Towards Hydrogen Society

-Introduction of activities in Japan-

12th December 2018

Daishu HARA

New Energy and Industrial Technology Development Organization (NEDO)

Agenda

1. About hydrogen policy in Japan
2. Representative projects in Japan

Relationship between Ministry and NEDO

Budget: 160 billion JPY (1.3 billion EUR) in 2018

As Innovation Hub,

- Promoting of industry-academia collaboration

- Accelerating social implementation of technology

Why Hydrogen/ Strategy

● Why Hydrogen?

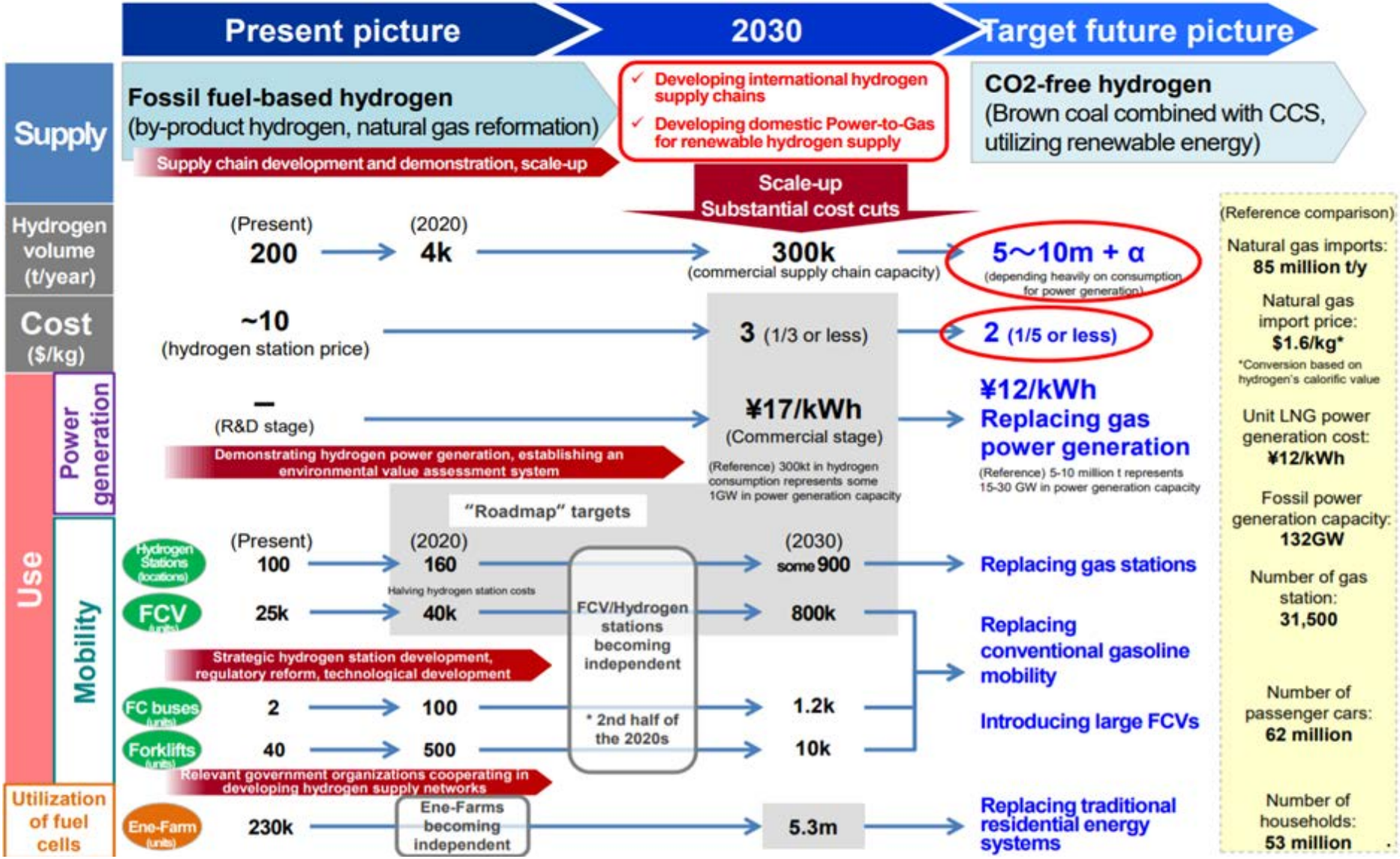
- ✓ Contribute **de-carbonization** (**E**nvironment)
- ✓ Mitigate **dependence on specific countries** (**E**nergy security)
- ✓ Enable to utilize **low cost feedstock** (**E**conomic affordability)

