Japan’s Perspective on the Hydrogen Economy

July 2023
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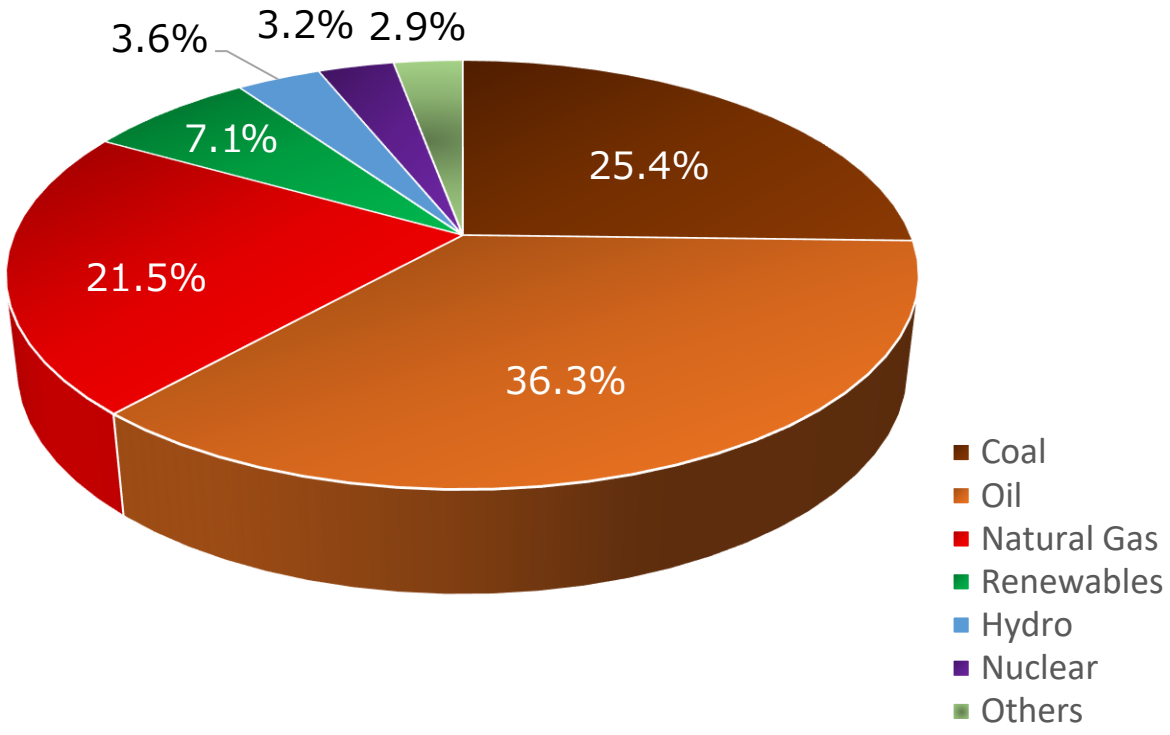
New Energy and Industrial Technology Development Organization (NEDO)

