

Hydrogen and Fuel Cells perspective in Japan

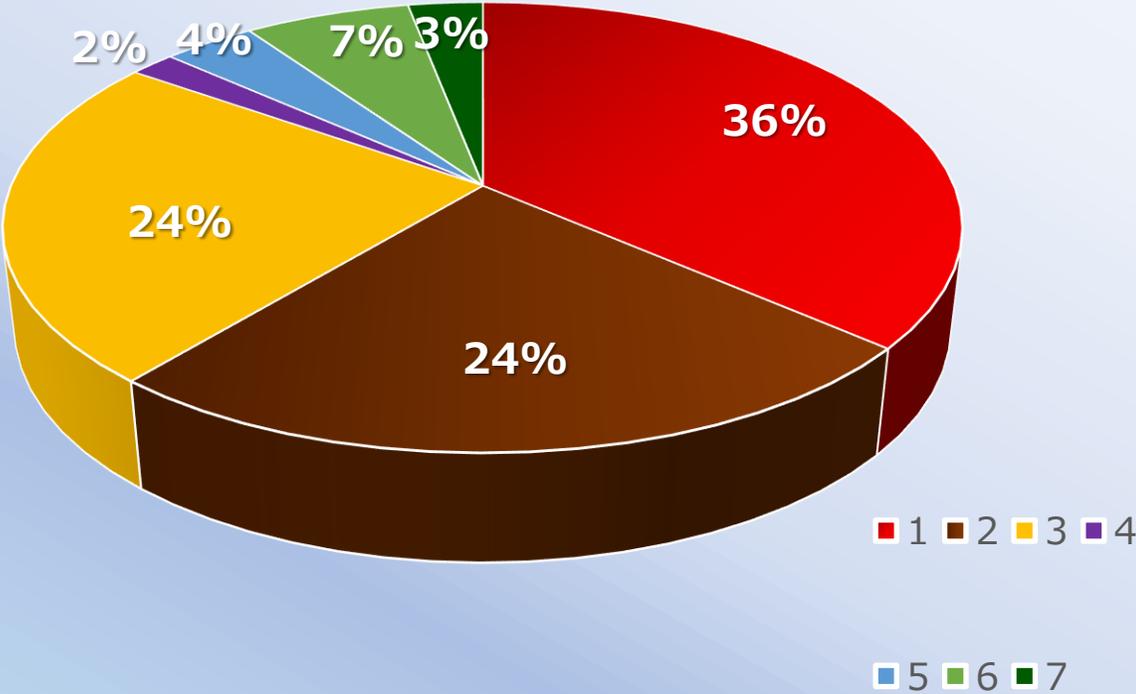
24 January 2023

Eiji Ohira

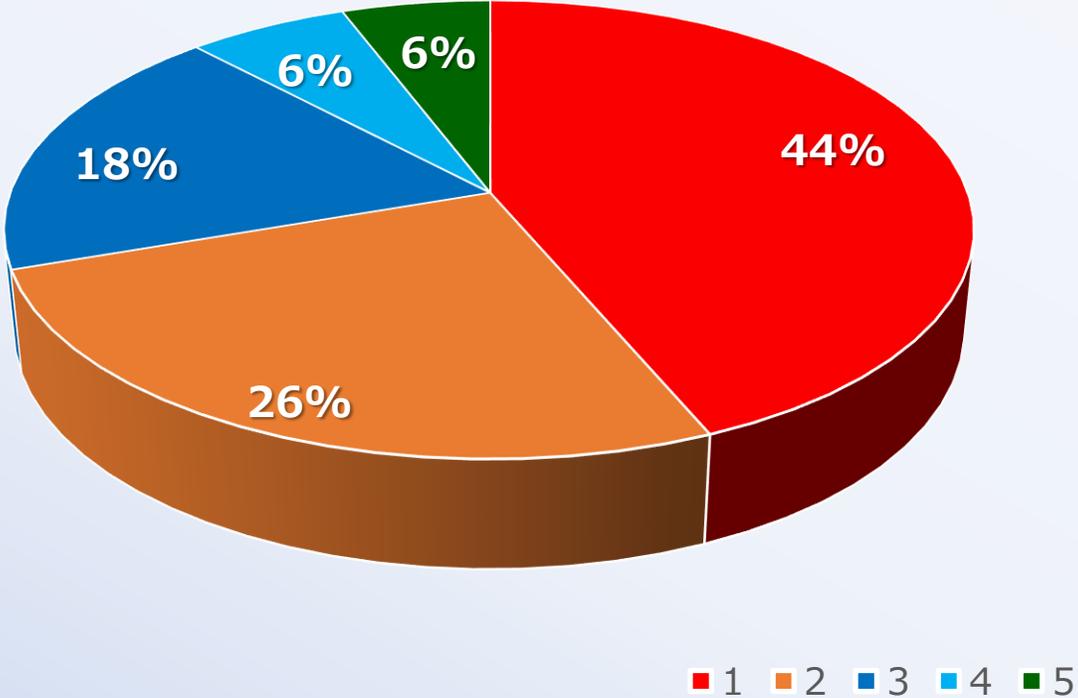
New Energy and Industrial Technology Development Organization (NEDO)

