Japan’s Approach to Commercialization of Fuel Cell / Hydrogen Technology

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Introduction of the world’s first commercially released FC Systems

PM’s new residence introduced the world’s first commercially released FC Systems (8th April, 2005).

The main participants from the Cabinet
- Prime Minister - Junichiro Koizumi
- Chief Cabinet Secretary - Hiroyuki Hosoda
- Minister of Economy, Trade and Industry - Shoichi Nakagawa
  (Official position at that time)

Panasonic  Ebara-Ballard
Expected Targets and Policies

**FCV**
- 2010: 50,000
- 2020: 5M
- 2030: 15M

**Stationary PEFC**
- 2010: 2.1GW
- 2020: 10 GW
- 2030: 12.5 GW

**Points of METI Budget for Fuel Cells (FY2006)**


1. **Promotion of FC & Hydrogen Research**
   - A New National lab. for hydrogen material R&D (US$ 14.4 million) (New)
   - “FC-cubic” National lab. (US$ 10.2 million)
   - R&D on PEFC (US$ 49.2 million)
   - Developing excellent human resources (US$ 0.4 million) (New)

2. **Creation of the world's first real market for stationary FCs**
   - R&D on PEFC - *Clarification of deterioration mechanism*
   - Large-scale stationary fuel cell demonstration project (US$ 28.0 million)
   - Support of FC supporting-industry (A part of US$ 55.9 million)

3. **Development of fuel cell applications**
   - Mobile application and niche market R&D (US$ 3.4 million) (New)

1 US$ = 118 Yen
The liaison committee of ministries and agencies concerned with commercialization of fuel cells*

In October 2002, the government decided to complete, by the end of FY2004, a review of 28 relevant items of six laws in response to requests from industry, while considering the special characteristics of hydrogen. The review of regulations amounting to 28 items of six laws was fully completed by the end of FY 2004.


Review of Regulations (1)

The review of regulations amounting to 28 items of six laws was fully completed by the end of FY 2004, removing legal and regulatory barriers to the creation of the initial market.

Five items that should be reviewed by the end of FY2002, avoiding obstacles to the experimental marketing of FCVs.

As a result of the examination, there are no obstacles to experimental FC introduction.

23 items that should be reviewed by the end of FY2004, when the creation of the initial market for fuel cells is assumed.

By the end of FY2003, collection of fundamental data and Codes & Standards proposals were chiefly conducted by the private sector.

The government confirmed the safety and took necessary measures such as technical standards revision by the end of FY2004.

Review of Regulations (2)

Example of Fuel Cell Vehicle

Individual Authorization

Type Certification

Example of Hydrogen Station

11m

8m

17m

H2

H2

6m

4m
Review of Regulations (3)

Example of Stationary Fuel Cell

Before

After

Chief Engineer

FC

3m

Nitrogen gas container

FC

0.15m

FC Demonstration Framework

PEFC System Demonstration Project (METI)

FCV Demonstration Study [JARI]

Demonstration Study of Hydrogen Station [ENAA]

Large-Scale Stationary FC Demonstration Project [NEF]

JARI: Japan Automobile Research Institute
ENAA: Engineering Advancement Association of Japan
NEF: New Energy Foundation
FC Bus Demonstration at Aichi Expo

- **Toyota / Hino FCHV-Bus**
- **Seto Area**
- **Nagakute Area**
- **Nagakute - Seto 4.4 km**

**Vehicle**
- FCHV-BUS (8 units)

**Cumulative range**
- 124,500 km

**Term**
- Mar. 25-Sep. 25, 2005

**Passengers**
- 1.0 million people

**Hydrogen consumption**
- 11.43 tons

**Energy consumption rate**
- 3.30 km/L (diesel equivalent)

**CO₂ reduction**
- 169.7 ton
Analysis result of energy consumption rate

Compared with 2004, 2005 shows better energy consumption rate.

### April - Dec. 2004 and 2005 FCV Comparison results (without Vehicle weight modification)

<table>
<thead>
<tr>
<th>Vehicle speed [km/h]</th>
<th>20</th>
<th>40</th>
<th>60</th>
<th>80</th>
<th>100</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
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Gasoline density : 0.729 kg/L  
Gasoline energy (LHV) : 45.1 MJ/kg  
Hydrogen energy (LHV) : 120 MJ/kg

April - Dec. 2004  
(Data number = 516)

April - Dec. 2005  
(Data number = 1787)

"Well to Wheel" Calculation Results
Summary (Efficiency)

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Input primary energy per 1km driving (10・15 Mode) Unit: MJ/km</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>FCHV current</td>
<td></td>
</tr>
<tr>
<td>FCHV future</td>
<td></td>
</tr>
<tr>
<td>Gasoline</td>
<td></td>
</tr>
<tr>
<td>Gasoline HV</td>
<td></td>
</tr>
<tr>
<td>Diesel</td>
<td></td>
</tr>
<tr>
<td>Diesel HV</td>
<td></td>
</tr>
<tr>
<td>CNG</td>
<td></td>
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<tr>
<td>Battery EV</td>
<td></td>
</tr>
</tbody>
</table>

FCHV current, "hydrogen station" and "FCHV" data are calculated by using JHFC demonstration top, while other data are calculated by published top.