Japan's Outlook

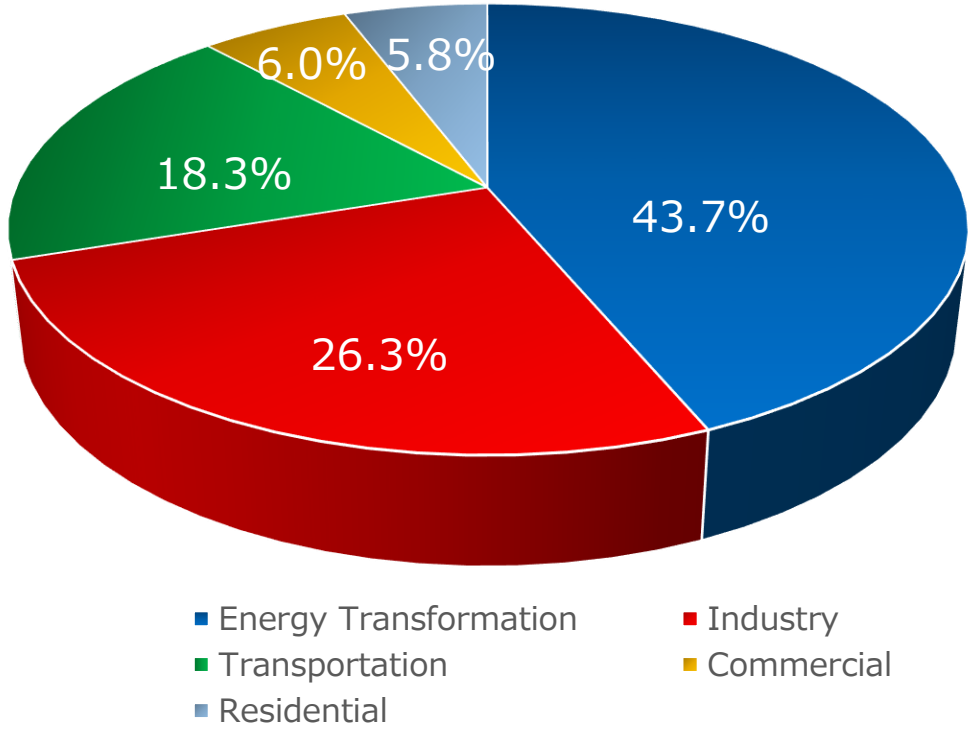
Background: Japan's Energy Situation

Primary Energy Supply in 2021 (18,575 PJ)



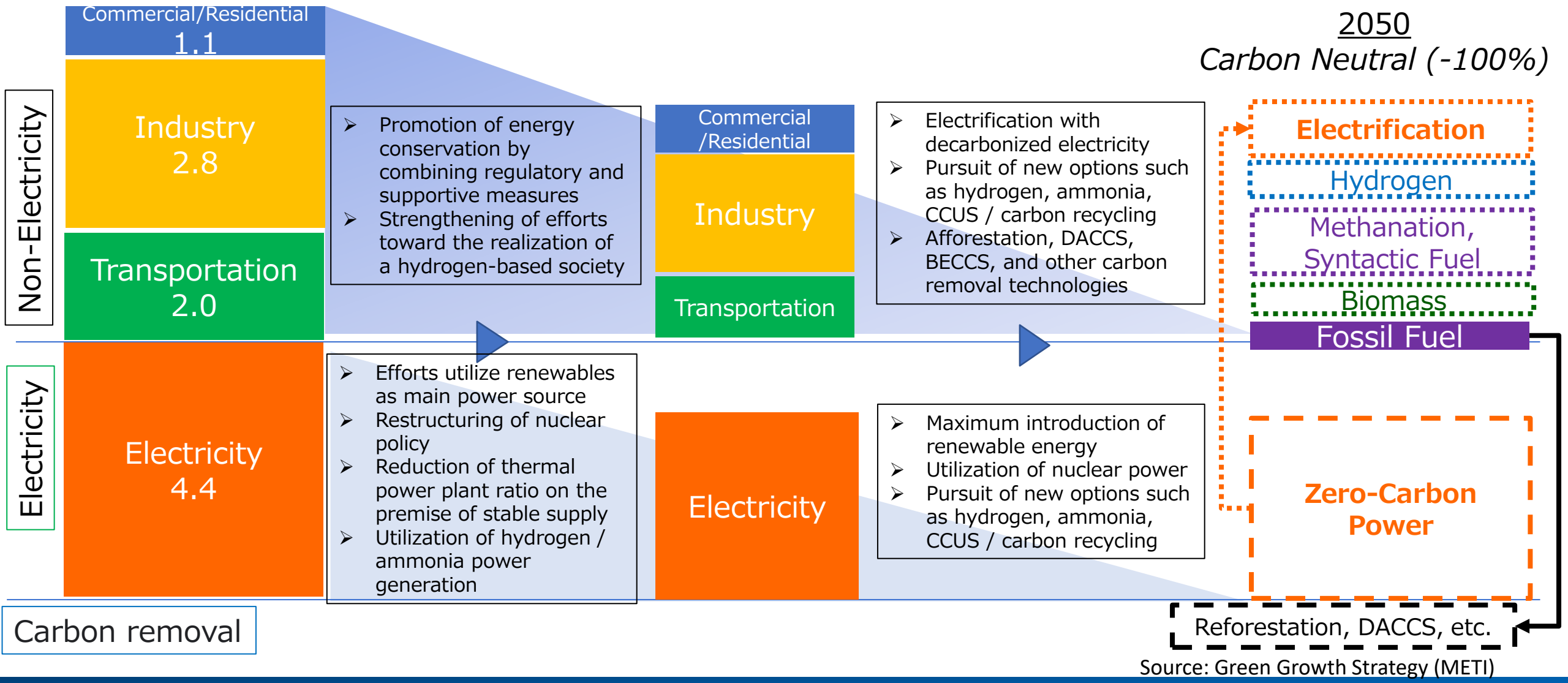
General Energy Statistics (Agency for Natural Resources and Energy, METI)

Energy related CO_2 Emission in 2020 (976 million tons)



Japan's National Greenhouse Gas Emissions in Fiscal Year 2020(MOE)