Background: Japan's Energy Situation

Primary Energy
(Total: 17,965 PJ in 2020)



Energy related CO₂ emission
(Total: 971 Mt-CO₂ in 2020 / -21.7% from 2013)



- Japanese government declared its ambition to reduce greenhouse gas emissions to net zero by 2050 in October 2020.
- METI formulated a “Green Growth Strategy Through Achieving Carbon Neutrality in 2050” including “Green Innovation Fund” for supporting 10 years R&DD activities (JPY 2 trillion).
- 1% Hydrogen/Ammonia are positioned in 2030 energy mix by 6th Japan's Strategic Energy Plan (October 2021)
- METI has established new committee to discuss on support measures for the hydrogen supply chain.

Direction: How to promote Hydrogen

Goals

Cost (\$/kg): \$3/kg by 2030 & less than \$2/kg by 2050

| | Short Term (- 2025) Approx. 2 million tons | Mid Term (- 2030) Max. 3 million tons | Long Term (- 2050) 20 million tons |
|--------|---|--|--|
| Supply | Existing source (ex. By products) | Maximize utilization as major source | Decarbonization of hydrogen production (with CCUS) |
| | Import | Accumulation of knowledge and cost reduction through demonstration project | Development of large-scale international hydrogen supply chain |
| | New domestic source | Accumulation of knowledge and cost reduction through demonstration project | Start up hydrogen production by electrolysis using excess energy from renewables |
| Demand | Transportation | Expansion to FC trucks in addition to FCVs and FC buses | Launch of ships (FC ships, etc.) to the market |
| | Power generation | Using of stationary fuel cell and small gas turbine for distributed energy | Commercialization of large-scale hydrogen power generation turbine |
| | Industry (raw material) | Conducting technology demonstration project (refinery, steel process, chemical process, etc.) | Realizing hydrogen steel process, green chemical, etc. |
| | Thermal (Industry, business, household) | Substitute fossil fuels through installation of fuel cell and decarbonization of supply infrastructure using electrolysis and existing gas pipes | Expanding supply through infrastructure development and hydrogen cost reduction |

Source: METI

Current status

| Items | Japan's Target (in 2030) | Current status (as of July 2022) |
|-----------------------------------|-----------------------------|-------------------------------------|
| Stationary Fuel Cell | | |
| Residential Fuel Cell (EneFarm) | 5.3 million | 439,852 (June 2022) |
| Mobility | | |
| Passenger Vehicles | 800,000 | 7,418 |
| Fuel Cell Buses | 1,200 | 120 |
| Hydrogen Refueling Station | | |
| Public Stations | 900 | 160 |



Step by Step approach



Hydrogen in Energy System
Step 3: Widely use of H₂

FCV & HRS

Step 2: Direct use of H₂ as energy source
(Marketization in 2014)

**Residential
Fuel Cell**

Step 1: Bring Fuel Cell Application into the Market
(Marketization in 2009)



