



IPHE Country Update: Japan

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Revised Points of the Hydrogen / FC Strategy Roadmap

Phase 1: Installation Fuel Cell (Current-)

1. Stationary FC

- ✓ Clarifies price targets of residential FCs ⇒ disseminates without government support by around 2020
 - PEFC: **800,000 yen** by 2019
 - SOFC: **1,000,000 yen** by 2021

2. Fuel Cell Vehicles

- ✓ Sets the goals of market introduction
 - **About 40,000 FCVs by 2020, 200,000 by 2025, 800,000 by 2030**
- ✓ Aims at introducing FCVs in main market segment (price range) by around 2025

3. Hydrogen Refueling Stations

- ✓ Sets the goals of installations and self-sustaining business
 - **About 160 stations by FY2020, 320 by FY2025**
 - *Needs around 900 stations in case of 300Nm³/h refueling capacity by 2030
 - **Self-sustaining business of HRs by the late 2020s**
- Thereafter establishes adequate amount of stations in response to the spread of FCVs

Phase 2: H2 Power Plant/ Mass Supply Chain (Realized in the late 2020s)

4. Hydrogen Power Plant

- ✓ reflects a report by study group on H2 power plant (March 2015) , embodies the description

Phase 3: CO₂-free Hydrogen (Realized in around 2040)

5. Hydrogen derived from Renewable Energy

- ✓ States to launch a working group which handles technical and economic issues regarding introduction of CO₂-free Hydrogen and come to conclusion by March 2017.
- ✓ Describes the promotion of advanced initiatives such as **the reform 2020 project** and **Fukushima new energy society initiative**

Step by Step approach to realize Hydrogen Society

Hydrogen / FC Strategy Roadmap

Phase:1

Installation Fuel Cell

2009: Residential FC
 2014: FCV
 2017: Stationary FC
 around 2020:
 -FCV fuel cost
 \leq HEV fuel cost
 -40,000 FCVs, 160 HRSs
 around 2025:
 -FCV in main market seg.
 FCV cost competitive
 \geq HEV
 -200,000 FCVs, 320 HRSs
 2nd half of 2020's:
 -Self-sustaining business
 of HRS
 around 2030:
 -800,000 FCVs

FCV: Fuel Cell Vehicle
 HEV: Hybrid Electric Vehicle
 HRS: Hydrogen Refueling Station

Phase:2

H2 Power Plant/ Mass Supply Chain

- Accelerate RD&D
 - Realize reasonable
 H2 Price

2nd half of 2020's:
 -H2 Cost (CIF) :
 JPY30/Nm³
 -Enhance Supply Chain
 in Japan
 around 2030:
 -Import H2 from overseas
 -Full Scale H2 Power Plant

Phase:3

CO2-free Hydrogen

around 2040:
 -Full Scale CO2-free H2
 (w/ Renewable Energy, CCS,
 etc)