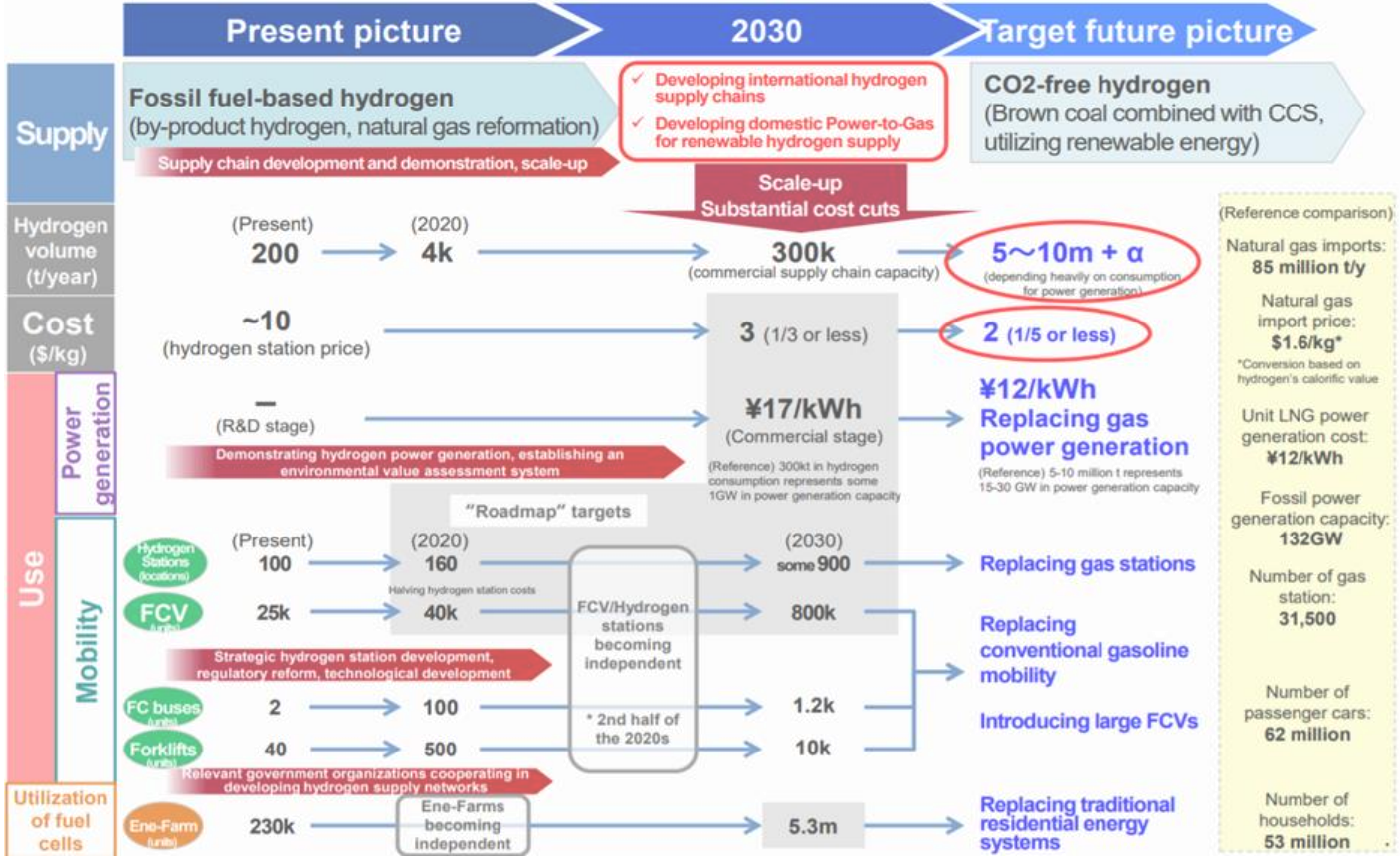
Towards 2050 Carbon Neutrality



Source: Green Growth Strategy (METI)

Japan's policy on Hydrogen

- **"Basic Hydrogen Strategy" (former Prime Minister Abe's Initiative)**
  - ✓ **World's first national strategy launched in Dec. 2017**
  - ✓ **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)



Japan's Policy Update

- Revision of Basic Hydrogen Strategy (6 June 2023)
  - ✓ Setting new targets
    - H_2 introduction: 12million tons (2040)/ Electrolysis: 15GW(2030, worldwide)
  - ✓ Promoting transition to "low-carbon hydrogen"
    - Definition of low-carbon hydrogen: below 3.4kg-CO_2e/kg-H_2
  - ✓ Strengthening industrial competitiveness
    - JPY 15 trillion Public-Private investment for H_2 supply chain next 15 years (incl. contracts for difference (CfD)-style subsidy scheme)
    - Prioritizing nine strategic areas (Electrolysis, Hydrogen Supply Chain, Fuel Cells, Power Generation, etc.)

