Country Update – Japan

Research, Development, and Deployment of Fuel Cells and Hydrogen in Japan

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Fuel Cell/Hydrogen Technology in Government Policies

-Science and Technology Basic Plan (Mar. 2006)
- New National Energy Strategy (May 2006)
- Basic Energy Plan (Mar. 2007)
- Next-Generation Automobile Fuel Initiative (May 2007)
- Cool Earth – Innovative Energy Technology (Mar. 2008)

Selection of 21 technologies as innovative technologies that should be given higher priority

- **"Hatoyama Initiative" (22 Sep. 2009)**

"Japan will aim to reduce its emissions by 25% by 2020, if compared to the 1990 level." Statement by Prime Minister Yukio Hatoyama at UN Summit on Climate Change

"Needless to say, solar panels, fuel cells and various other types of green technology need to be mobilized. Hydrogen energy is also likely to become available in the future."

Press Conference by PM Yukio Hatoyama following his attendance at meetings at the UN and the Pittsburgh G20 Summit

21 Key Innovative Energy Technologies

Efficiency improvement | *Low carbonization*

Supply side

Demand side

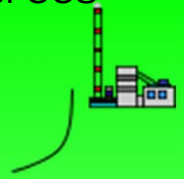
Cross sectoral

Power Generation

1. Efficient LNG-fired power plants

2. Efficient coal-fired power plant

3. CCS



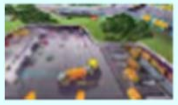
4. Innovative solar power

5. Advanced nuclear power

6. Superconducting power transmission

Transport

7. ITS



8. FCV

9. PHEV/EV

10. Biofuel

Industry

11. Innovative materials/ manufacturing process

12. Steel making process with Hydrogen

Residences/ Buildings

13. Efficient houses/buildings

14. Efficient lighting

15. Fuel Cell for residential use

16. Efficient Heat pumps

17. Efficient IT devices/networks

18. HEMS/BEMS/Regional EMS

19. Power storage

20. Power electronics

21. Hydrogen production/storage/ transport

3. CCS (restated)

Framework for R&D of Hydrogen and Fuel Cells under METI in Japan

METI
(Hydrogen & Fuel Cell Promotion Office)

