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# **Contents**

- 1. Deployment of FCVs and Retail HRSs
- 2. HySUT Activities
- **3. Technology Development for the Next Generation HRSs**
- 4. Future Issues



## **1. Deployment of FCVs and Retail HRSs** Number of registered FCVs in Japan



TOYOTA MIRAI (Dec. 2014)



HONDA CLARITY FUEL CELL (Mar. 2016)





#### Support Program for Construction by NeV\* (sponsored by METI\*\*)

| Facility                                 | Capacity<br>(Nm3/h) | Туре                         | Support | Max. amount<br>(Million US\$) |
|--|---------------------|------------------------------|---------|-------------------------------|
|  | 300 or more         | On-site (for bus refueling)  | 1/2     | 3.9                           |
| HRS                                      |                     | Off-site (for bus refueling) | 1/2     | 3.5                           |
|  |                     | On-site (Compact type)       | 2/3     | 2.9                           |
|  |                     | On-site (Others)             | 1/2     | 2.9                           |
|  |                     | Off-site (Compact type)      | 2/3     | 2.5                           |
|  |                     | Off-site (Others)            | 1/2     | 2.5                           |
|  |                     | Mobile                       | 2/3     | 2.5                           |
|  |                     | On-site (Compact type)       | 2/3     | 2.2                           |
|  | 50 or more          | On-site (Others)             | 1/2     | 2.2                           |
|  | and                 | Off-site (Compact type)      | 2/3     | 1.8                           |
|  | less than 300       | Off-site (Others)            | 1/2     | 1.8                           |
|  |                     | Mobile                       | 2/3     | 1.8                           |
| Gaseous Hydrogen Production and Shipping |                     | 1/2                          | 0.6     |                               |
| Liquefied Hydrogen Shipping              |                     | 1/2                          | 0.4     |                               |

\* NeV: Next Generation Vehicle Promotion Center \*\*METI: Ministry of Economy, Trade and Industry



# **Support Program for Operation**

#### **Program by NeV (sponsored by METI)**

| Туре   | Max. support amount per HRS (million US\$) |
|--|--|
| On-site HRS                                    | 0.22                                       |
| Off-site HRS                                   | 0.22                                       |
| Mobile (Refueling site: 1)                     | 0.22                                       |
| Mobile (Refueling sites: 2 or more)            | 0.26                                       |
| Capacity (Nm3/h): 50 or more and less than 100 | 0.16                                       |

#### **Program by HySUT (sponsored by Automakers)**

| Туре   | Max. support amount per HRS (million US\$) |
|--|--|
| On-site HRS                                    | 0.11                                       |
| Off-site HRS                                   | 0.11                                       |
| Mobile (Refueling site: 1)                     | 0.11                                       |
| Mobile (Refueling sites: 2 or more)            | 0.13                                       |
| Capacity (Nm3/h): 50 or more and less than 100 | 0.08                                       |



# Number of retail HRSs and FCVs (as of June 30, 2018)



| Area                   | Number of retail HRSs | Number of<br>FCVs |
|------------------------|-----------------------|-------------------|
| 1. Hokkaido            | 1                     | 16                |
| 2. Tohoku              | 3                     | 44                |
| 3. Kanto               | 40                    | 1033              |
| 4. Chubu               | 25                    | 1021              |
| 5. Kansai              | 12                    | 243               |
| 6. Chugoku/<br>Shikoku | 8                     | 92                |
| 7. Kyushu              | 11                    | 131               |
| Total                  | 100                   | 2,580             |



# Breakdown of retail HRSs in Japan

| Company  | Number of<br>HRSs |     |
|--|-------------------|-----|
| JXTG Nippon Oil & Energy   | 40                | 0   |
| Iwatani  | 17.5              | On  |
| Air Liquide Japan  | 4                 | Of  |
| Tokyo Gas  | 3                 |     |
| Toho Gas   | 2.5               | Ma  |
| Osaka Gas  | 2                 |     |
| Nippon Mobile Hydrogen Station Services  | 6                 | Tot |
| Seiryu Power Energy Co.,   | 4                 |     |
| Toyota Tsusho Air Liquide Hydrogen<br>Energy   |                   |     |
| Idemitsu Kosan, Saibu Gas<br>Chubu Gas, Seiryu Power Energy<br>Mie Hydrogen Station<br>Shikoku Taiyo Nippon Station<br>Oita EBL Hydrogen Station<br>Others | 1 to 2            |     |

| Туре     | Number of<br>HRSs |
|----------|-------------------|
| On-site  | 15                |
| Off-site | 46                |
| Mobile   | 39                |
| Total    | 100               |



7

# Features of retail HRSs



Ebina-Chuo Station by JXTG (Multi-Fuel) (Courtesy of JXTG)



Narita Station by Idemitsu Kosan (Narita Airport) (Courtesy of Idemitsu Kosan)

| Features                                    | Station   |
|---|---|
| Multi-Fuel<br>(Integrated gas station)      | ✓18 HRSs by JXTG  |
| Multi-Fuel<br>(Hydrogen, Gasoline, CNG,LPG) | ✓ Nissin HRS by Toho Gas  |
| Multi-Fuel (Hydrogen, CNG)                  | ✓2 HRSs by Tokyo Gas  |
| Multi-Fuel (Hydrogen, LPG)                  | ✓Otsu HRS by Iwatani  |
| Station with convenience store              | ✓2 HRSs by Iwatani  |
| Near the highway                            | ✓4 HRSs by JXTG<br>✓1 HRS by Toyota Tsusho                              |
| Airport                                     | ✓ Narita HRS by Idemitsu<br>Kosan<br>✓ Kansai Airport HRS by<br>Iwatani |