+ Japan's edge in technology since 1970s

● "Basic Hydrogen Strategy" (Prime Minister's Initiative)

- ✓ **World's first national strategy**
- ✓ **2050 Vision: position H_2 as a new energy option** (following Renewables)
- ✓ **Target: make H_2 affordable** ($3/kg by 2030 ⇒ $2/kg by 2050)

Scenario on Hydrogen Basic Strategy



Hydrogen Energy Ministerial Meeting

【Purpose】

- **Realize hydrogen as key technology and to be a new energy alternative for de-carbonization by connecting resources such as fossil fuel and Carbon Capture, Utilization and Storage(CCUS), or renewable energy**
- **Harmonize and cooperate for enhancing utilization of hydrogen at a global scale**
- **Verify and Discuss on**
  - ✓ **Innovative challenges and latest knowledge**
  - ✓ **Possibility of international cooperation**
  - ✓ **Future direction**

  for formulating global initiative on hydrogen

- Date: 23rd October 2018
- Venue: Dai-ichi Hotel Tokyo, Japan
- Host: Ministry of Economy, Trade and Industry, Japan
- Attendees : Ministers, Government officials, Private Sectors
- Invited Countries: Australia, Austria, Brazil, Brunei, Canada, China, Chile, Costa Rica, Denmark, France, Germany, Iceland, India, Indonesia, Italy, Netherlands, New Zealand, Norway, Poland, Qatar, Russia, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sweden, United Arab Emirates, United Kingdom, United States of America, EC, IEA (30 countries, 1 region, and 1 organization)

Point of Tokyo Statement (Chair's Summary)

1. Collaboration on Technologies and Coordination on Harmonization of Regulation, Codes and Standards

2. Promotion of Information Sharing, International Joint Research and Development Emphasizing Hydrogen Safety and Infrastructure Supply Chain

3. Study and Evaluation of Hydrogen's Potential across Sectors Including Its Potential for Reducing Both CO_2 Emissions and Other Pollutants

4. Communication, Education and Outreach

Agenda

1. About hydrogen policy in Japan
2. Representative projects in Japan

Current Direction of NEDO's Program

1. Fuel Cells:

(1) PEFC: for mobility

- Target: 0.03-0.1 g-PGM/kW (depend on durability), 50,000 hrs. life time (commercial vehicle), Power Density:> 4kW/L (in 2030)

(2) SOFC: for stationary use

- Established R&D cycle for cell stacks, provided from private sector, by public institute in the project
- New target: >65% efficiency (mono-generation)

2. Hydrogen Refueling Station:

Reducing CAPEX / OPEX

- To address regulatory reform on FCV/HRS in Japan
  ex. Unmanned operation with remote monitoring, Risk assessment on HRS, etc.
- Developing low cost equipment (incl. polymer materials, Electro-chemical compressor, etc.)

Current Direction of NEDO's Program

3. Hydrogen Supply Chain / Gas Turbine:

- Developing combustor for Hydrogen Gas Turbine

  Control of combustion for low NOx, back fire, etc.

- Realizing large scale hydrogen supply chain

  Hydrogen carriers for long distance transportation

4. Power to Gas:

- Developing System Technology

  System Operation, Energy management, Demand response

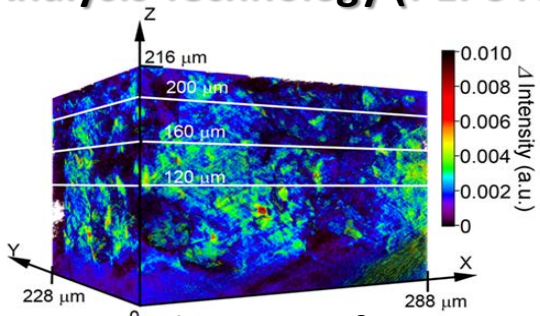
- Improving electrolysis technology

  Analyzing reaction mechanism, develop lifetime evaluation, etc.
  (Alkaline, PEM, SOEC)