2020

Tokyo Olympic
/Paralympics

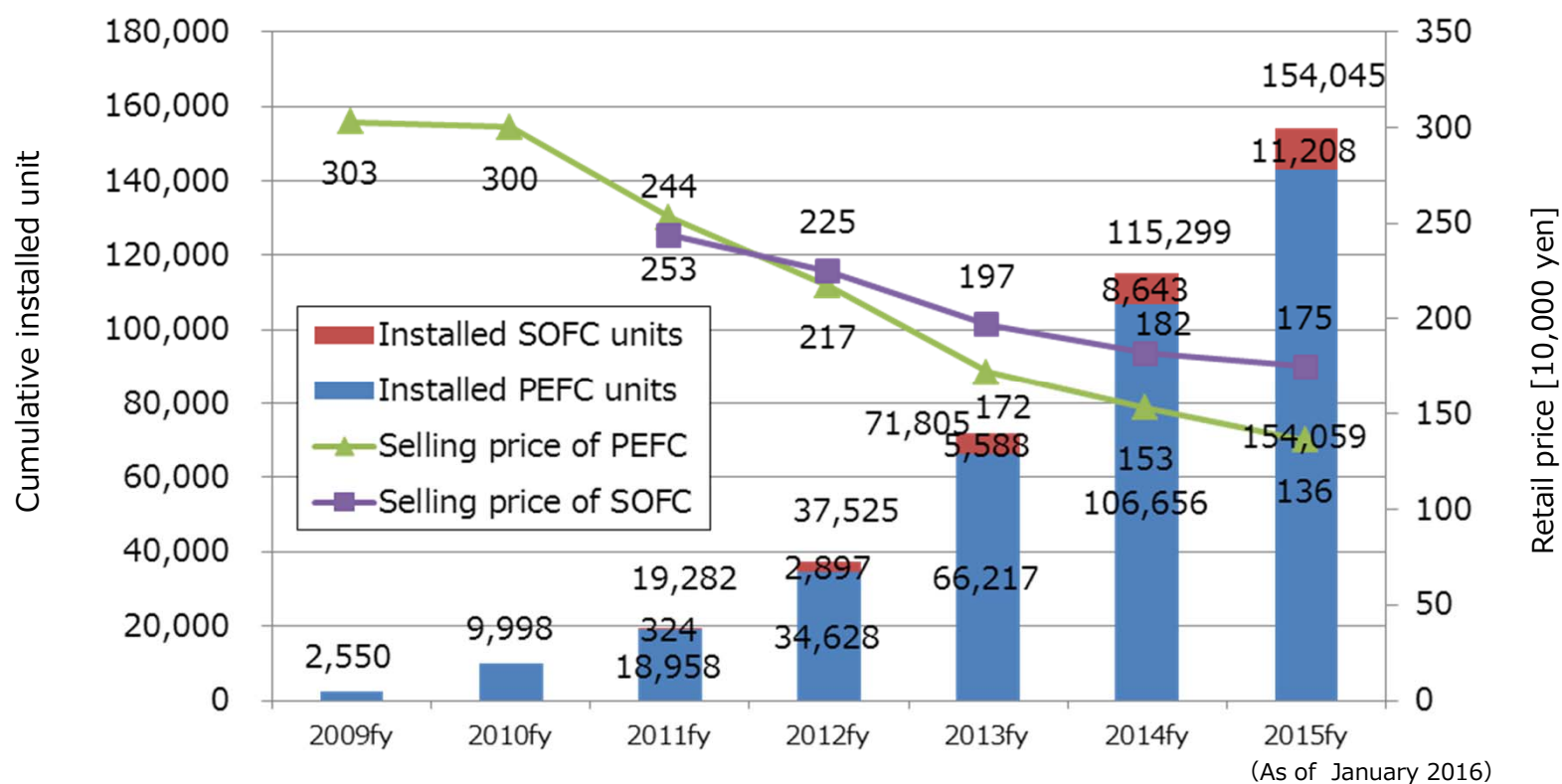
2030

