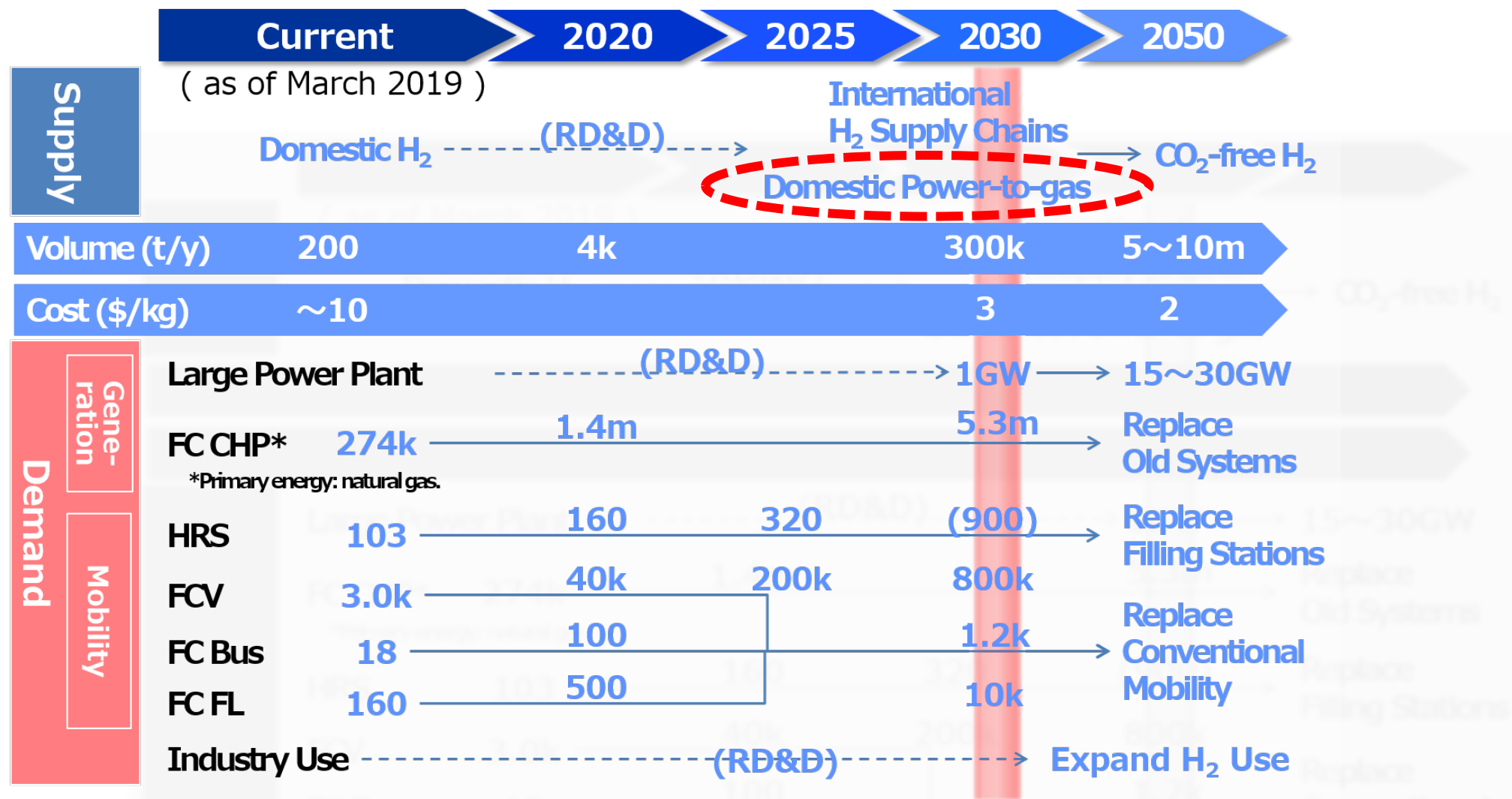


# **Fukushima Hydrogen Energy Research Field (FH<sub>2</sub>R)**

**New Energy and Industrial Technology Development Organization (NEDO)**

# Japan's Policy on Hydrogen



Basic Hydrogen Strategy: launched in Dec 2017

# Action Plan: "Strategic Roadmap for HFC"

		Goals in the Basic Hydrogen Strategy	Set of targets to achieve		Approach to achieving target
Use	Mobility	FCV 200k by 2025 800k by 2030	2025	<ul style="list-style-type: none"> <li>Price difference between FCV and HV (¥3m → ¥0.7m)</li> <li>Cost of main FCV system (FC ¥20k/kW → ¥5k/kW Hydrogen Storage ¥0.7m → ¥0.3m)</li> </ul>	<ul style="list-style-type: none"> <li>Regulatory reform and developing technology</li> </ul>
		HRS 320 by 2025 900 by 2030	2025	<ul style="list-style-type: none"> <li>Construction and operating costs (Construction cost ¥350m → ¥200m Operating cost ¥34m → ¥15m)</li> <li>Costs of components for HRS (Compressor ¥90m → ¥50m Accumulator ¥50m → ¥10m)</li> </ul>	<ul style="list-style-type: none"> <li>Consideration for creating nation wide network of HRS</li> <li>Extending hours of operation</li> </ul>
		Bus 1,200 by 2030	Early 2020s	<ul style="list-style-type: none"> <li>Vehicle cost of FC bus (¥105m → ¥52.5m)</li> </ul>	<ul style="list-style-type: none"> <li>Increasing HRS for FC bus</li> </ul>
		※In addition, promote development of guidelines and technology development for expansion of hydrogen use in the field of FC trucks, ships and trains.			