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	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

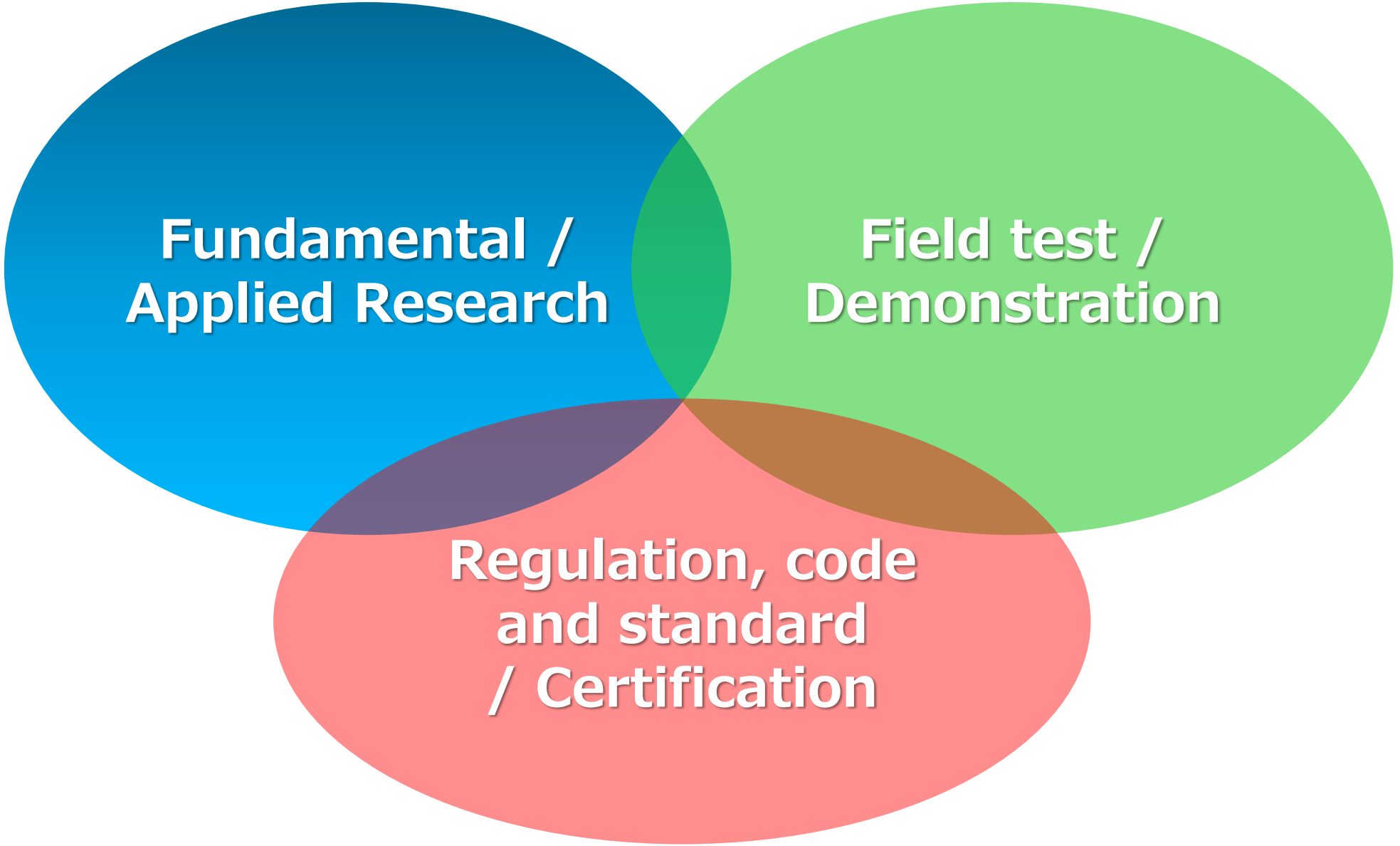
Source: METI

Current status

Items	Japan's Target (in 2030)	Current status (as of Feb. 2023)
Stationary Fuel Cell		
Regidential Fuel Cell (EneFarm)	3 million	480,373 (Mar. 2023)
Mobility		
Passenger Vehicles	800,000	7,692
Fuel Cell Buses	1,200	132
Forklift	N/A	397
Hydrogen Refueling Station		
Public Stations	1,000	167(Mar. 2023)