2040

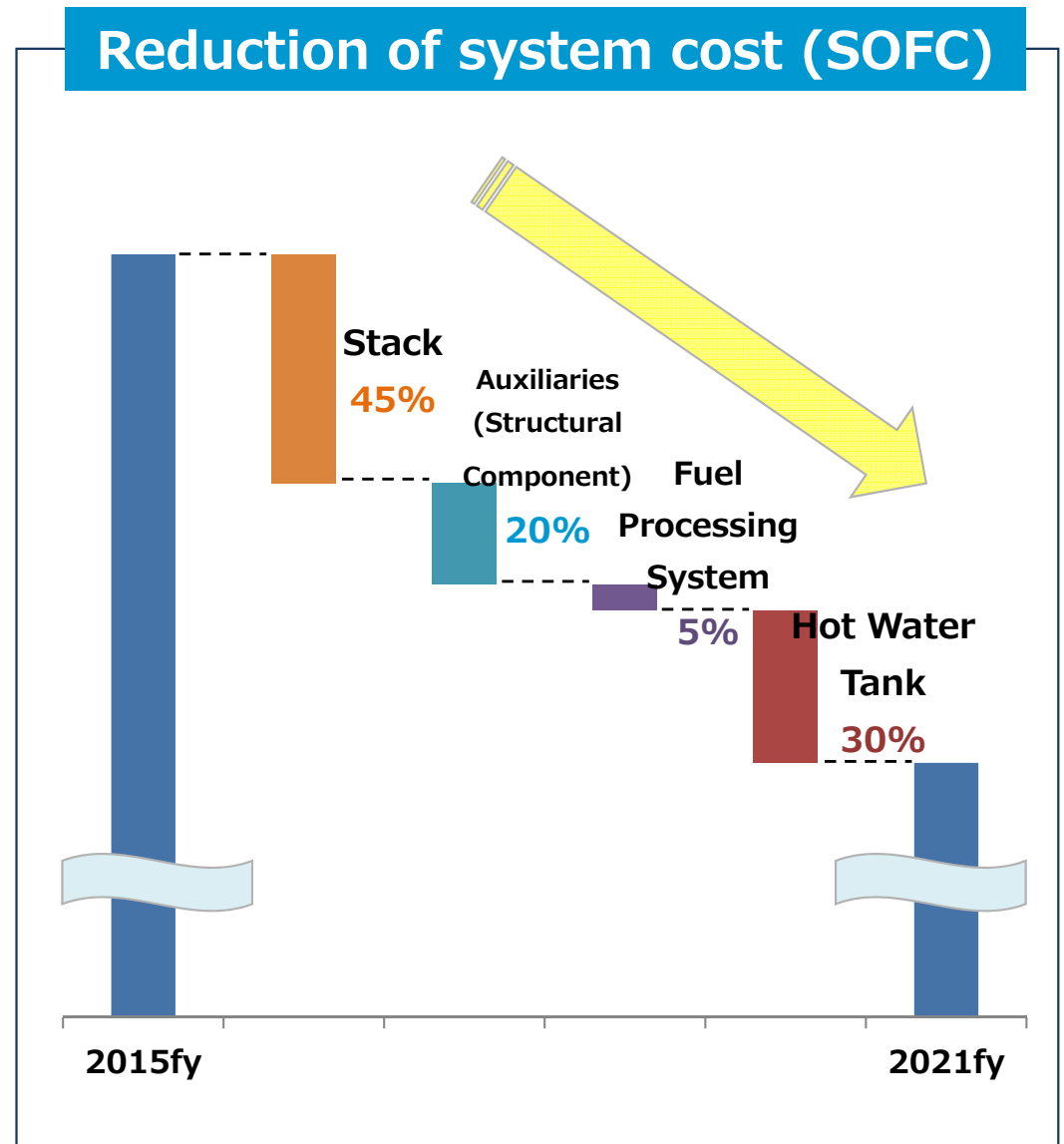
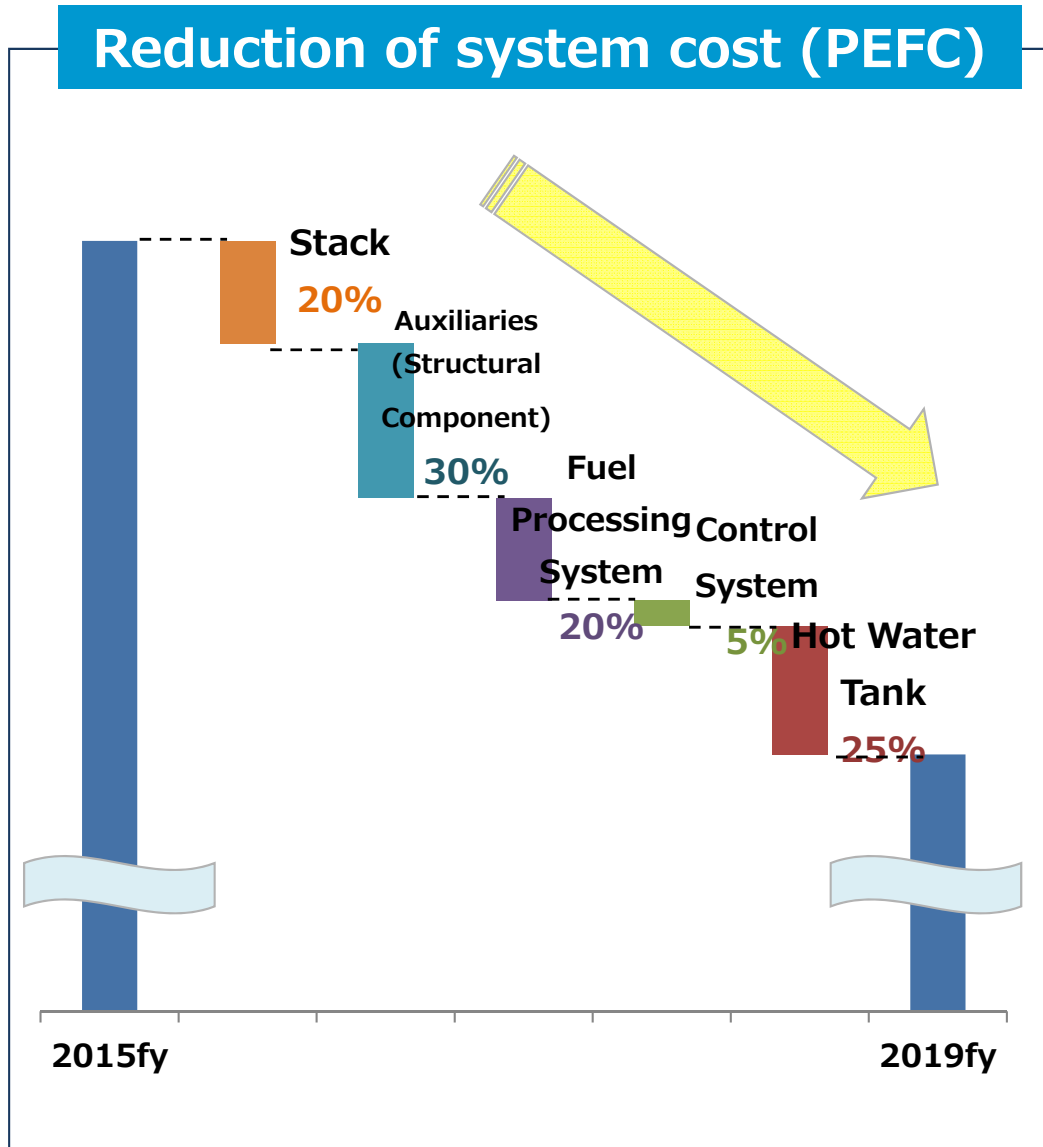
[Residential Fuel Cells] Promote dissemination and cost reduction