Supply	Power	Commercialize by 2030	2020	<ul style="list-style-type: none"> <li>Efficiency of hydrogen power generation (26% → 27%) ※1MW scale</li> </ul>	<ul style="list-style-type: none"> <li>Developing of high efficiency combustor etc.</li> </ul>
	FC	Early realization of grid parity	2025	<ul style="list-style-type: none"> <li>Realization of grid parity in commercial and industrial use</li> </ul>	<ul style="list-style-type: none"> <li>Developing FC cell/stack technology</li> </ul>
	Fossil Fuel + CCS	Hydrogen Cost ¥30/Nm3 by 2030 ¥20/Nm3 in future	Early 2020s	<ul style="list-style-type: none"> <li>Production: Production cost from brown coal gasification (¥several hundred/Nm3 → ¥12/Nm3)</li> <li>Storage/Transport : Scale-up of Liquefied hydrogen tank (thousands m<sup>3</sup> → 50,000m<sup>3</sup>) Higher efficiency of Liquefaction (13.6kWh/kg → 6kWh/kg)</li> </ul>	<ul style="list-style-type: none"> <li>Scaling-up and improving efficiency of brown coal gasifier</li> <li>Scaling-up and improving thermal insulation properties</li> </ul>
	Green H2	System cost of water electrolysis ¥50,000/kW in future	2030	<ul style="list-style-type: none"> <li>Cost of electrolyzer (¥200,000m/kW → ¥50,000/kW)</li> <li>Efficiency of water electrolysis (5kWh/Nm3 → 4.3kWh/Nm3)</li> </ul>	<ul style="list-style-type: none"> <li>Designated regions for public deployment demonstration tests utilizing the outcomes of the demonstration test in Namie, Fukushima</li> <li>Development of electrolyzer with higher efficiency and durability</li> </ul>

# Developing Alkaline Electrolysis Technology

Asahi Kasei developed the technology under NEDO's program (2013 – 2019)