↔ Other Ministries

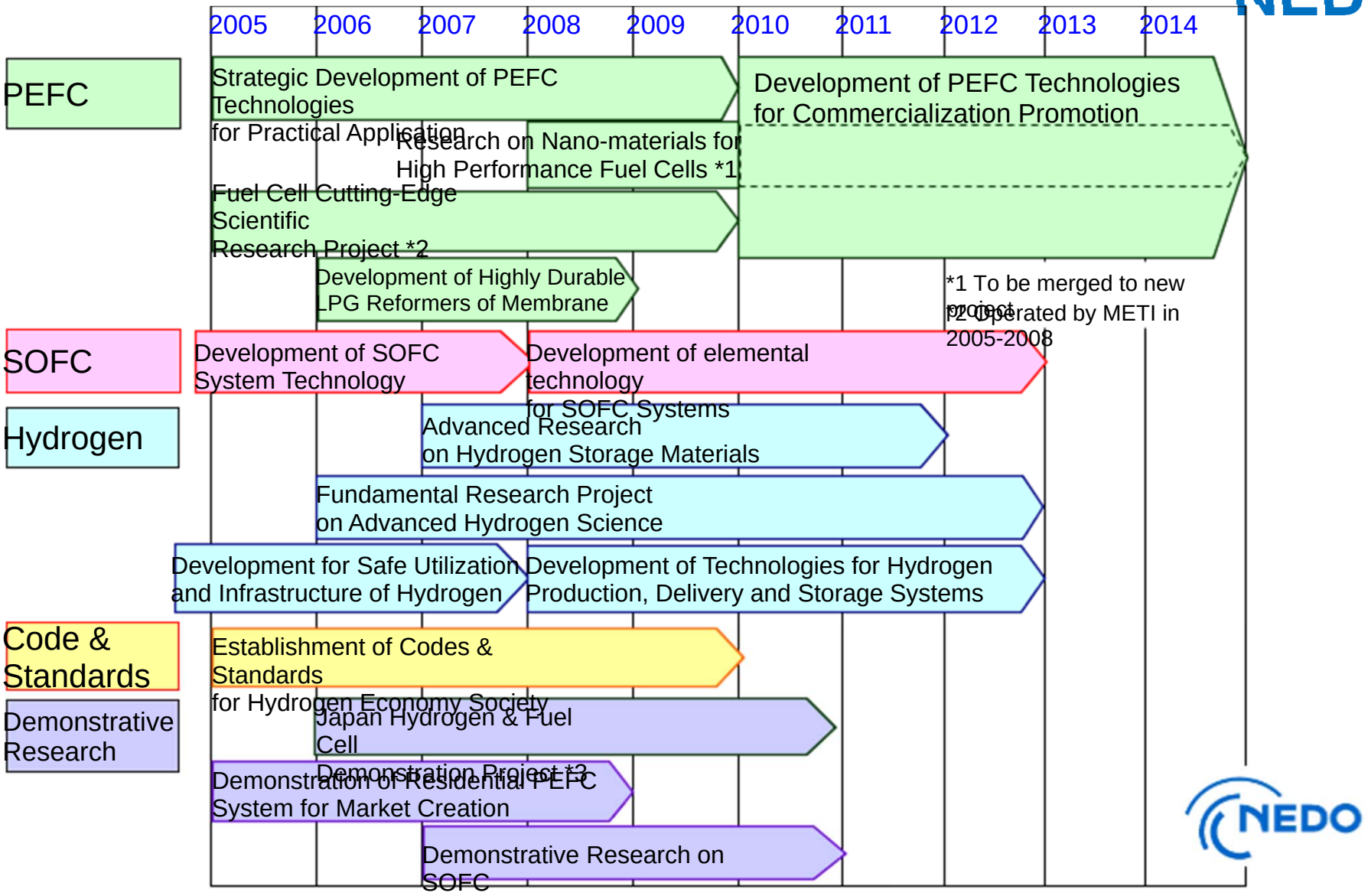
↓ Funding

NEDO
New Energy and Industrial Technology Development Organization
PEFC programs, SOFC programs, hydrogen storage materials program, hydrogen science project, JHFC project

↓ Funding, operation & management

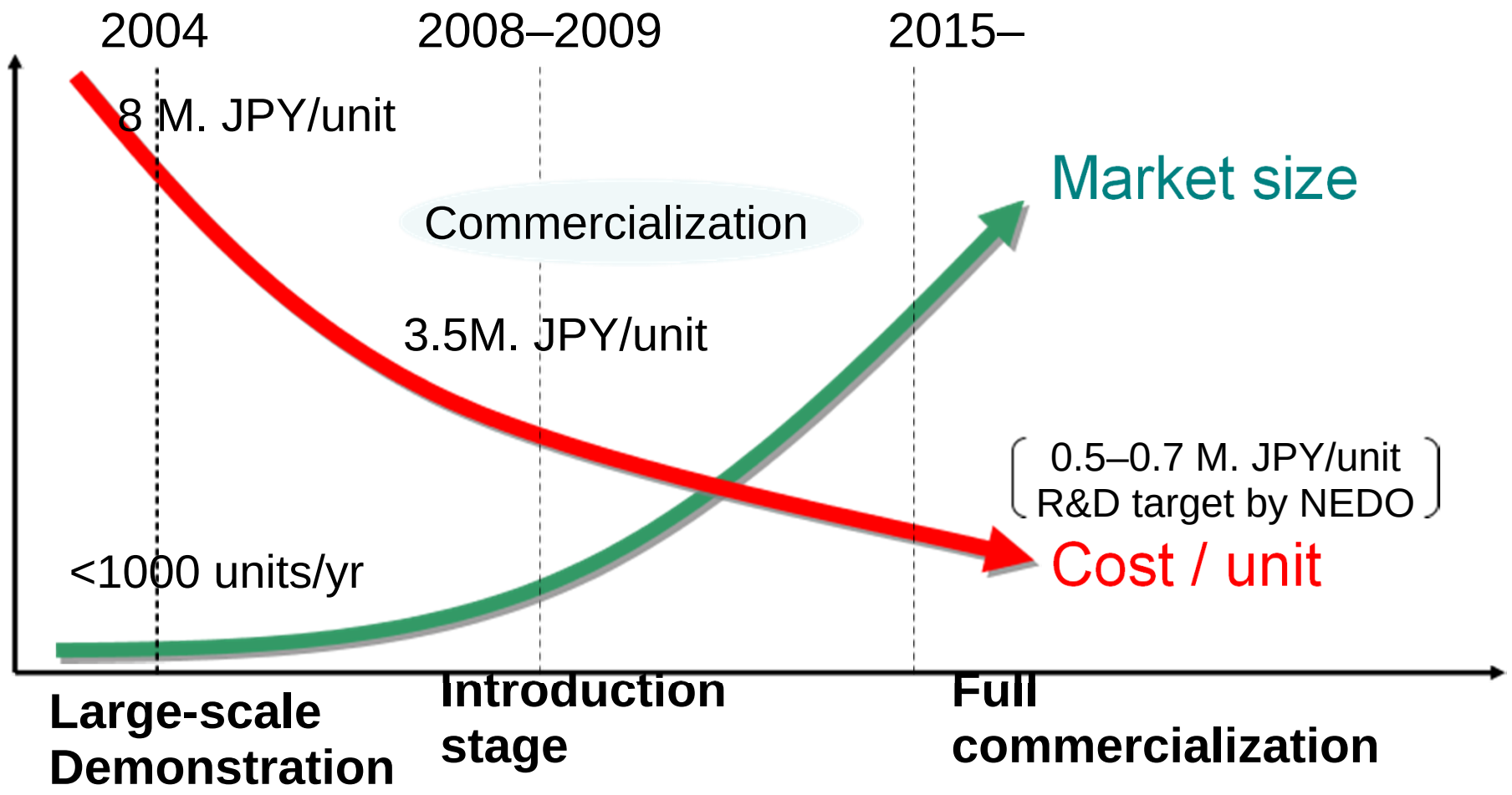
Universities, companies, national lab, etc.