NEDO's R&DD on Hydrogen

Comprehensive approach



Step by Step approach

Hydrogen in Energy System

Step 3: Widely use of H_2

FCV & HRS

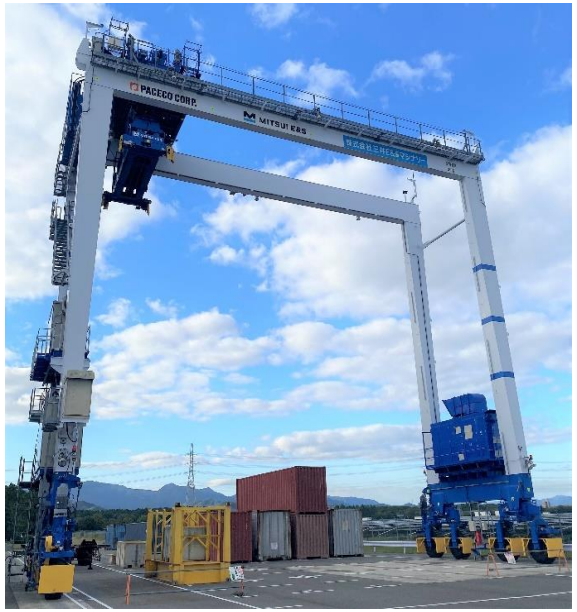
Step 2: Direct use of H_2 as energy source (Marketization in 2014)

Residential Fuel Cell

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

出典） 岩谷産業

Current Topic: Various Fuel Cell Application development



Current Topic: Refueling test facility for HDV

Developing new refueling protocol
80 kg-H_2 / 10 min

Ref. Passenger Vehicle: 5 kg-H_2 / 3 min

JARI/HySUT

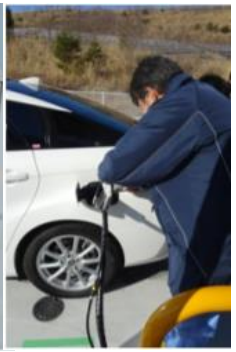
Current Topic: Hydrogen Technical Center

Demonstration at “Real Environment

- Testing a new equipment
- Refueling protocol
- Metering etc.

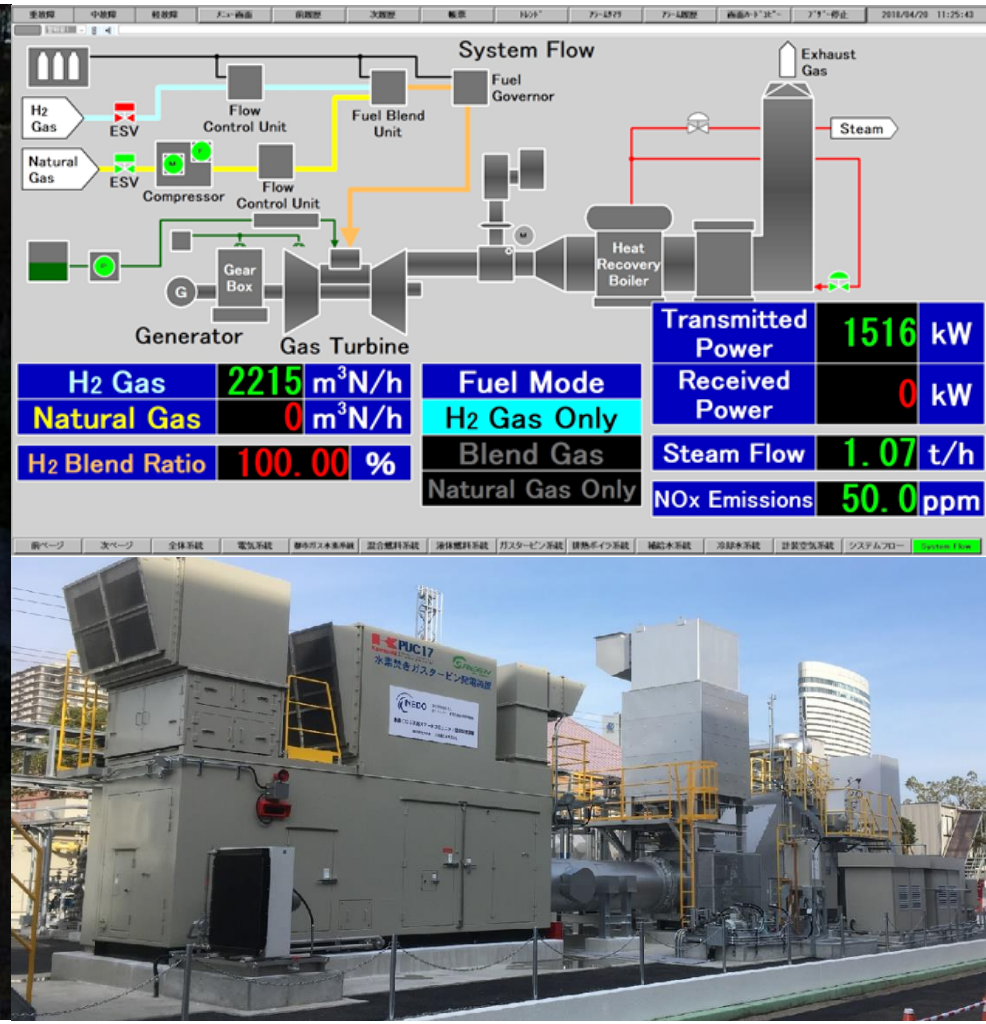
Total System Analysis for cost reduction