出典) 岩谷産業



Long Haul Transportation



Area Delivery

Approx. 300 Fuel Cell Trucks will be introduced

Current Topic: Refueling test facility for HDV

Developing new refueling protocol
80 kg-H₂ / 10 min

Ref. Passenger Vehicle: 5 kg-H₂ / 3 min



Current Topic: Hydrogen Gas Turbine



Current Topic: Liquefied Hydrogen

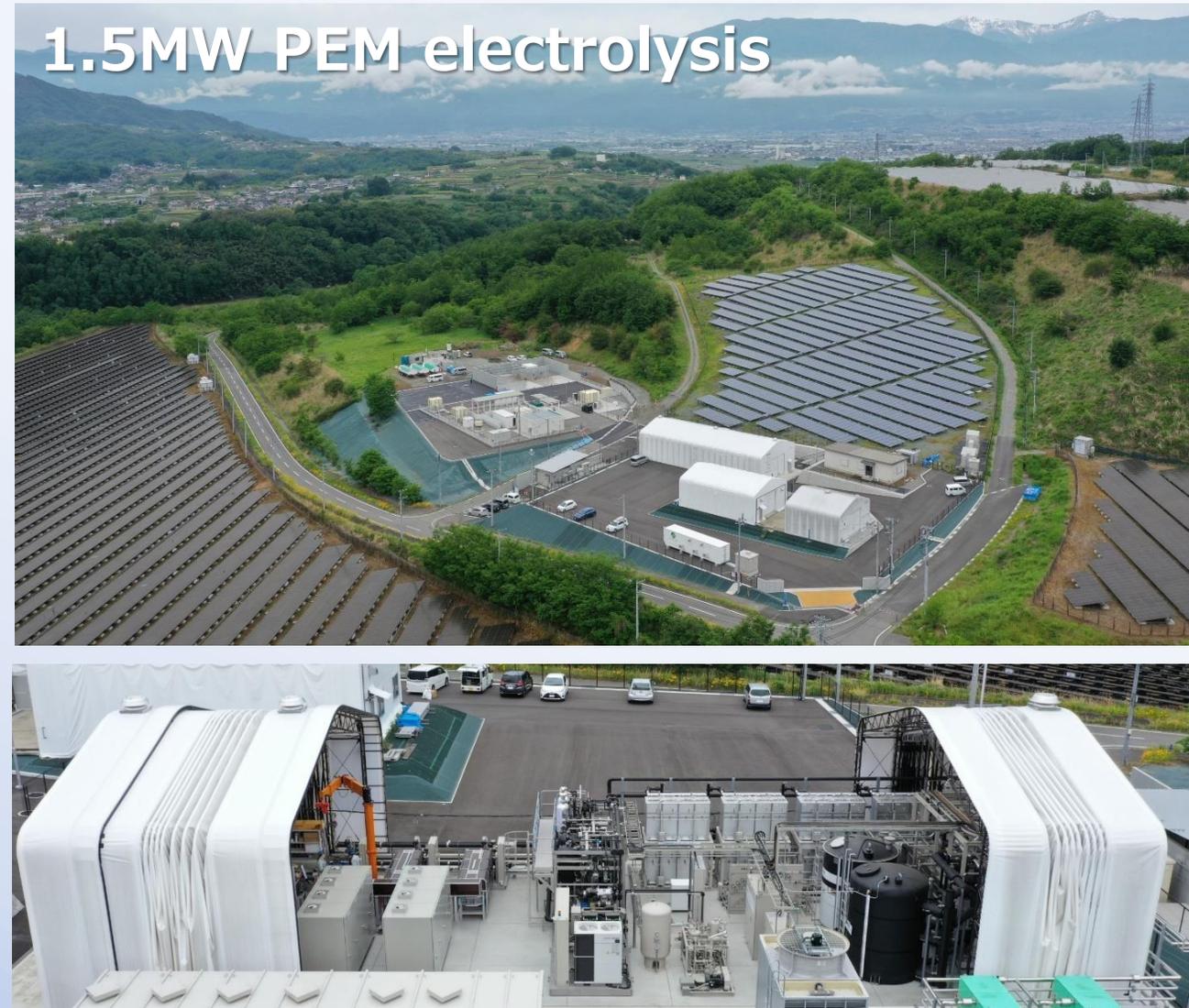


Current topic: MW scale Power-to-Gas

10MW Alkaline electrolysis



1.5MW PEM electrolysis



Current topic: Hydrogen@Port

Production

Transportation

Utilization