R&D on Fuel Cell and Hydrogen Technologies by NEDO



Scenario of Market Creation for Residential Full

Large-scale Demonstration project → **Market creation by government support (subsidization)** → **Full commercialization self sustained and growing market**



Commercialization of Residential Fuel Cells

Residential fuel cell systems commercialized in 2009.

- 0.7–1.0 kW PEFC + heat recovery (CHP)
- Three manufactures
- Subsidization program initiated

1/2 of users' costs (system + installation) up to 1.4M JPY

5,269 units were offered **(as of Mar. 2010)**

(3,307 by demonstration project in 2004-2008)

ENE·FARM

"ENE-FARM" - The unified logo for Residential Fuel Cells

SOFC Demonstration Project

To collect data and experience of practical operation of residential SOFC systems.

- Degradation by impurity
- Influence of current density, operating temperature

- Troubles of equipment

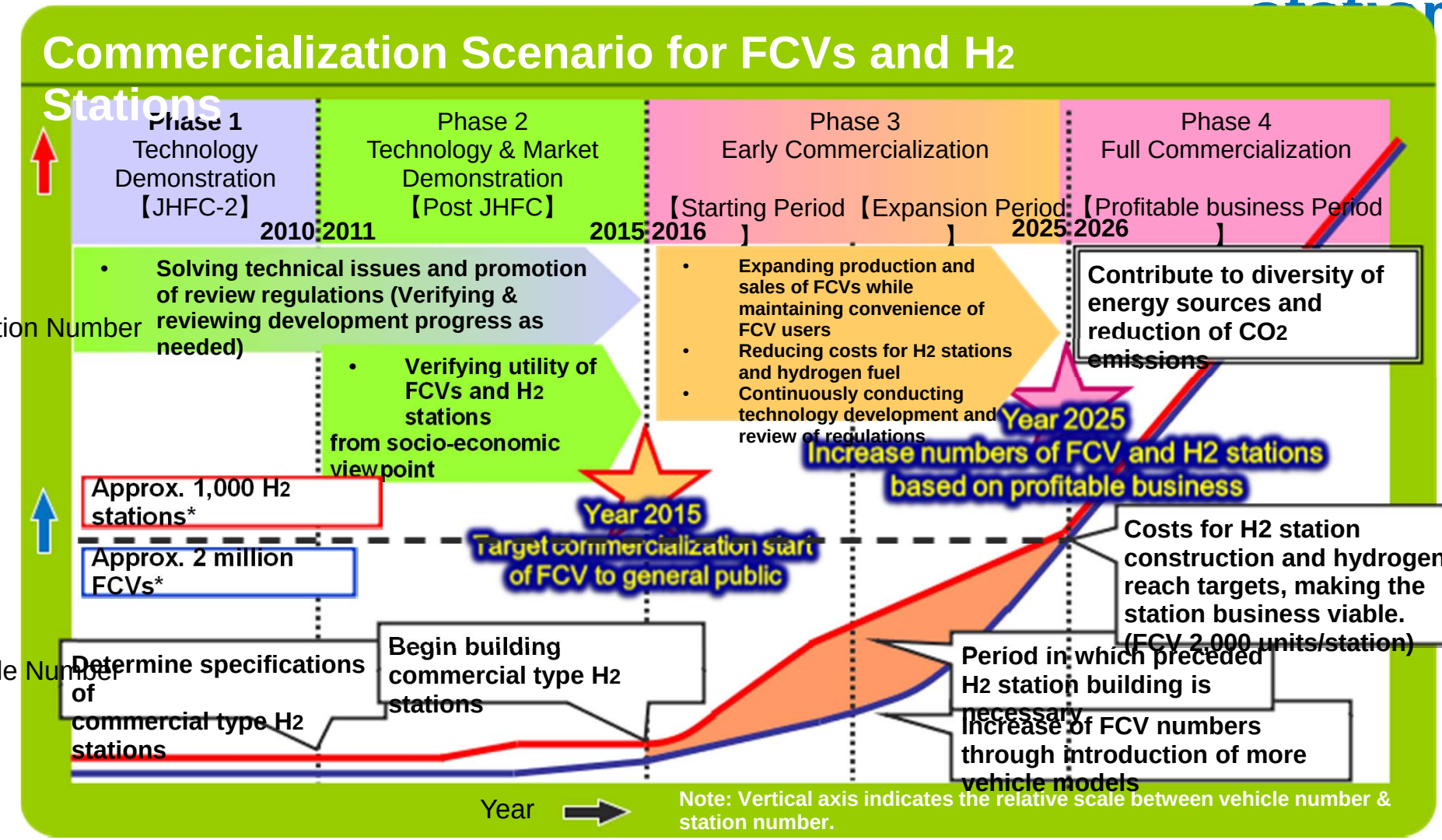
⇨ Durability improvement by modification of cell stack structure and system design