Goals in the Roadmap	Progress
<ul style="list-style-type: none"> Establish the self-sustaining market of “Ene-Farms” at the early stages, and disseminate 1.4 million units by 2020, and 5.3 million units by 2030. 	<ul style="list-style-type: none"> Over 150,000 units installed.
<ul style="list-style-type: none"> For the retail price of “Ene-Farms” (including construction cost for installation), aim at the price that can be recovered the investment within 7 or 8 years (PEFC: 0.8 million yen, SOFC: 1 million yen) by 2020, and within 5 years by 2030. 	<ul style="list-style-type: none"> Average retail price: about 1.4 million yen Payout time: about 18 years *As of 2015, Excluding subsidies

Changes in installed number and retail price









[Residential Fuel Cells] Breakdown of Cost Reduction



[Stationary Fuel Cells] Demonstration toward Market Introduction

Goal in the Roadmap	Progress
<ul style="list-style-type: none"> For business and industry use, aim at launching SOFC cogeneration type in 2017. 	<ul style="list-style-type: none"> Demonstrations have been progressing in several models steadily, and expected to be launched in 2017.

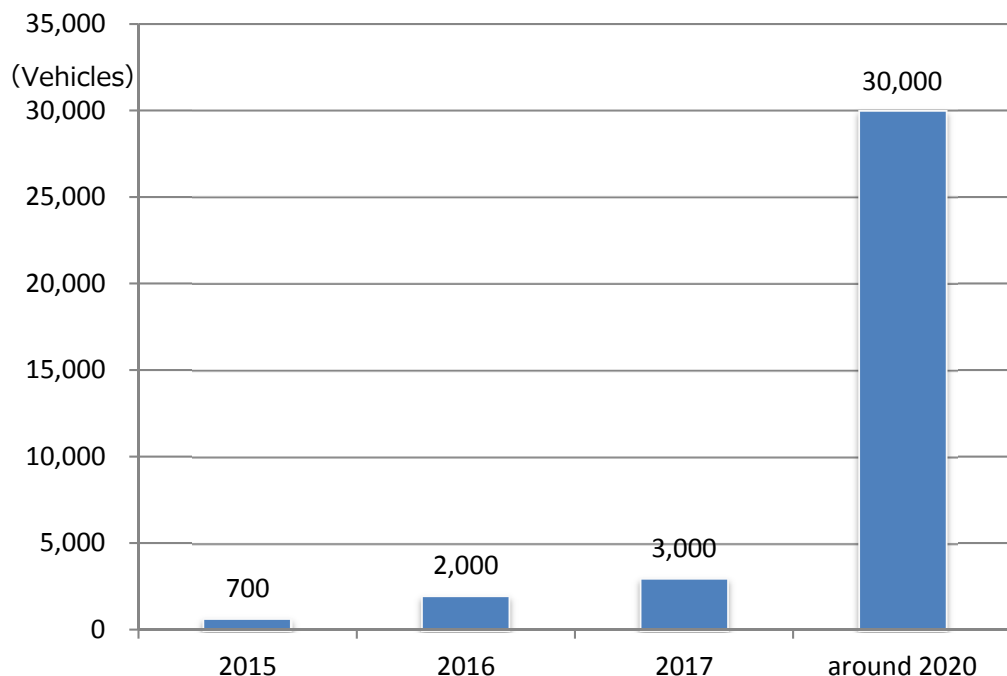
Development and Demonstration of SOFC units for business and industry

Manufacturer	Denso	Miura	Fuji Electric	Hitachi Zosen	Mitsubishi Hitachi Power Systems (MHPS)	(Reference) Bloom Energy
	Demonstration model					Business model
Appearance						
Output	5 kW	5 kW	20 kW	50 kW	250 kW	200 kW
Type	Cogeneration (under consideration)	Cogeneration	Cogeneration (under consideration)	Cogeneration	Cogeneration	Mono-generation
Electrical generation efficiency (target value)	50 %	50 %	50 %	50 %	55 %	50 – 60 % (Actual performance)
Total efficiency (target value)	(under consideration)	90 %	(under consideration)	80 %	73% (hot water) 65% (steam)	–
Major envisioned demand	Barbers and hair salons, small stores, family restaurants		Gym, welfare facilities, hospitals, small buildings		Data centers, large buildings, and hotels	

[Fuel Cell Vehicles] Set New Goals of dissemination

Goals in the Roadmap	Progress
<ul style="list-style-type: none"> Launch FCVs onto the market by 2015, and aim at the market introduction as around 40,000 FCVs by 2020, 200,000 by 2025, 800,000 by 2030. 	<ul style="list-style-type: none"> Toyota began selling its Mirai in December 2014. Honda began selling its Clarity Fuel Cell in March 2016. In September 2015, Toyota announced the estimated global sales of FCVs around 2020 as 30,000 or higher.
<ul style="list-style-type: none"> Aim at realizing the price of FCVs having price competitiveness equivalent to that of hybrid vehicles at the same class by around 2025. 	<ul style="list-style-type: none"> The retail price of Toyota Mirai and Honda Clarity Fuel Cell are both around 7million yen. Further efforts to reduce costs for FC system and platinum catalyst are promoted.

Toyota's expected global sales of FCVs (Single year)



Honda's new release



Auto manufacturer	Honda Motor
Car's name	Clarity Fuel Cell
Retail price (including tax)	7,660,000 yen
Launch	March 2016

