INTERNATIONAL PARTNERSHIP FOR
HYDROGEN AND FUEL CELLS IN THE ECONOMY

IPHE Country Update November, 2015: JAPAN

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Covered Period	From June to November, 2015

1. New Policy Initiatives on Hydrogen and Fuel Cell

- METI is working to review and revise the Hydrogen and Fuel Cell strategic Roadmap which has been announced in June 2014. The revised one will be announced next year.

2. Hydrogen and Fuel Cell R&D Update

- In August, NEDO hold annual project summarizing event about HFC RD&D program. In this event, to provide the opportunity for stakeholders to know about IPHE's activity, IPHE chair, Dr. Bernard FRIOS, was invited and gave the keynote speech. <http://www.nedo.go.jp/content/100766017.pdf>
- NEDO started new PEFC R&D project. The new projects aim to improve performance and durability 10 times more than the present technology per unit of noble metal.

3. Demonstration and Deployments Update

- New two Fuel Cell demonstration projects for business use were begun. One is 5kW SOFC-CHP, another is 250kW SOFC-CHP. These new demonstration projects are based on the target from the strategic roadmap which said 'Realizing fuel cells for commercial and industrial use onto the market by 2017'
- New demonstration projects for large scale hydrogen utilization projects were started. There are two hydrogen supply chain creation programs, and two hydrogen gas turbine development programs.
- Totally about 141 thousands FC units for residential use have been installed.
- About 400 commercial FCVs have been sold.
- Totally 31 commercial HRSs are operating.

4. Events and Solicitations

- From 2nd to 4th in March 2016, there is the largest exhibition in Japan called 'FC-EXPO 2016'. The exhibition focuses HFC technology in market.

5. Investments: Government and Collaborative Hydrogen and Fuel Cell Funding

All of items are Budget Request for Hydrogen and FCs in FY 2016 (METI).

- Dissemination of stationary FCs: Subsidies for purchase of Micro-CHP FCs [US$ 142 million/ JPY17 billion]
- Dissemination of FCVs: Subsidies for capex and opex of HRSs [US$ 52 million/ JPY 6.2 billion], Support for purchase of FCVs [Included in US$ 125 million /JPY 15 billion]
- Building a H2 supply chain: Subsidies for demonstrations for a H2 supply chain [US$ 28 million/ JPY 3.35 billion]
- R&D of FC, etc.: Subsidies for R&D of FCs [US$ 36 million/ JPY 4.35 billion], R&D of HRSs [US$ 38 million/ JPY 4.5 billion]
- Construction of a H2 energy network: Subsidies for construction of a H2 energy network [Included in US$ 67 million/ JPY 8 billion]
- R&D of H2 production, transport and storage: Subsidies for R&D for producing, transporting and storing H2 derived from renewable energy [US$ 14 million/ JPY 1.7 billion]

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Summary Country Update November, 2015: JAPAN

Transportation	Target Number	Current Status	Partnerships, Strategic Approach	Policy Support
Fuel Cell Vehicles[1]	No target	365 By Oct 2015	• Under revising the Hydrogen and Fuel Cell strategic Roadmap	• Subsidy for purchase (national government and partially local government initiative)
FC Bus	Over 100 by 2020 (Tokyo government)	(Few) Demonstration stage	-	• Subsidy for R&D, demonstration (national government initiative)
Fuel Cell Trucks[2]	No target	-	-	• Subsidy for R&D (national government initiative)
Forklifts	No target	(Few) Demonstration stage	• FC forklifts will be launched in 2016	• Subsidy for R&D, demonstration (national government initiative)
H_2 Refueling Stations	**Target Number**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
70 MPa On-Site Production	100	14 [Open 4] By Nov 2015	• Preceding installation in four major metropolitan areas • Under discussion about the deployment after 100 station installation	• Subsidy for capex and opex (national government and partially local government initiative)
70 MPa Delivered		67 [Open 27] By Nov 2015		