## Iwatani's Tokyo-Ariake Hydrogen Station for Bus Refueling



#### Tokyo-Ariake Hydrogen Station (Source: Iwatani's website)

Location: 1-8-5 Ariake, Koto-ku, Tokyo Area: 3,200 m2

**Main Features:** 

- 1. Hydrogen Supply System Liquid Hydrogen Storage
- 2. fueling Capacity FCV: 16 vehicles/h
- FC Bus: 4 buses/h
- 3. fueling time FCV: 3 min/vehicle
  - FC Bus: 15 min/bus
- 4. Cryogenic Pump Capacity: 80kg/h
  - In: 0.3MPa / Out: 82MPa
- 5. Storage
  - Volume: 300L x 8 System: 3-bank Switching System Max. Operating Pressure: 82MPa

# **2. HySUT Activities Hydrogen Quality Control** (FY2013-17 NEDO's R&D Program)

Establishment of Quality Control Guideline (HySUT-G 0001)
 Analysis cost reduction by development of abbreviated analysis methods



## Hydrogen Fueling Protocol (FY2013-17 NEDO's R&D Program)

Establishment of Fueling Performance Validation Guideline (HySUT-G 0003)
 R&D for fueling protocol technology



# **Regulations, Standards and Guidelines for HRSs**

#### **Laws and Regulations**

- High Pressure Gas Safety Act
- Security Regulation for General High Pressure Gas
- >Ordinance on Safety of Gas Containers
- Ordinance on Designated Equipment Inspection
- Ordinance on Safety of Industrial Complexes
- Fire Service Act
- Building Standards Act
- Industrial Safety and Health Act
- Act on the Prevention of Disaster in Petroleum Industrial Complexes and Other Petroleum Facilities
- Road Transport Vehicle Act
- Road Traffic Act
- •Act on Port Regulations

#### **Technical Standards**

- Exemplified standard
- Japan Industrial Standard (JIS)
- International Standard (ISO/TC197)
- The High Pressure Gas Safety Institute of Japan (KHK-S)
- Japan Petroleum
  Energy Center
  (JPEC-S)
- Japan Industrial and Medical Gases Association (JIMGA-S)

### Safety of HRSs

#### **Self-Guidelines**

**HySUT** 

- Quality Control (HySUT-G 0001)
- Hydrogen Metering (HySUT-G 0002)
- Fueling Performance Validation (HySUT-G 0003)
- Inspection Apparatus (HySUT-G 0004)
- HPIT\* (HySUT-G 0005)
- \* Hydrogen Powered Industrial Truck

#### Reliability of Retail HRSs

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# Number of FCVs and Refueling Data at retail HRSs

Number of FCVs

**Refueling Amount (kg/month)** 



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# 3. Technology Development for the Next Generation HRSs



HySUT

### **Construction of Hydrogen Technical Center for research on cost reduction of HRS system** (FY2015-17 NEDO's R&D Program)

| Equipment       | Specification   |
|-----------------|---|
| Hydrogen Source | Hydrogen Gas Cylinder Bundle(19.6MPa) x 3   |
| Compressor      | Capacity: 340Nm <sup>3</sup> /h, Pressure: 87.5MPa                                |
| Pressure Vessel | Max. Operating Pressure: 87.5MPa, Volume: 300L x 4<br>Material: CFRP (Type3)      |
| Dispenser       | Max. Operating Pressure: 87.5MPa<br>JPEC-S0003 Fueling, Direct fueling capability |



# **Location of Hydrogen Technical Center**





# **External View of Hydrogen Technical Center**





### Study on technologies for cost reduction of HRS system (1) at Hydrogen Technical Center (FY2017 NEDO's R&D Program)

Review of station equipment specification based on actual use condition at the spreading stage





# **Testing at Hydrogen Technical Center**



Dispenser



Back to back fueling



**Fueling to Testing Truck** 



#### Study on technologies for cost reduction of HRS system (2) Standardization of Modules (FY2017 NeV \* Program\*\*)

Standardization of device and control design specifications on a module basis



\* NeV: Next Generation Vehicle Promotion Center

\*\* Basic research on HRS construction subsidies for dissemination of FCVs (Feasibility study on cost reduction effect by standardization of modules and equipment design of HRSs)



- Standardization of specification and interface (facility, piping, wiring etc.)

- Reduction of design and construction costs
- Shortening of construction period from designing
- and ordering to completion
- Expansion of flexibility of equipment combination



## Study on technologies for cost reduction of HRS system (3) Standardization of design specification

Promotion of cost reduction by fueling capacity specification (new industrial standard category)



**R&D** Program



#### 4. Future Issues Hydrogen/FC Strategy Roadmap by METI (June 2014, Revised March 2016)



# Basic Hydrogen Strategy (Excerpt)

by the Ministerial Council on Renewable Energy, Hydrogen and Related Issues (Dec 2017)

![](_page_23_Figure_2.jpeg)

![](_page_23_Picture_3.jpeg)

# Thank you very much for your attention!

![](_page_24_Picture_1.jpeg)

This report contains the results of the programs supported by the New Energy and Industrial Technology Development Organization (NEDO).

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