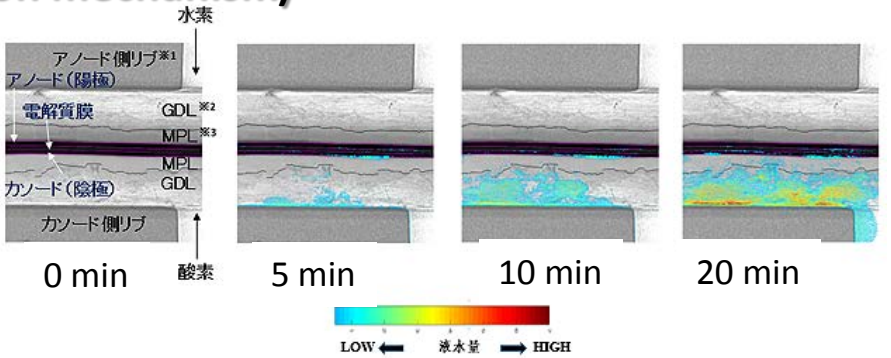
Highlight of NEDO's Program (PEFC)

NEDO focused on basic research.

Analysis Technology (PEFC reaction mechanism)



3D visualization of PFEC anode catalyst degradation

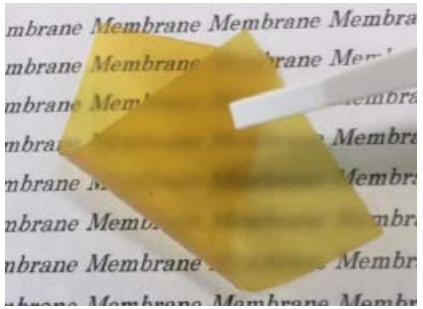


Water distribution in PEFC

PEFC performance evaluation

Material Design Concept

Catalyst

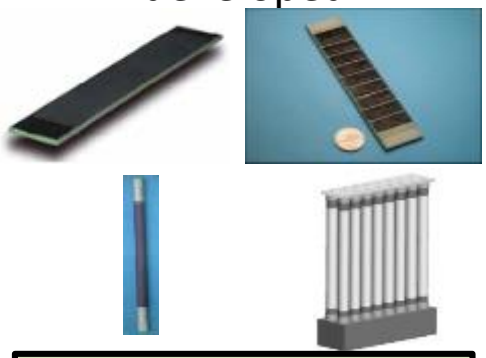


Membrane

Highlight of NEDO's Program (SOFC)

Success model of R&D cycle had been established for 1)valuation/analysis and 2) endurance by public entities, 3) feedback to private sector.

Hi endurance and low cost Cell Stack will be developed



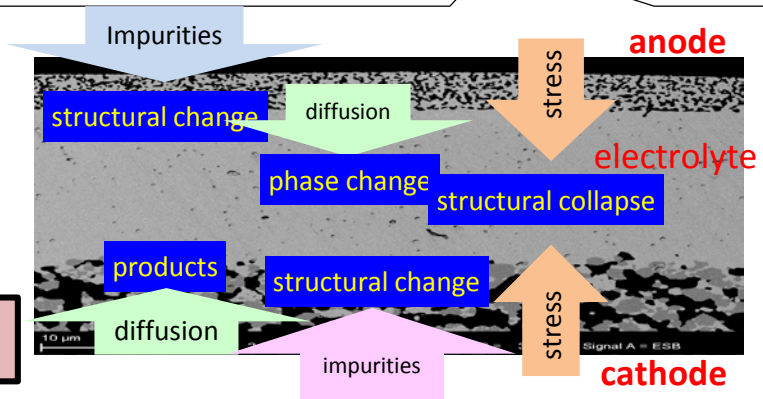
Private sector

Develop & Improve

Endurance Test

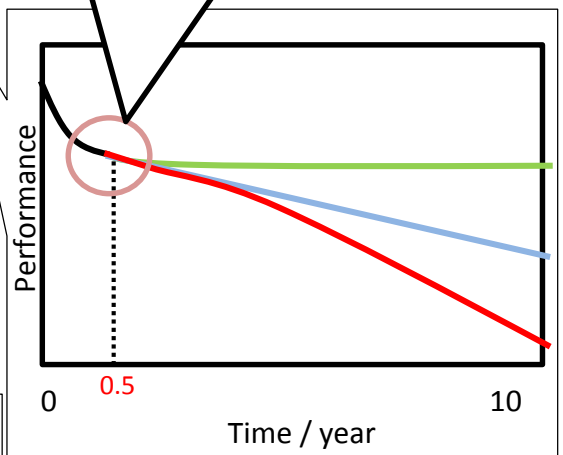
R&D cycle

Evaluation / Analysis



NEDO project

Quantitative Detection of tiny degradation within shot term (several month).
→high resolution with short term forecast of degradation