[1] Includes Fuel Cell Electric Vehicles with Range Extenders
[2] As above

35 MPa On-Site Production	No target	5 [Open 0]	• Municipality lead introduction such as official vehicle use	• Subsidy for capex (national government (MOE) and partially local government initiative)
35 MPa Delivered	No target	-	-	-
Stationary	**Target Number[3]**	**Current Status**	**Partnerships, Strategic Approach**	**Policy Support**
Small[4]	1.4 mil by 2020 5.3 mil by 2030	141,303 By Sep 2015	• ENE-FARM partners (composed of manufacturers, gas companies and constructors)	• Subsidy for purchase (national government and partially local government initiative)
Medium[5]	No target	4 :SOFC 41:PAFC	• 'Realizing fuel cells for commercial and industrial use onto the market by 2017' in the strategic roadmap	• Subsidy for R&D, demonstration (national government initiative)
Large[6]	No target	-	-	-
District Grid[7]	No target	-	-	-
Regional Grid[8]	No target	-	-	-
Telecom backup	No target	-	-	-

[3] Targets can be units installed and/or total installed capacity in the size range indicated
[4] <5 kW (e.g., Residential Use)
[5] 5kW – 400 kW (e.g., Distributed Residential Use)
[6] 0.3MW – 10 MW (e.g., Industrial Use)
[7] 1MW – 30 MW (e.g., Grid Stability, Ancillary Services)
[8] 30MW plus (e.g., Grid Storage and Systems Management)

H_2 Production	Target[9]	Current Status	Partnerships, Strategic Approach	Policy Support
Fossil Fuels[10]	No target	-	• Using mainly in on-site HRS	-
Water Electrolysis[11] (PEM, Alkaline, SOEC)	No target	-	• Effectively utilizing surplus power of renewable energy and storing energy as hydrogen	• Subsidy for R&D, demonstration (national government initiative)
By-product H_2	No target	-	• Using mainly in off-site HRS	-
Energy Storage from Renewables	**Target[12]**	**Current Status**	**Partnership, Strategic Approach**	**Policy Support**
Power to Power[13] Capacity	No target	-	• Dissemination of hydrogen which utilized surplus power for expansion of the renewable energy	-
Power to Gas[14] Capacity	No target	-	-	-

[9] Target can be by quantity (Nm^3, kg, t) and by percentage of total production; also, reference to efficiency capabilities can be a target
[10] Hydrogen produced by reforming processes
[11] Please indicate if targets relate to a specific technology (PEM, Alkiline, SOEC)
[12] Can be expressed in MW of Installed Capacity to use the electricity from renewable energy generation, and Annual MWh of stored energy capacity
[13] Operator has an obligation to return the electricity stored through the use of hydrogen back to electricity
[14] Operator has the opportunity to provide the stored energy in the form of hydrogen back to the energy system through multiple channels (e.g., merchant product, enriched natural gas, synthetic methane for transportation, heating, electricity)