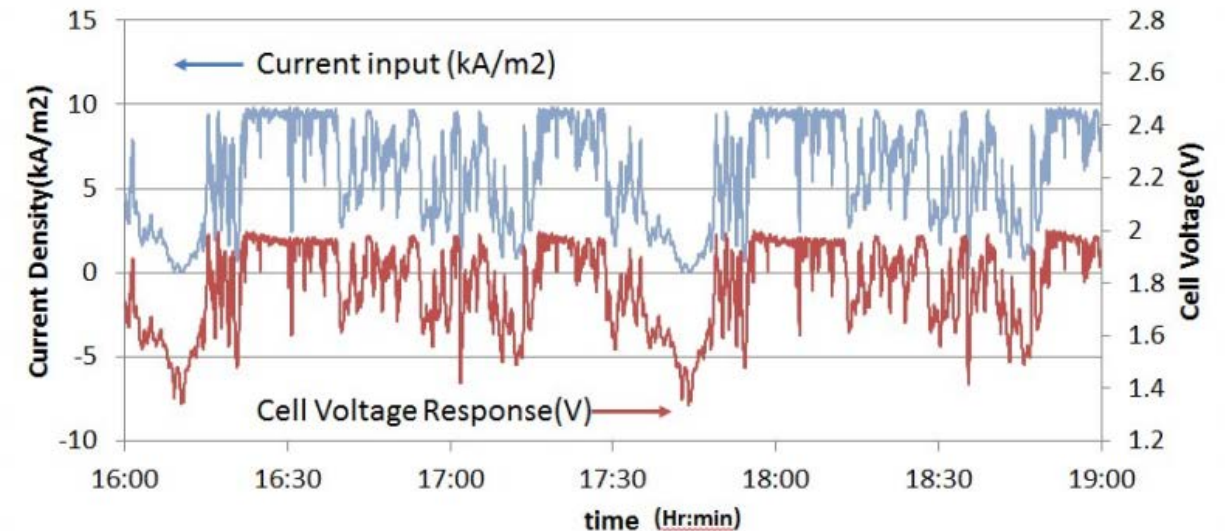


*Large Scale Alkaline Electrolysis: 3m<sup>2</sup>/Cell*

Spec:

- Cell Voltage : 1.78 V (@0.6 A/cm<sup>2</sup>)
- Cell Area : 3m<sup>2</sup> /cell
- Current Density: < 0.6 A/cm<sup>2</sup>
- Operation Temperature: <90°C
- Operation Condition: Normal Pressure

Load Following Test:



# Outline of the project

1. Project Period: September 2016 to March 2023

2. Project Member:

**TOSHIBA** Toshiba Energy Systems & Solutions Corporation

 Tohoku Electric Power Co., Inc.

 Tohoku Electric Power Network Co., Inc.

**Iwatani** Asahi**KASEI**

3. Purpose

- Develop a hydrogen utilization business model that optimizes the exploitation of hydrogen as both a commercial commodity and an energy source for balancing the supply and demand of the electricity grid
- Realize a new control system that optimizes hydrogen production and supply with demand forecasting for hydrogen

