

## Japan's action to promote hydrogen

17 November 2021 Eiji Ohira New Energy and Industrial Technology Development Organization (NEDO)

## **Background: Japan's Energy Situation**





Energy related CO2 emission (Total: 1,028,778 kt-CO2 in 2019)



Need to increase renewables to address energy security & climate change, but…

### **Policy Update**



- In October 2020, the Japanese government declared its ambition to reduce greenhouse gas emissions to net zero by 2050
- To achieve the target, METI formulated a "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" as industrial policy to lead the challenging goal of carbon neutrality to a "Positive cycle of economic growth and environmental protection"
- Upholding high goals for each of the 14 priority fields including hydrogen, the strategy makes explicit current challenges and future actions by the field
- To support R&D activity, METI established the "Green Innovation Fund." (approx. US\$ 19 billion for 10 yeas)

### **Towards 2050 Carbon Neutrality**





## **Direction: How to promote Hydrogen**



	Goals	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 product	tion (with CCUS)		
	Import	Accumulation of knowledge and cost reduction through demonstration project	Development of large-scale international hydrogen supply chain	Further scale up through diversification of hydrogen source		
	New domestic source	Accumulation of knowledge and cost reduction through demonstration project	Start up hydrogen production by electrolysis using excess energy from renewables	Scale up hydrogen production by electrolysis, and realizing innovative hydrogen production technology		
Demand	Transportation	Expansion to FC trucks in addition to FCVs and FC buses	Launch of ships (FC ships, etc.) to the market	Use of hydrogen and synthetic fuel for aviation		
	Power generation	Using of stationary fuel cell and small gas turbine for distributed energy	Commercialization of large-scale hydrogen power generation turbine	Further scale up and function as balancing power		
	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 (Year)	Current status (as of June 2021)
<b>Residencial Fuel Cell</b>		
Number of units	5.3 million (2030)	392,926 (as of March 2021)
Mobility		
Number of Passenger Vehicles	800k (2030)	5,268
Number of Fuel Cell Buses	1.2k (2030)	104
Hydrogen Refueling Station		
Number of Stations         Image: Station of the stati	<image/>	

### **NEDO's Budget for Hydrogen R&D in 2021**

## CNEDO

#### Total Budget: JPY 23,425 million (≒ US\$ 210 million)





- Hydrogen Refueling Station
- Hydrogen Energy
  - System
- Other Innovative Research



## **Current Direction of NEDO's Program**

First Step: Promoting fuel cell application

#### **Fuel Cells:**

#### (1) PEFC: for mobility

- ✓ Advanced technology for next generation vehicle
- ✓ Improving productivity
- ✓ New application (Ship, Heavy / Middle duty vehicle, etc.)

	2030	2040
Power Density	6kW/L	9kW/L
Max Voltage	> 0.6V	0.85V
Max Temperature	< 100°C	120℃
Cruse range / 5kg H2	800 km	> 1,000 km
System Cost	< US\$40 / kW	US\$20 / kW

#### (2) SOFC: for stationary use

Efficiency > 65% (mono-generation), Durability > 130,000 hrs.

#### **Hydrogen Refueling Station:**

- ✓ Reducing CAPEX / OPEX: make it half by 2025
- ✓ Preparing for Heavy Duty Vehicles

## **Current Direction of NEDO's Program**



#### Second Step: Develop H<sub>2</sub> demand & Integrate w/ energy system

#### Hydrogen Supply Chain / Large Scale Hydrogen Application:

- ✓ Large scale hydrogen supply chain with liquefied hydrogen and organic chemical hydride as hydrogen carrier
  - Improve efficiency of hydrogen liquefaction, less boil-off rate storage, scale-up hydrogen equipment, etc.
- $\checkmark$  Hydrogen gas turbine and other application
  - > Developing combustor: low NOx emission, preventing back fire

#### Power to Gas / Integrated Energy System

- $\checkmark\,$  Alkaline and PEM water electrolysis
  - Scale-up, improve efficiency, durability under current fluctuation, etc.
- ✓ Next generation water electrolysis technology: SOEC, Anion Exchange Membrane
- ✓ System Technology: Energy management, System optimization, etc.
- ✓ Developing regional hydrogen utilization model

### **Current Topic: Liquefied Hydrogen**





#### **Current topic: MW scale Power-to-Gas**





#### 1.5MW PEM electrolysis





## Hydrogen scaling up Project under Green Innovation Fund

Social implementation model: Large-scale utilization in coastal zone



## Hydrogen scaling up Project under Green Innovation Fund

Social implementation model: Onsite hydrogen production and utilization / local supply chain





> Hydrogen is key technology for carbon neutral

- Japan has been strongly promoting hydrogen

## > Just started market penetration

- technology ready around the world
- need to enhance application, improve technology

# Our goal: Developing low-carbon energy system - scaling-up / integration with other energy system



## Thank you!