Country Update

JAPAN

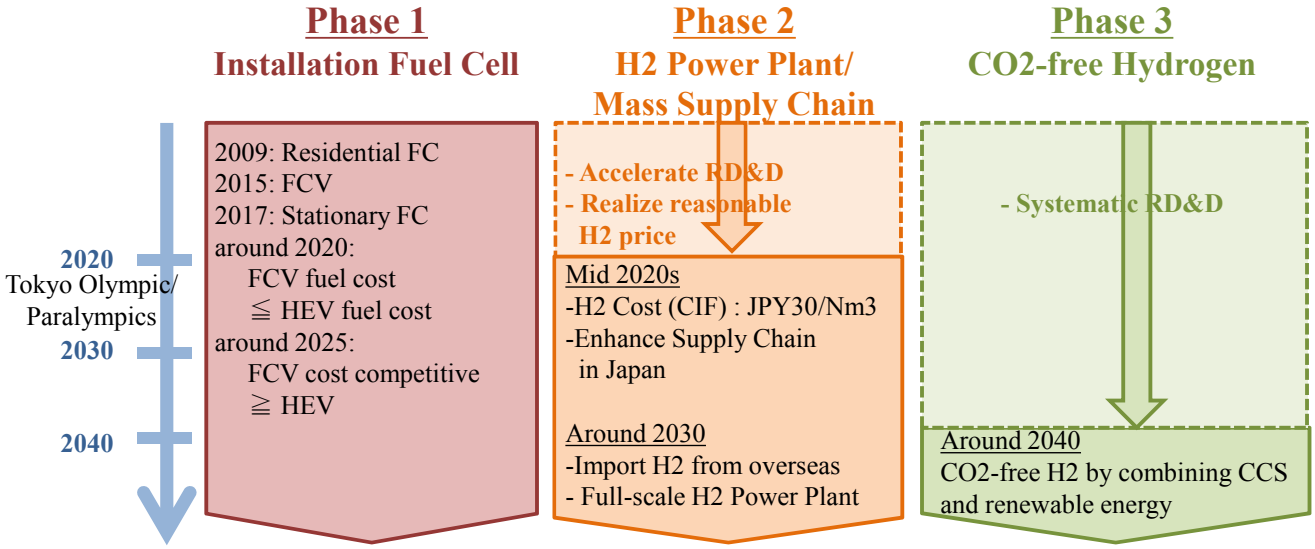
December 1st, 2015

24th IPHE SC Meeting

Grenoble, France

Hydrogen / FC Strategic Roadmap

- Step by step approach to realize Hydrogen Society



Market on H2 and FC in Japan

Approx. 1 trillion yen in 2030 → Approx. 8 trillion yen in 2050

Expansion of Fuel Cell Vehicles (FCVs)

Toyota Motor

<December 2014>

- Released "MIRAI" at a price of 7.23 million yen

<October 2015>

- Announced its FCV sales plan of 30,000 in global market around 2020 or later.

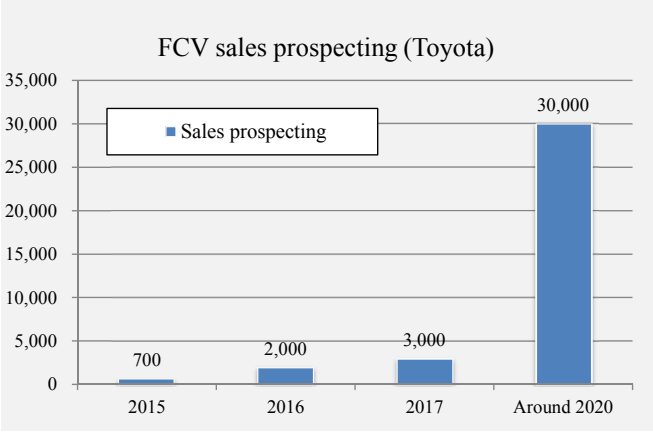
Honda Motor

<November 2014>

- Announced a FCV concept

< October 2015>

- Announced "CLARITY FUEL CELL" released at a price of 7.66 million yen in March 2016

