrete, biofuel, plastic materials

Home/ Office

Housing and building, Next generation PV
(perovskite solar cell)

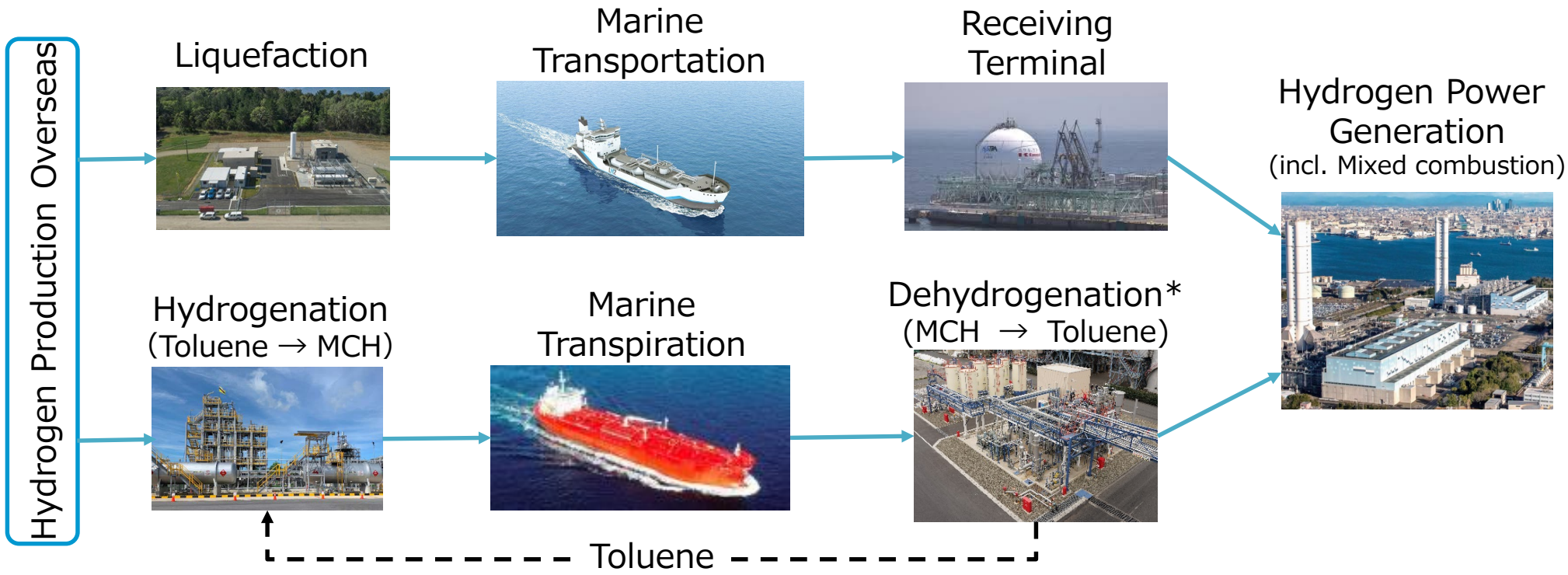
Resource circulation
Biomaterials, recycled materials, waste power generation

Lifestyle-related industry
Local decarbonization business

GI Fund Project① : Establishing Global Hydrogen Supply Chain

- By using the Green Innovation Fund, Japanese government will support large demonstration projects at the aim of commercializing global supply chain with several carriers and hydrogen power generation no later than 2030 **(~300 Billion Yen)**.
- The goal of this project is to establish a strong technological base to attain the hydrogen supply cost target **(¥30/Nm3 by 2030, less than ¥20/Nm3 in 2050)**

Image of Global Supply Chain of Liquid Hydrogen(LH2) and Methylcyclohexane



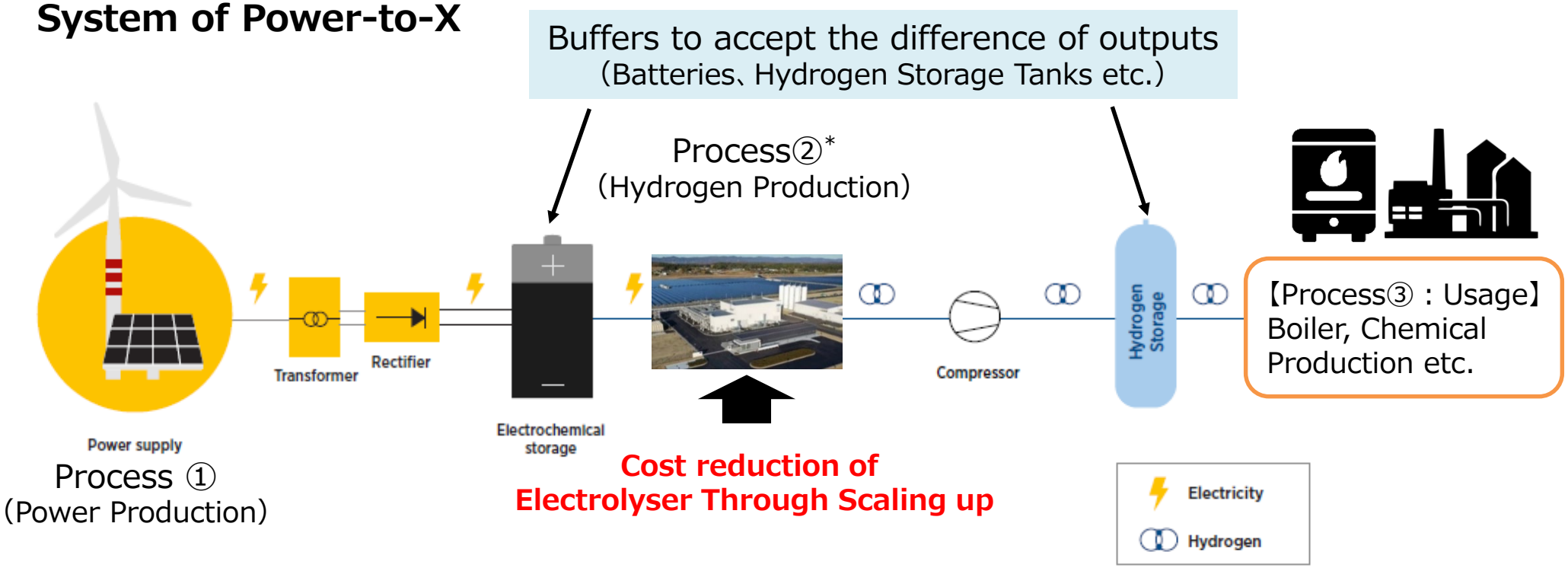
*Try to make the most of the existing assets such as oil refinery plants.