Education & Training



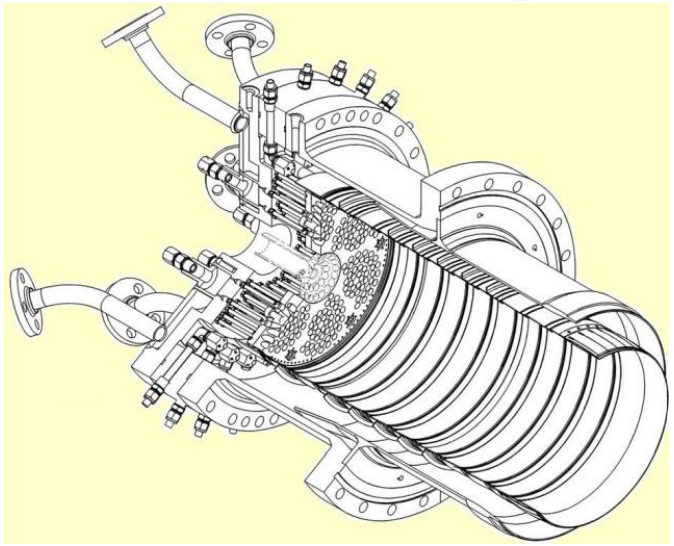
Current Topic: Hydrogen Gas Turbine

1MW Hydrogen/Natural Gas dual fuel gas turbine system developed by KHI



Current Topic: Hydrogen Gas Turbine

Hydrogen Combustor for hundred MW class Gas Turbine developed by MHI