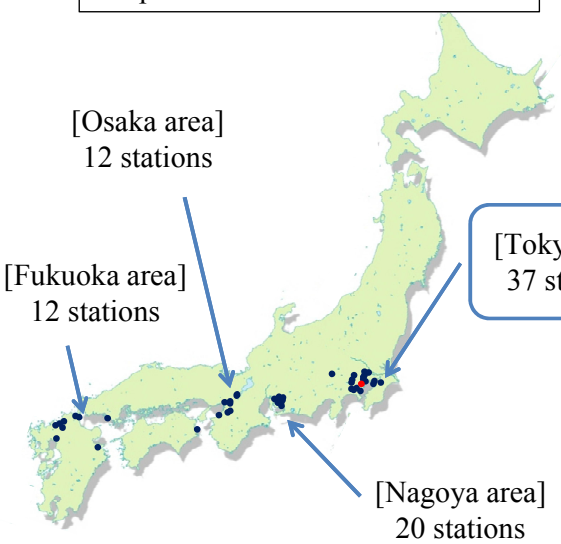


Tokyo Motor Show 2015

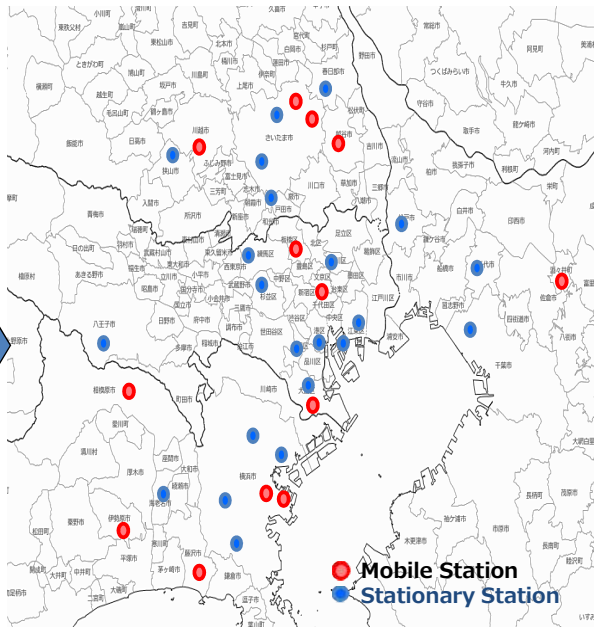
Deployment of Hydrogen Refueling Stations (HRSs)

- Target: 100 HRSs in 4 major populated areas
- METI subsidizes around 1/2 or more of capex and 2/3 of opex

Status of HRSs (as of Nov 2015)
- Budget secured: 81 stations
- Open: 31 stations



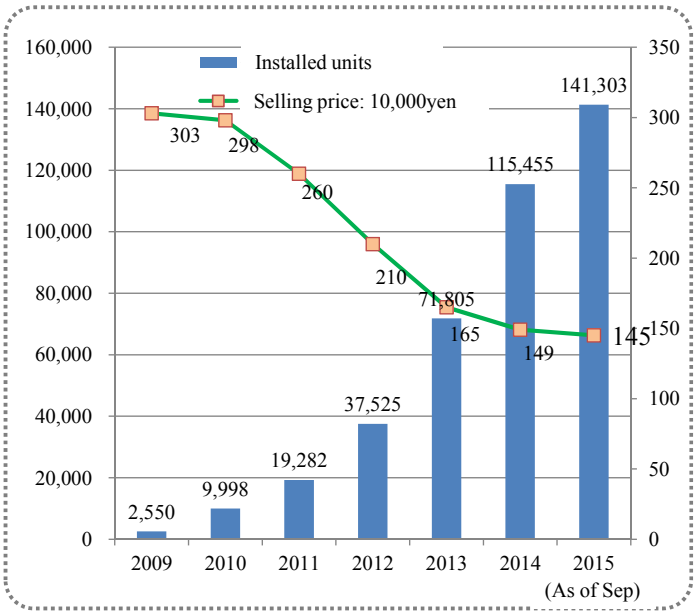
[Tokyo area]
37 stations



Expansion of Residential FCs ("ENE-FARM")

- Total units installed: 141,303 (as of Oct 2015)
- Target: 1.4million units by 2020, 5.3million units by 2030
- Price: Currently dropped to around half of 2009

Dissemination Scenario of Stationary Fuel Cells



Efforts for Spread and Expansion

(1) Creation of Initial Demand

•Part of the introduction expense is supported to create a market during the initial introduction stage. (22.2 billion yen was secured in the FY 2014 supplementary budget.)

(2) Market Expansion

•Development of a small-size Ene-Farm for condominiums
(→ Market introduction in April, 2014)

•Promoting overseas sales mainly in Europe where there is high demand for heat
(→ Market introduction in April 2014)