FCHV future; calculated by using FC Stack Sys future efficiency 60% and published top.

Electric power sources: *Japan Mix*
**Large-Scale Stationary Fuel Cell Demonstration Project**

Provide feedback on various demonstration data for research and development. Step up learning curve toward mass production and inspection. Price target (in 2008): 1.2 million yen / system (10.2 thousand US$ / system)

Breakdown of installation (FY2005)

<table>
<thead>
<tr>
<th>Location</th>
<th>Energy supplier</th>
<th>Installation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hokkaido</td>
<td>Tokyo Gas</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Tohoku</td>
<td>Osaka Gas</td>
<td>30</td>
<td>90</td>
</tr>
<tr>
<td>Kanto</td>
<td>Nippon Oil</td>
<td>100</td>
<td>300</td>
</tr>
<tr>
<td>Chubu</td>
<td>Japan Energy</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>Kinki</td>
<td>Idemitsu</td>
<td>50</td>
<td>150</td>
</tr>
<tr>
<td>Shikoku</td>
<td>Kyushu Oil</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Chugoku</td>
<td>Taiyo Oil</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Kanto</td>
<td>Toho Gas</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Kinki</td>
<td>Saibu Gas</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Chugoku</td>
<td>Iwatani</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Kanto</td>
<td>Cosmo Oil</td>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>Chugoku</td>
<td>Showa Shell Sekiyu</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Kanto</td>
<td>Kamata (LemonGas)</td>
<td>5</td>
<td>15</td>
</tr>
</tbody>
</table>

In FY2005, up to 8 million yen (60.8 thousand US$) per stationary FC for household is subsidized to the energy supplier.

**Web site**: http://happyfc.nef.or.jp

**A New National lab. for hydrogen material R&D**

In order to realize a hydrogen energy society, the new laboratory aims to establish basic technologies to use hydrogen more safely and conveniently.

1.7 Billion Yen (US$ 14.4 Million) Requested (FY 2006)

A new national lab. will be established on July 1st, 2006.

Aiming at a unique research base for hydrogen material in the world.

Prof. Yukitaka Murakami (Kyushu University) is expected to become the director of the new national laboratory.

Kyushu University (Ito campus)
A New National Lab. for basic FC R&D

Polymer Electrolyte Fuel Cell Cutting-Edge Research Center
(FC³ = FC-cubic)

Established on April 1, 2005.
- Dr. Hiroshi HASEGAWA, who has transferred from Toyota Motor Co., became the director of FC-cubic.
- Budget: 1.2 Billion Yen (US$ 10.2 Million) Requested for FY 2006
  (1 Billion Yen (US$ 8.5 Million) for FY 2005)

METI/NEDO has started an International Joint Research Project with grants of up to 30 million Yen (254 thousand US$) per project from FY2004.
In FY2005, 9 joint research activities were adopted from 38 applications in December.

Research is conducted by a diverse variety of partners from 7 counties: Fribourg University (Switzerland), Rutgers University (The State University of New Jersey), Berkeley Research Associates, Inc., The Naval Research Laboratory (USA), University of Bordeaux 1 (France), Institute for Energy Technology (Norway), Institute of Physical Chemistry of Polish Academy of Science (Poland), National University of Singapore (Singapore), Membrane Reactor Technologies Ltd., The University of British Columbia (Canada).
- International Partnership for the Hydrogen Economy (IPHE) -

1. Purpose
To serve as a mechanism to organize and implement effective, efficient, and focused international research, development, demonstration, common codes and standards, and commercial utilization activities related to hydrogen and fuel cell technologies.

2. IPHE Partners members
Australia, Brazil, Canada, China, European Commission, France, Germany, Iceland, India, Italy, Japan, Republic of Korea, New Zealand, Norway, Russian Federation, United Kingdom, United States.

3. Results and schedule
November 2003: Steering Committee Meeting (US)
March 2004: Implementation-Liaison Committee Meeting (Germany)
May 2004: SC Meeting (China) - Beijing Action Plan
September 2004: ILC Meeting (Iceland) - Reykjavik Action Plan
January 2005: SC Meeting (France) - IPHE Scoping Papers
March 2005: ILC Meeting (Brazil)
September 2005: SC Meeting (Kyoto, Japan) - Evaluation of IPHE Project
January 2006: ILC Meeting (China)
March 2006: SC Meeting (Canada)

Thank you very much for your kind attention!

More Information....
- FCCJ: http://fccj.jp/index_e.html
- JHFC: http://www.jhfc.jp/e/index.html
- ENAA: http://www.enaa.or.jp/EN/index.html