Current Topic: Liquefied Hydrogen

Current Topic: MW scale Electrolysis

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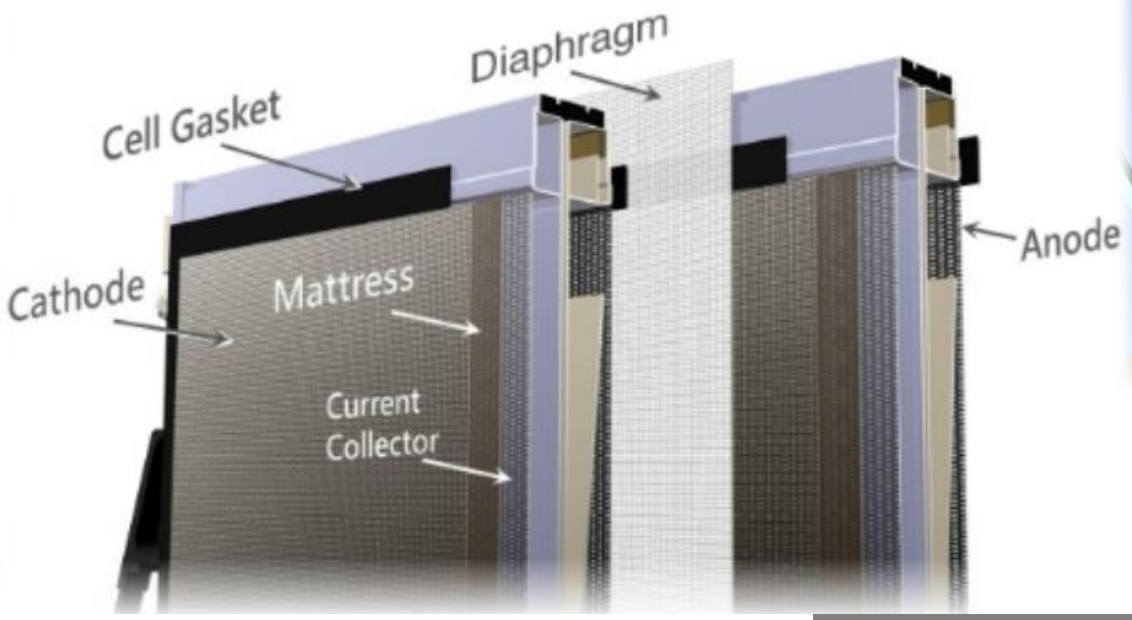
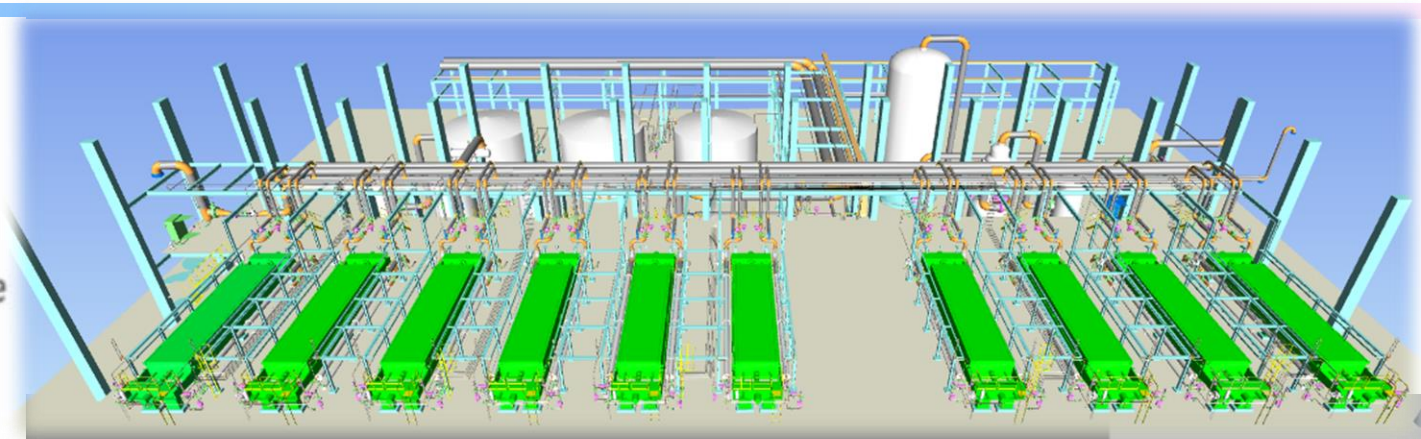
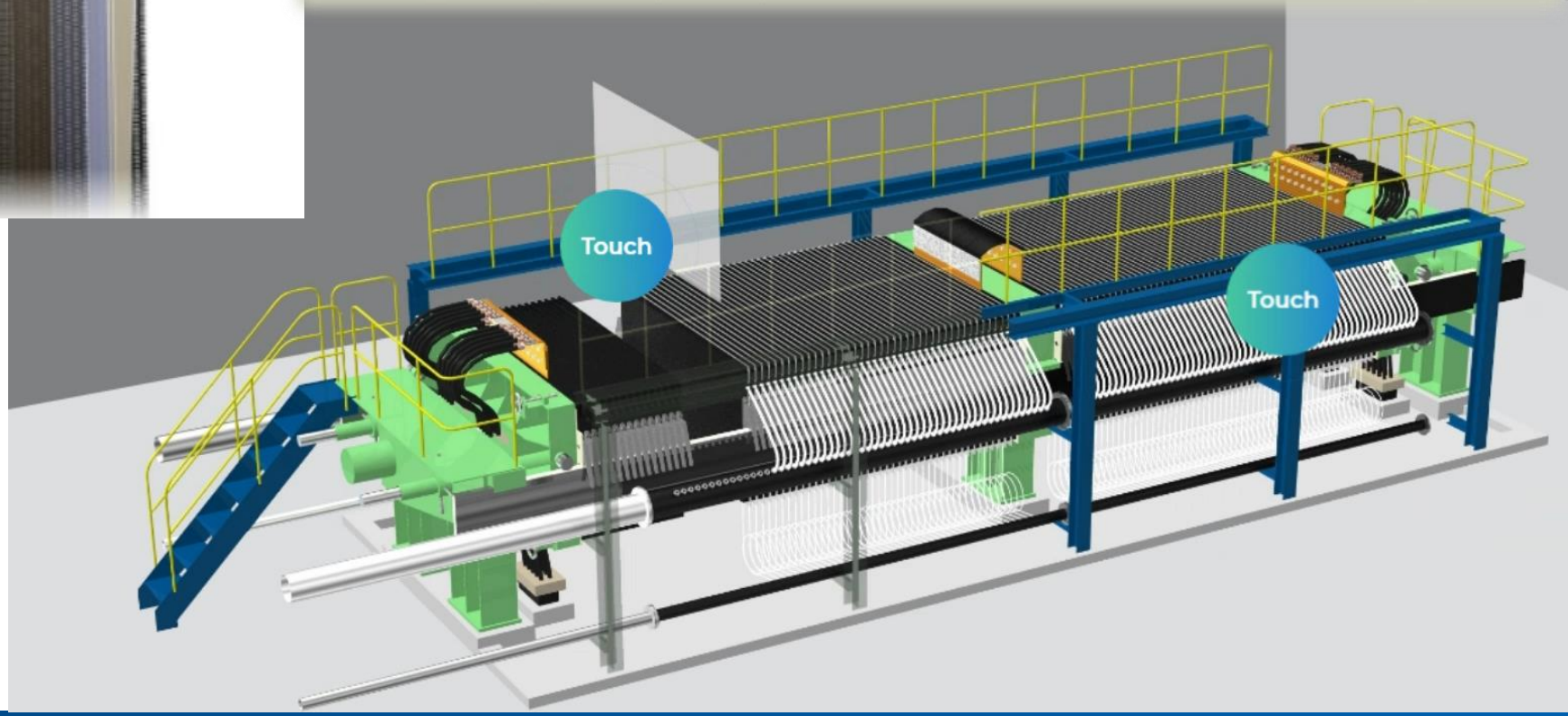