A Home Fuel Cell Sold in Europe

(3) Reduction of the Cost of FCs

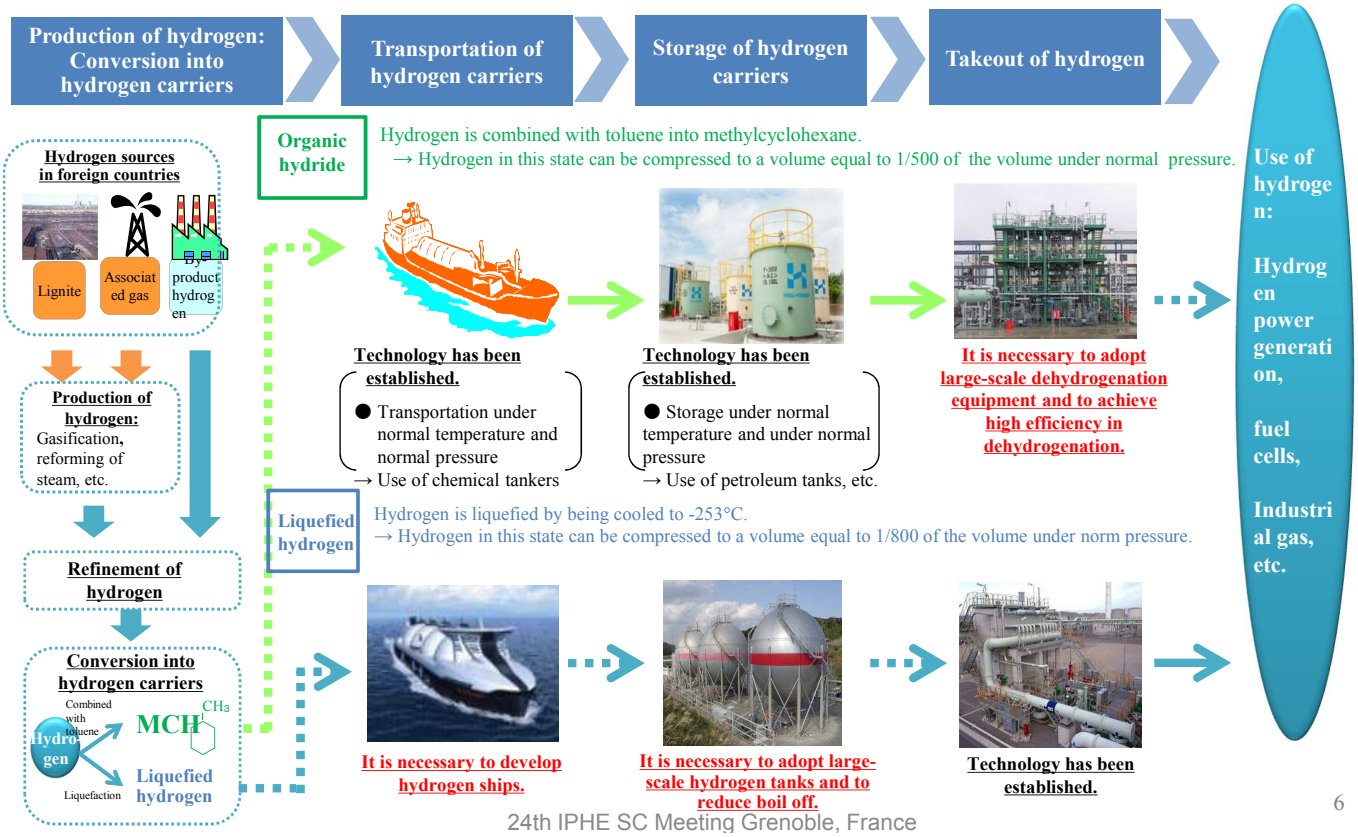
- Development of the technology to reduce the amount of platinum used for electrode catalysts

Hydrogen Production Method

At present, these substances are already being put to practical use. → **On a midterm basis, unused energy is utilized.** → **On a long-term basis, renewable energy is utilized.**

Fossil fuels (Petroleum, natural gas, etc.)	Byproduct hydrogen (Iron-making, chemistry, etc.)	Unused energy	Renewable energy (Wind power, solar power, etc.)
			