4. Budget (not confirmed): US\$ 200 million

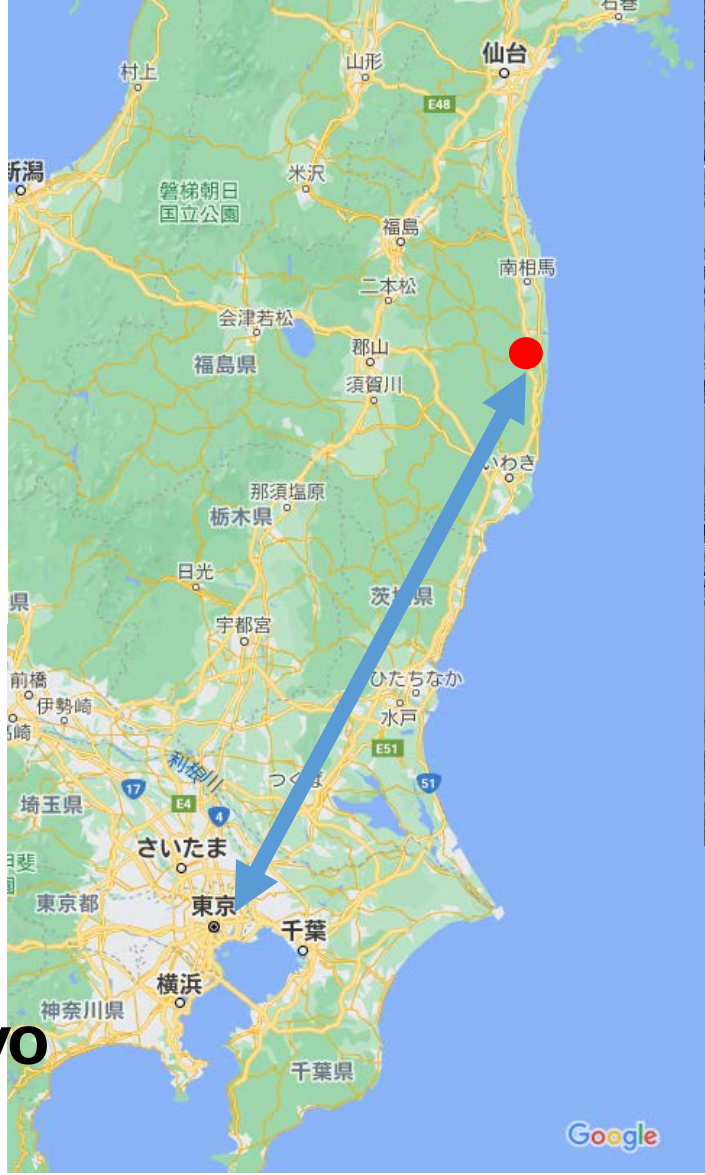


# FH2R Location



**Namie machi,  
Fukushima Pref.**

**250km from Tokyo**

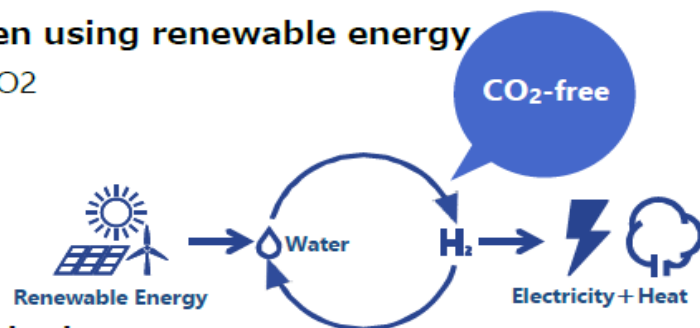


**Total 22ha**  
**- PV 18ha / H2 facility 4ha**

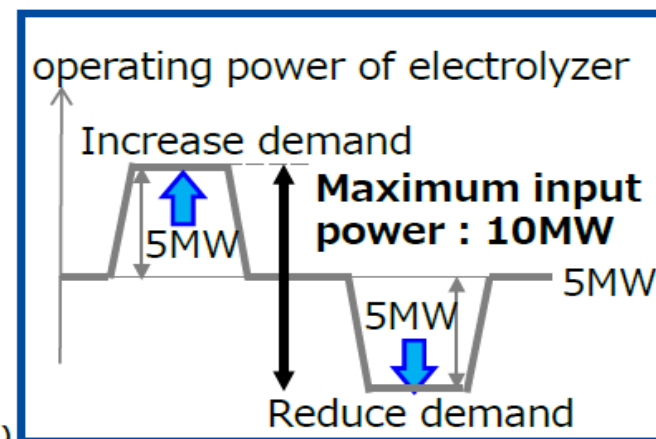
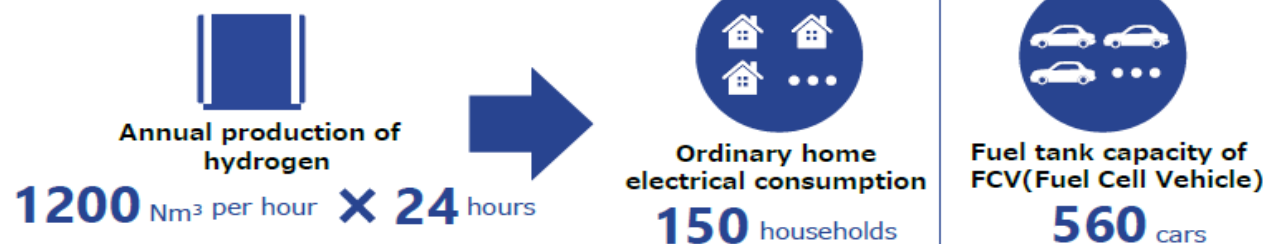
# Features of the project

## 1 Produce CO<sub>2</sub>-free hydrogen using renewable energy

By using CO<sub>2</sub>-free hydrogen, CO<sub>2</sub> emissions can be reduced



## 2 Produce large amounts of hydrogen



## 3 Realize expansion of use of renewable energy

“Hydrogen energy management system” performs optimum operation for each unit using information from “Power grid control system balances the supply and demand of electricity grid and generates demand response information” and “Hydrogen demand and supply forecasting system predicts hydrogen demand in the market and generates hydrogen demand forecasting information”.