[Hydrogen Refueling Stations] Set New Goals of Installations

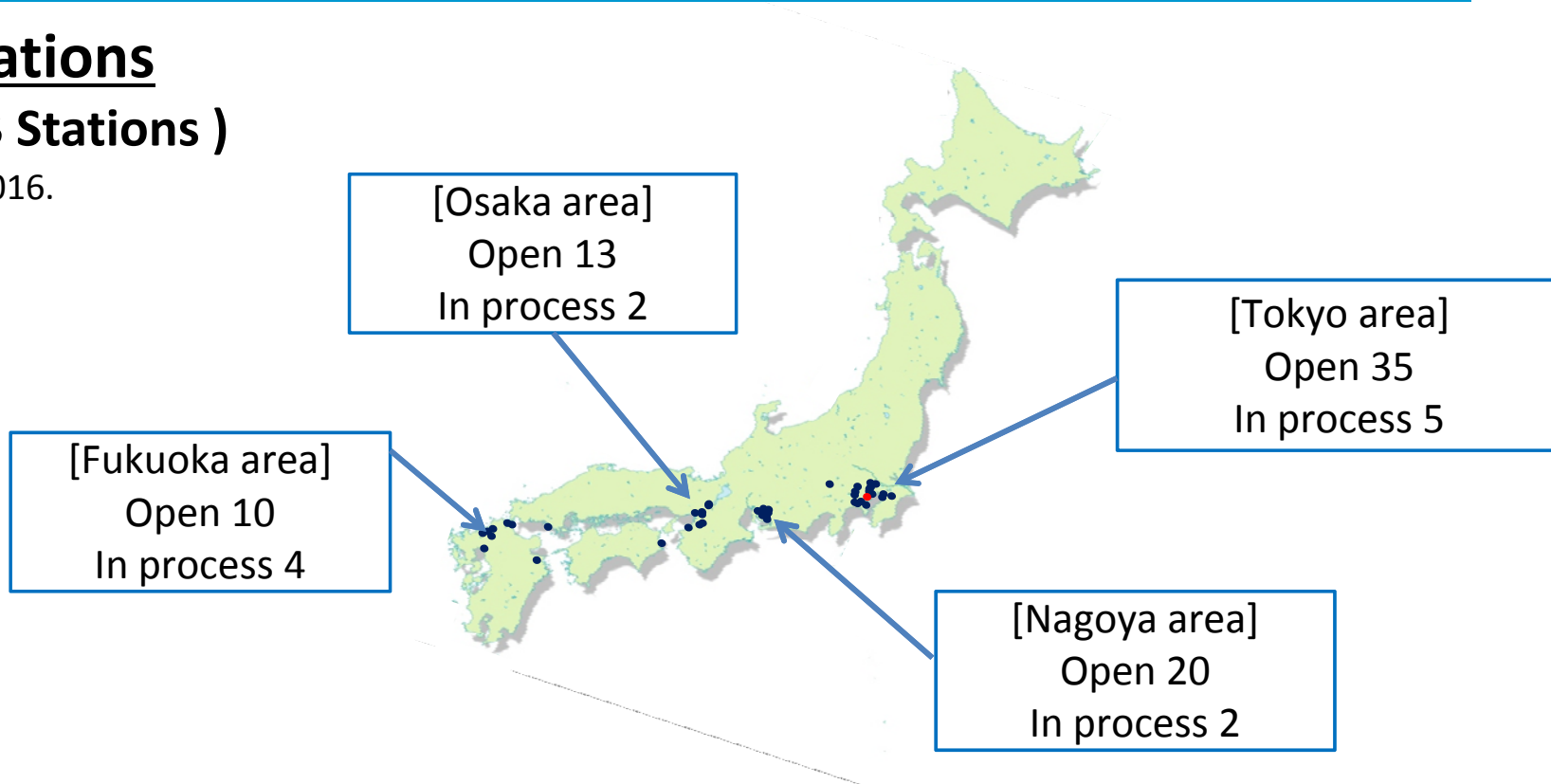
Goals in the Roadmap	Progress
<ul style="list-style-type: none"> Ensure about 160 HRSs in FY2020 and 320 in FY2025. 	<ul style="list-style-type: none"> 78 HRSs are commercially available and 13 in process. (*As of May 2016)
<ul style="list-style-type: none"> For the price of hydrogen, aim at offering at the same or lower price as compared with the fuel cost of gas vehicles in 2015, and as compared with the fuel cost of hybrid vehicles by around 2020. 	<ul style="list-style-type: none"> In HRSs currently opened, the price of 1,000-1,100 yen/kg, which is closed to the fuel cost of hybrid vehicles, is strategically set.

Map of Hydrogen refueling stations

Open 78 Stations

(In process 13 Stations)

* As of May 2016.