✓ Hydrogen is produced by reacting fossil fuel with water vapor at high temperature.	✓ Hydrogen is generated as a byproduct during the manufacture of sodium hydroxide or similar. ✓ Hydrogen-rich byproduct gas is generated during coke refining, a steel manufacturing process.	✓ Hydrogen is produced from unused energy such as low-grade coals like lignite, crude petroleum, and associated gas in gas fields (in the future, technology for reducing CO_2 emissions, such as CCS, will be utilized). ✓ Unused byproduct hydrogen will be utilized.	✓ Hydrogen is produced in such a way that electricity generated by renewable energy is passed into water (electrolysis of water).

Inexpensive, Stable Hydrogen Supply System



Demonstration project for hydrogen supply chain

- "Demonstration project for hydrogen supply chain based on unused-energy-derived hydrogen" has started with the national budget of 2.05 billion yen for 2015FY.
- With this budget, NEDO adopted 4 demonstration projects in June 2015.

Adopted projects

Theme	Project	Participants	Duration	Purpose
Demonstration project for establishment of hydrogen supply chain based on unused-energy-derived hydrogen	(1) Demonstration project for establishment of large-scale hydrogen marine transportation supply chain derived from unused brown coal	-Kawasaki Heavy Industries, Ltd -Iwatani Corporation -Electric Power Development Co. Ltd	2015～2020	Demonstration of brown coal gasification, marine transportation and loading
	(2) Demonstration of the hydrogen supply chain by chemical hydride method utilizing unused energy	-Chiyoda Corporation	2015～2020	Demonstration of scale up for hydrogenation /de-hydrogenation plant and operability of hydrogen chain using Toluene-MCH cycle
Technology development of systems using renewable hydrogen	(3) Development of Smart Community technology by utilization of hydrogen CGS(Co-Generation System)	-Obayashi Corporation -Kawasaki Heavy Industries,Ltd	2015～2017	Demonstration of hydrogen firing or co-firing on GT cogeneration and energy system configured hydrogen power generation
	(4) R&D on Gas turbine for co-firing of hydrogen-natural gas for low-carbon footprint power generation	-Mitsubishi Hitachi Power Systems , Ltd. -Mitsubishi Heavy Industries, Ltd	2015～2018	Development of applicable gas turbine by natural gas /hydrogen co-firing in existing power generation plant

Budget Request for Hydrogen and FCs in FY 2016 (METI)

Phase 1 — **Installation Fuel Cell** — Focus on implementation from the present

Phase 2 — **H2 Power Plant/ Mass Supply Chain** — Realization in the late 2020s

Phase 3 — **CO2-free Hydrogen** — Realization in 2040s

Dissemination of stationary FCs

Subsidies for Micro-CHP FCs
[US$ 142 million/ JPY17 billion]

Promote the accelerated introduction of ENE-FARMs. Promote lower cost through mass production.

Dissemination of FCVs

Subsidies for HRSs
[US$ 52 million/ JPY 6.2 billion]

Support the building of HRSs. Partially subsidize activities for creating new demand, etc.

Support for FCVs
[Included in US$ 125 million /JPY 15 billion]

Building a H2 supply chain

Demonstrations for a global H2 supply chain
[US$ 28 million/ JPY 3.35 billion]

Demonstrate how hydrogen can be produced from untapped overseas energy resources (by-product hydrogen, brown coal, etc.), transported in the form of liquefied hydrogen or organic hydride, and used to generate power.

R&D of FC, etc.

R&D of FCs
[US$ 36 million/ JPY 4.35 billion]

Conduct R&D to enhance performance and lower costs of FCs, and demonstrate commercial applications of FCs.

Large-CHP FCs

R&D of HRSs
[US$ 38 million/ JPY 4.5 billion]

Develop technologies to lower costs of HRSs, enhance safety and security and collect data so as to review regulations.

Construction of a H2 energy network

Construction of a H2 energy network
[Included in US$ 67 million/ JPY 8 billion]

Build a network that effectively connects multiple hydrogen applications in the region.

R&D of H2 production, transport and storage

R&D for producing, transporting and storing H2 derived from renewable energy
[US$ 14 million/ JPY 1.7 billion]

Develop technologies of high efficiency water electrolysis units, tanks for storing liquefied hydrogen, etc. with the use of renewable energy sources in mind

Exchange rate: 1USD=120yen