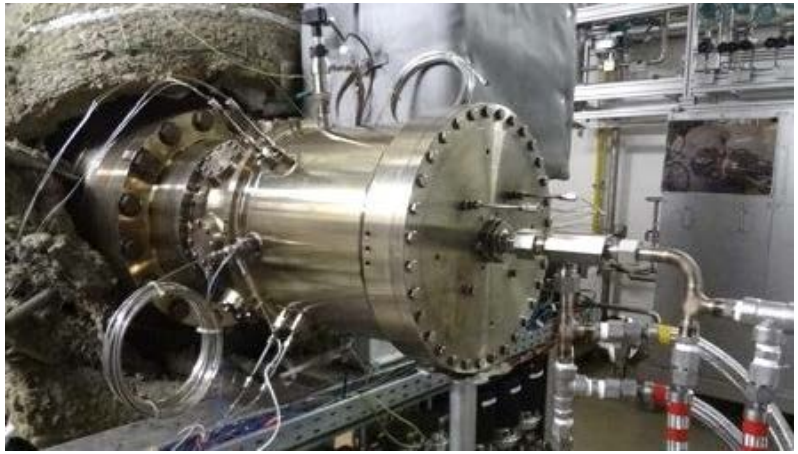


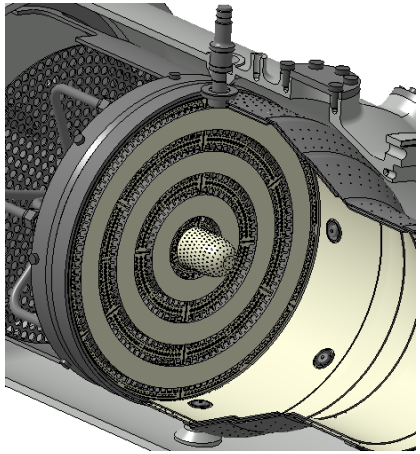
Endurance Test of Cell Stack

NEDO project

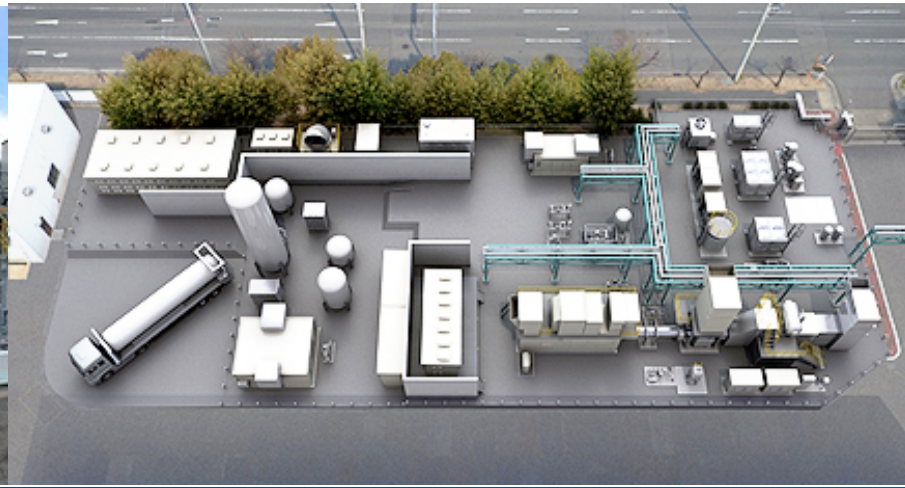
Highlight of NEDO's Program (H_2GT)