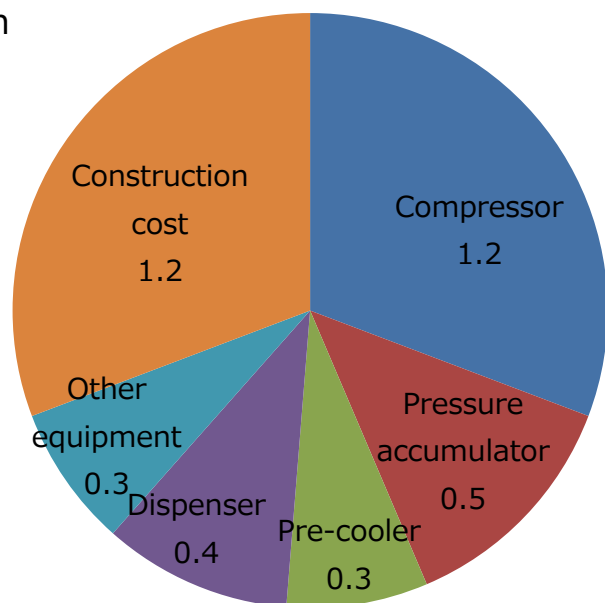
[Hydrogen Refueling Stations] Breakdown of Cost Reduction

Goals in the Roadmap	Progress
<ul style="list-style-type: none"> Aim at reducing installation cost (capex) into a half of the current cost by around 2020. 	<ul style="list-style-type: none"> Capex: About 390 million yen <ul style="list-style-type: none"> * Average of off-site stations (300 N m³/h), and other facility expenses are added in some cases.
<ul style="list-style-type: none"> Aim at reducing annual operating expense (opex; except for depreciation expense) to closer to 20 million yen level. 	<ul style="list-style-type: none"> Opex: About 47 million yen <ul style="list-style-type: none"> * Average of off-site stations (300 N m³/h)

Breakdown of capex

Total: About 390 million yen

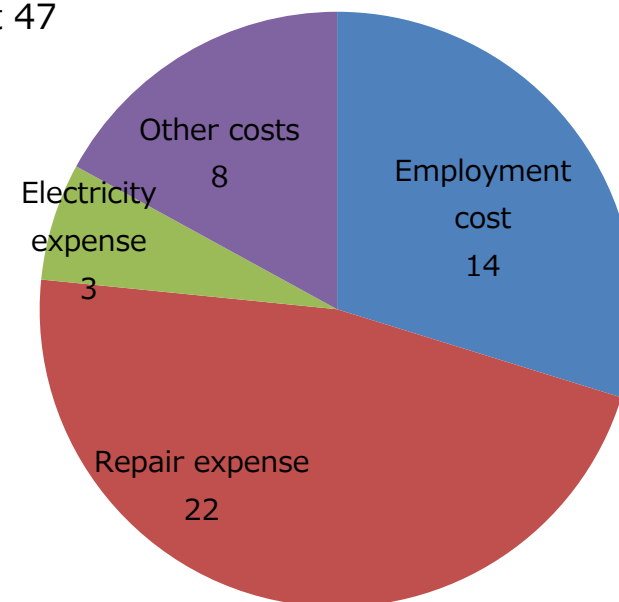
Unit: 100 million yen



Breakdown of opex

Total: About 47 million yen

Unit: million yen



Budget for Hydrogen and Fuel Cells in FY 2016 (METI)

Phase 1

Installation Fuel Cell

Focus on implementation from the present

Phase 2

H2 Power Plant/ Mass Supply Chain

Realized in the late 2020s

Phase 3

CO2-free Hydrogen

Realized in around 2040

Disseminate stationary FCs

Subsidies for Residential FCs [9.5 billion yen]

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



Disseminate FCVs

Subsidies for HRSs [6.2 billion yen]

Support HRS installations and promote creating new FCV demand.



Support for FCVs [Included in 15 billion yen]

Build a H2 supply chain

Demonstrations for global H2 supply chain [2.8 billion yen]

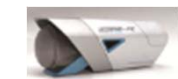
Demonstrate how hydrogen can be produced from untapped overseas energy resources, transported in the form of liquefied hydrogen or organic hydride, and used to generate power. Implement P2G field tests, etc.



R&D of FC, etc.

R&D of FCs [3.7 billion yen]

Conduct R&D for better performance and lower costs of FCs, and demonstrate stationary FCs for business use



Stationary FC for business use

R&D of HRSs [4.15 billion yen]

Develop technologies for lower costs and safety of HRSs, and collect data for reviewing regulations.

Construct of H2 energy network

Construction of a H2 energy network [Included in 4.5 billion yen]

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 [1.55 billion yen]

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