Source : HySTRA、AHEAD, etc.

GI Fund Project② : Scaling up Electrolysers

- To further reduce the cost of electrolysers, Japanese government will support demonstration projects for 1) scaling up electrolysers, 2) implementing superior components and 3) system optimization with several demands(**~70 Billion Yen**)
- The goal of this project is to establish a strong technological base to attain the cost of electrolyer **(up to 1/6 of the current system cost)**

System of Power-to-X



System optimization (i.e. balance the trade off between flexible operation and preparing buffers) is a crucial step to minimize the hydrogen supply cost

Points of energy supply-demand outlook in 2030

		(2019 ⇒ current target)	**2030 energy mix (ambitious outlook)**
Energy conservation		(16.55 billion L ⇒ 50.30 GL)	**Approx. 62 billion L** (Final consumption before energy conservation: approx. 350 GL)
Power generation mix Electricity generated : 1,065 TWh ⇒ Approx. 930-940 TWh	**Renewable energy**	(18% ⇒ 22-24%)	**36-38%**
	Hydrogen/Ammonia	(0% ⇒ 0%)	**1%**
	Nuclear	(6% ⇒ 20-22%)	**20-22%**
	LNG	(37% ⇒ 27%)	**20%**
	Coal	(32% ⇒ 26%)	**19%**
	Oil, etc.	(7% ⇒ 3%)	**2%**
(＋ non-energy related gases/sink		**increase equivalent to the above)**	
GHG reduction rate		(14% ⇒ 26%)	**46%** **Further, 50% target is aimed at.**

*** Figures are all interim and subject to change in the future.**

Roadmap of Hydrogen (expansion of supply and demand of hydrogen)

	Short term (-2025)	Mid term (-2030)	Long term (-2050)
Actual･Target Volume	**Approx. 2 mil ton**	**Up to 3 mil ton**	**Approx. 20 mil ton**
Existing Source (offgas, etc.)	Maximized use as major supply source of hydrogen	Transition to clean source (utilization of CCUS, etc.)	
Hydrogen Import	Accumulation of knowledge and cost reduction realization through demonstration	Establishment of global hydrogen supply chain on a commercial basis	Expansion through diversification of sources and suppliers
New Domestic Supply Source (electrolysis, etc.)	Accumulation of knowledge and cost reduction realization through demonstration	Ramp up of electrolysis by utilizing surplus renewable energy	Scale up of hydrogen production by electrolysis. Emergence of new production technology.
	Short term (-2025)	**Mid term (-2030)**	**Long term (-2050)**
Sector･Target Volume	**Approx. 2 mil ton**	**Up to 3 mil ton**	**Approx. 20 mil ton**
Transportation	Expansion to FC trucks, etc. (in addition to FC passenger vehicles and FC buses)	Launch of maritime vessel into market (FC ship, etc.)	Hydrogen usage in aviation market (synthetic fuel, etc.)
Power Generation	Regional proliferation focusing on stationary fuel cells, micro turbines	Commercialization of large scale H2-fueled turbine (together w/ development of supply chain)	Function as buffer to support decarbonization of power sector
Industrial Sector (feedstock)	Transition toward clean hydrogen use in the desulfurization process of crude oil, and demonstration of production process in steel and chemical sector		Hydrogen direct reduction steelmaking, 'green' chemical (MTO, etc.)
Heat Demand (industrial/commercial/ residential)	Substitution of fossil fuels by introduction of water electrolyzer, decarbonization of existing supply infrastructures including gas pipelines, etc.		Expansion of supply by improving infrastructure and reducing hydrogen cost

Hydrogen Energy Ministerial Meeting

2018

21 countries（**5** ministers）, region and organizations

300 attendees

TOKYO STATEMENT

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

2019

35 countries（**8** ministers）, region and organizations

600 attendees

GLOBAL ACTION AGENDA

2020

(On-line Special Event)

23 representatives（**14** ministers）from countries, region and organizations

2800 registrations/**+10,000** views

GLOBAL ACTION AGENDA PROGRESS REPORT

2021

(On-line Special Event)

29representatives（**18** ministers）from countries, region and organizations

3200 registrations