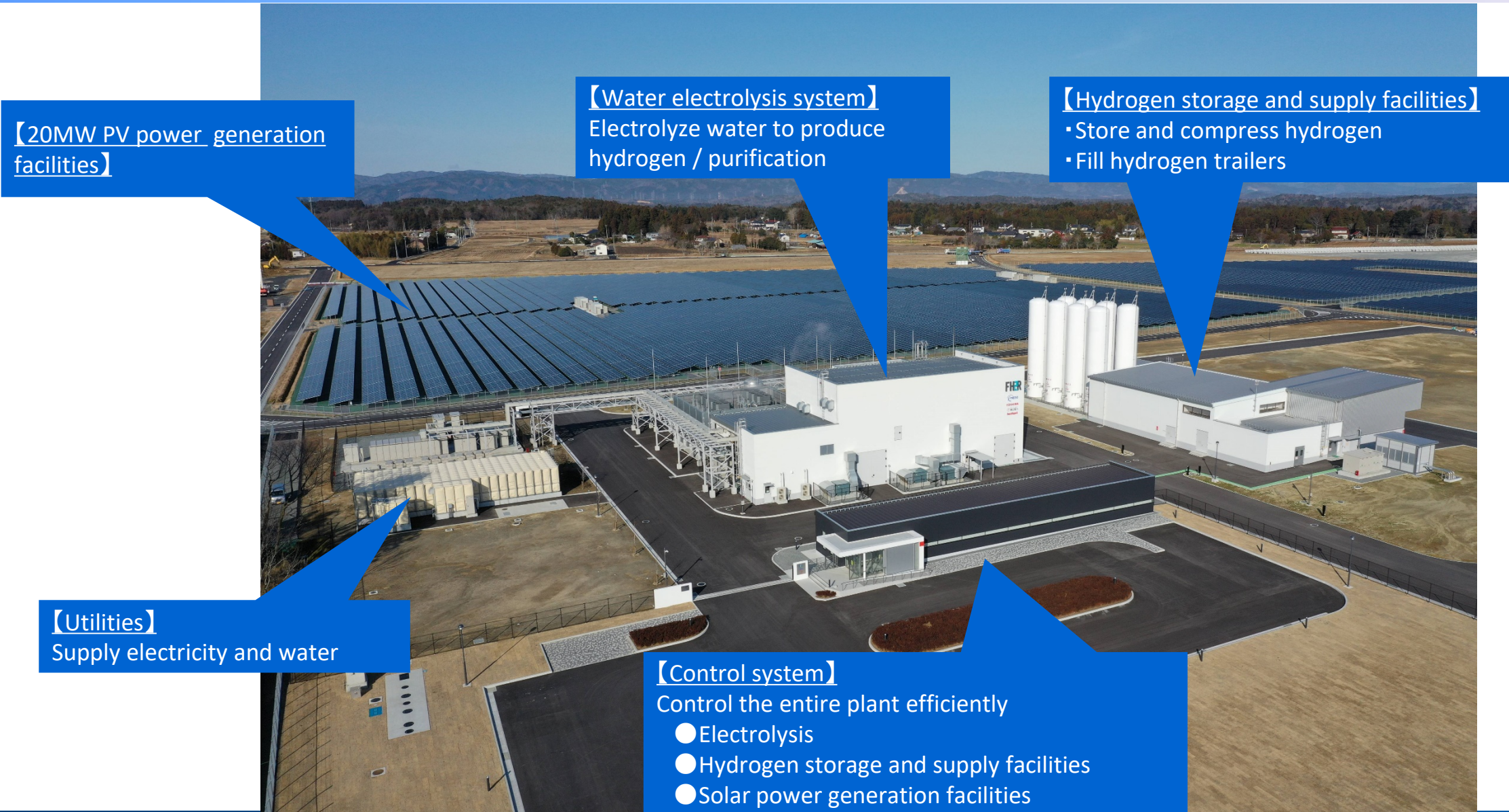


Image of balancing the supply and demand of electricity grid

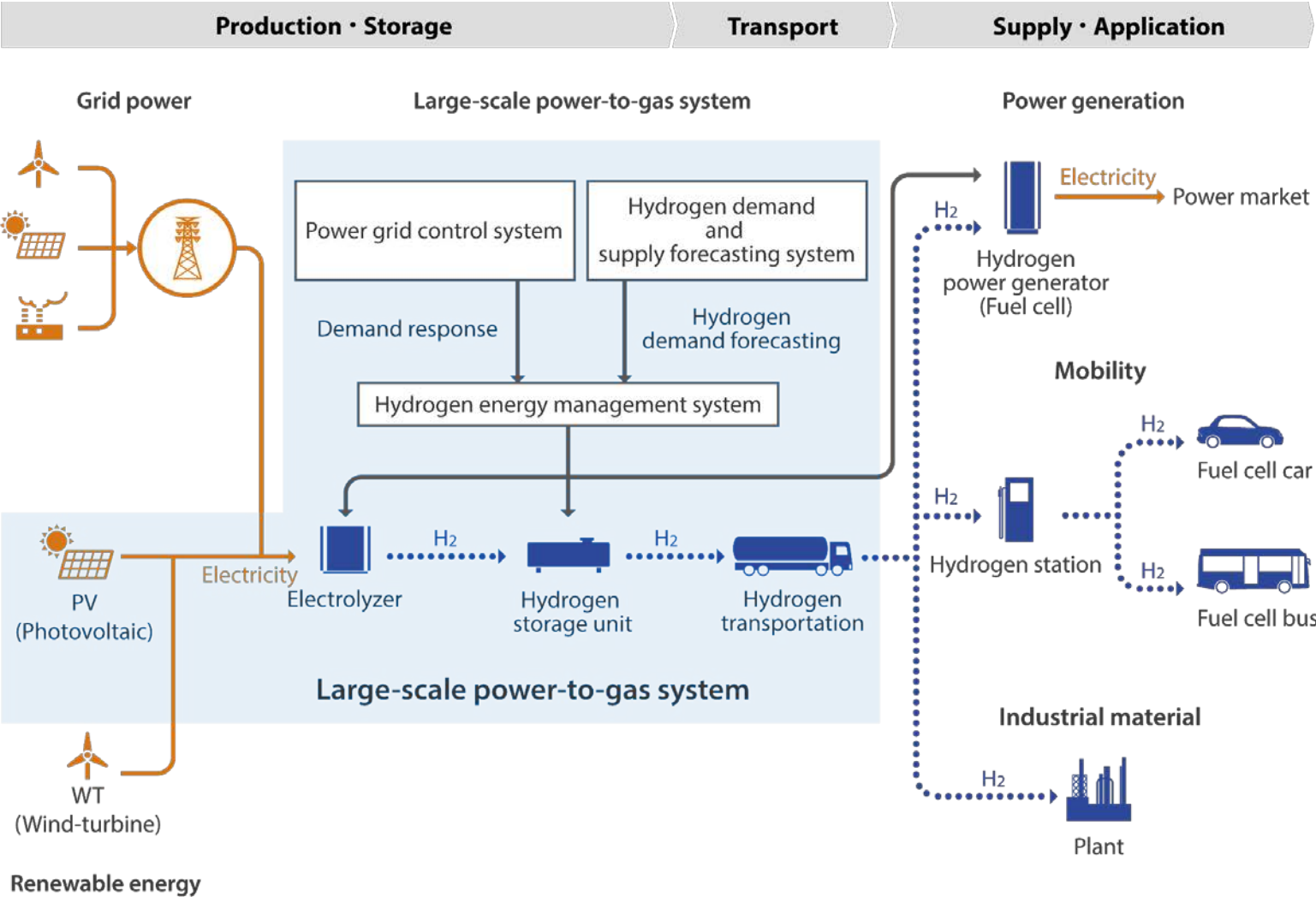
Electricity Grid	Hydrogen Power-to-gas System
Demand < Supply	Increase hydrogen production (Increase demand)
Demand > Supply	Reduce hydrogen production (Reduce demand)



# Function of facilities







Item	Specification
Function	(1) Produce • Storage • Supply of hydrogen (2) Balancing the supply and demand of the electricity grid
Annual producing capability (Rated output)	900t-H <sub>2</sub> /year
Input power (Electrolysis)	(Max.) 10MW (Rated) 6MW (Range) 1.5MW ~ 10MW
Hydrogen Storage / transport (Compressed hydrogen)	(1) Tube Trailer 2,642Nm <sup>3</sup> , 19.6MPa (2) Curdle 265.8Nm <sup>3</sup> , 19.6MPa





**Tube Trailer (capacity : 0.237t(2,642 Nm3))**



**Curdle (Capacity : 0.024 t (265.8 Nm3))**



# Opening Ceremony (March 2020)



Photo: Prime Minister's office of Japan

# Next Step

- *Verifying / Improving reliability of the technology*
  - *system operation under several conditions*
  - *durability of electrolysis in dynamic operation*
  
- *Identifying technical challenge*
  - *how to reduce OPEX / CAPEX*
  - *harmonizing future Balancing Market*
  
- *Developing hydrogen demand*
  - *demonstration project will be conducted*
  - *Tokyo 2020 (in 2021)?*