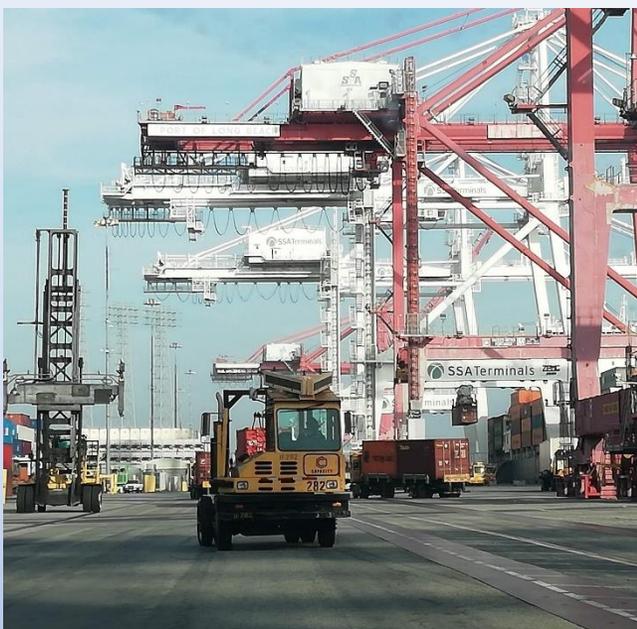
@Merced

@San Pedro (LA·LB Port)



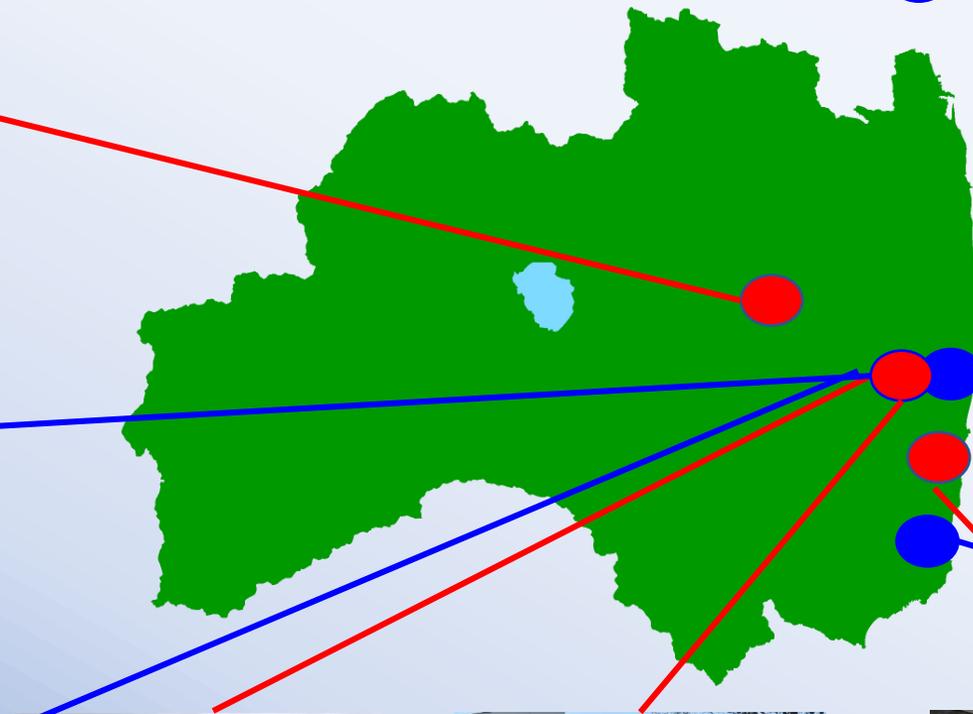
93MPa

70MPa



Hydrogen Valley in Fukushima

- Stationary Fuel Cell
- Hydrogen Refueling Station



- *Hydrogen is key technology for carbon neutral*
 - *Japan has been strongly promoting hydrogen*
- *Just started market penetration*
 - *need to enhance application, improve technology*
- *Our goal: Developing low-carbon energy system*
 - *scaling-up / integration with other energy system*



Thank you!