Developing combustor for H_2 gas turbine

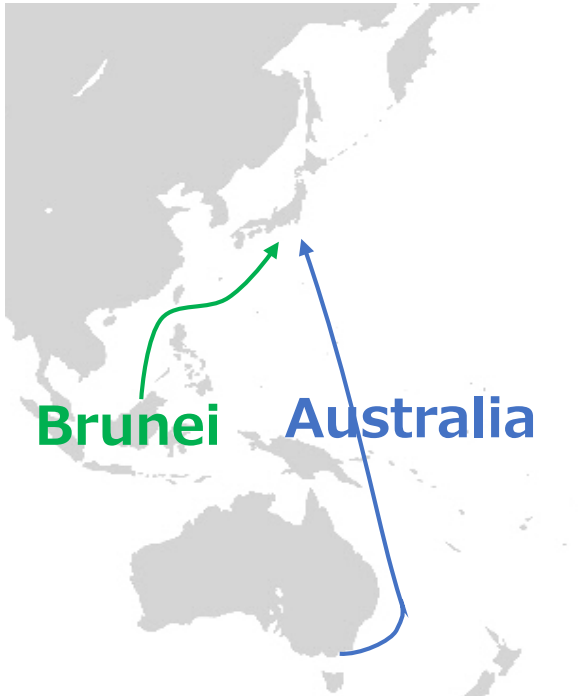




Demonstration project / H_2 gas turbine



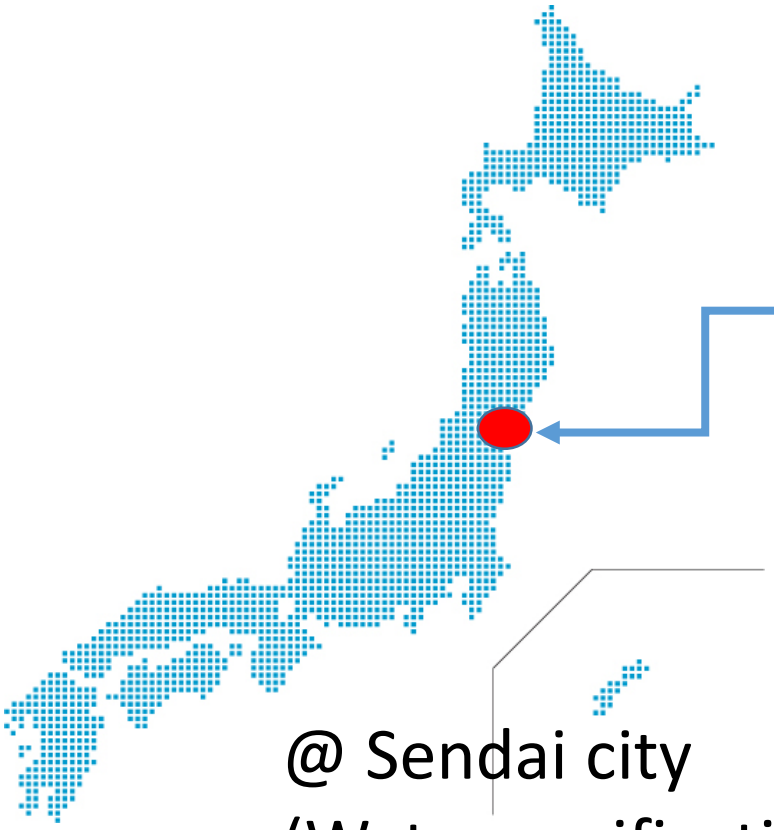
Highlight of NEDO's Program (Supply Chain)



Japan-Australia H_2 Supply Chain Project

Japan-Brunei H_2 Supply Chain Project

Highlight of NEDO's Program (Power to Gas)



@ Sendai city
(Water purification plant)
PV + 24kW electrolysis

- Enhancing PV capacity factor
- Emergency power supply

Highlight of NEDO's Program (Power to Gas)

@ Fukushima Pref.　10MW electrolysis / provide H2 to Tokyo 2020

Great Chance / Tokyo 2020

Olympic Village with Hydrogen

Image: Tokyo Metropolitan Government

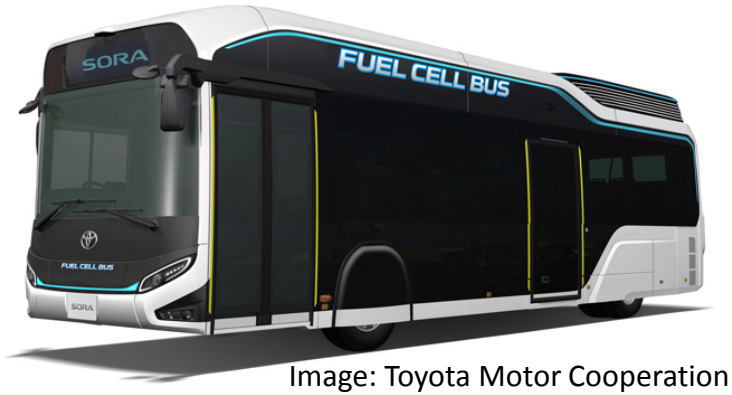


Image: Toyota Motor Cooperation

Image: Tokyo Metropolitan Government

Thank you!