Current topic: Hydrogen@Port

Production → **Transportation** → **Utilization**

@Merced — **@San Pedro（LA･LB Port）**


RNG


Pipeline


Production


Storage

93MPa


Mobile Refueler

70MPa

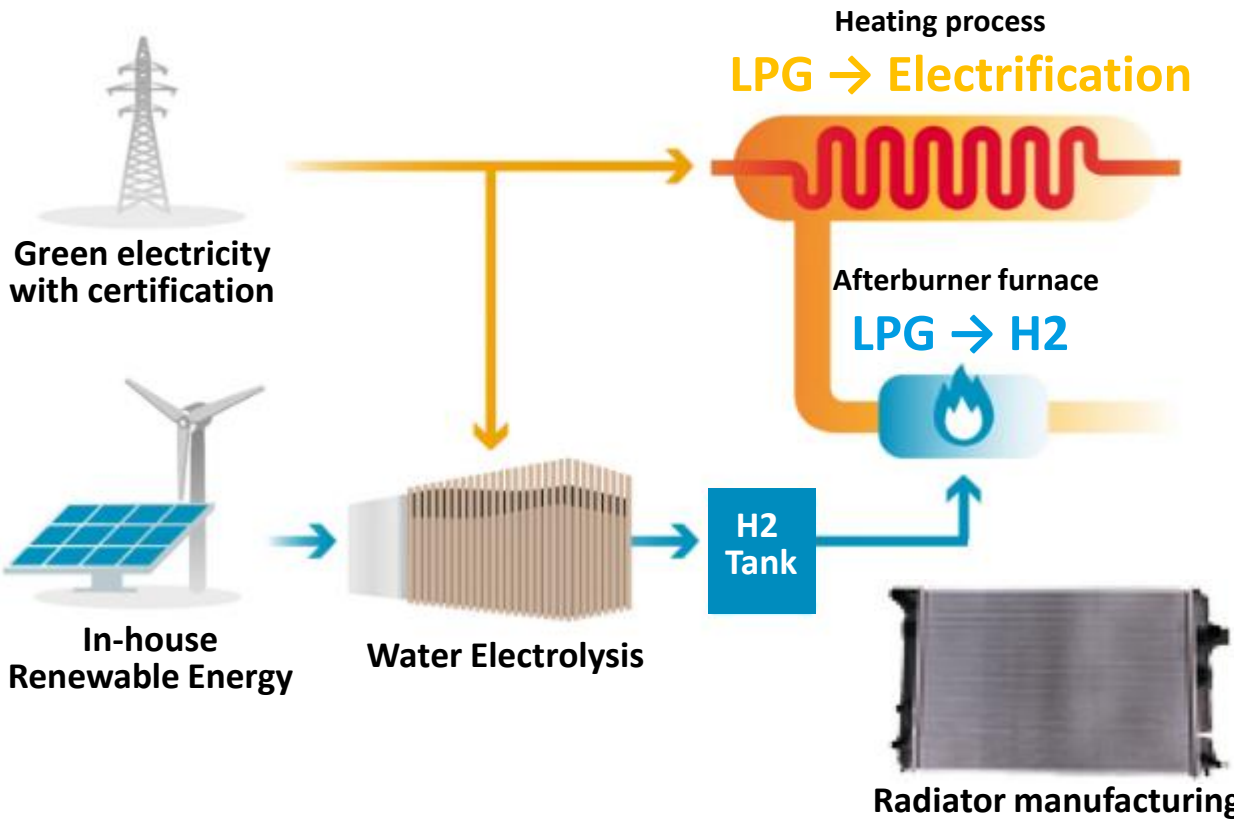

Top handler


RTG


Tractor


Drayage truck

Current topic: Industry decarbonization



at DENSO Fukushima factory

https://www.denso.com/global/en/news/newsroom/2023/20230309-g01/

https://global.toyota/en/newsroom/corporate/38917359.html

https://www.denso.com/jp/ja/driven-base/project/fukushima_factory/

Conclusion

Conclusion

- *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!