Project period: FY2007-2010

Characteristics of SOFC

- High efficiency of electric power generation
- No expensive catalysts (Pt etc.) needed
- Mature ceramic technology applicable
- Scale-up

Commercialization of FCV and hydrogen stations



* Precondition: Benefit for FCV users (price/convenience etc.) are secured, and FCVs are widely and smoothly deployed

Source : FCCJ

2nd milestone is set in 2025 to contribute to reduction of CO2 emissions.
Approximately 1,000 H2 stations and approximately 2 milliion FCVs are set as common

Japan Hydrogen & Fuel Cell Demonstration Project (JHFC Phase II)

- To clearly show energy-saving effect and environmental im
- To collect data for codes & standards development and certification practices

- Project Year: 2006–2010
- Demonstration of FCV under actual circumstances
- Hydrogen stations: upgraded to 70 MPa
- Demonstrative operation of various means of H2 production and supply and its verification
- Awareness & education: To raise public awareness regarding FCVs and H2 Statio

The Research Association of Hydrogen Supply/Utilization Technology (HySUT)

Association of private companies on H2 supply & utilization

- Verify hydrogen supply business by demonstrative research in societies
- Installations and operations of hydrogen infrastructures
- Operations and maintenance of hydrogen utilization such as fuel cell vehicles

- Members: 13 companies

Oil Utilities:
Nippon Oil, Idemitsu Kosan, Cosmo Oil, Japan Energy, Showa Shell Sekiyu
Gas Utilities:
Tokyo Gas, Osaka Gas, Toho Gas, Saibu Gas
Other companies (Industrial gas suppliers, hydrogen stations):
Iwatani, Taiyo Nippon Sanso, Air Liquide Japan, Mitsubishi Kakoki Kaisha

- Established on July 31, 2009
- FY2009–2015

Basic Research Programs for Innovation in Science of Hydrogen & Fuel cell Technologies

Back to the basic

Basic research programs for innovation and breakthrough

Polymer Electrolyte Fuel Cell Cutting-Edge Research Center

Project period: FY2005–2009
Head: AIST (FC-Cubic)

Research Center for Hydrogen Industrial Use and Storage

Project period: FY2006–2012
Head: Kyushu Univ. and AIST Kyushu

Advanced Fundamental Research on Hydrogen Storage Materials

Project period: FY2007–2011
Head: AIST

Basic materials research for High Performance Fuel Cell

Project period: FY2008–2014
Head: Yamanashi Univ.

Hiper-FC

Concluding Remarks

- Residential fuel cell systems have been commercialized
  - Supported by subsidization by government
  - **5,269 units were offered (as of Mar. 2010)**
- Residential SOFC is under demonstration
- **2nd milestone of FCV and hydrogen station is set in 2025 to contribute to reduction of CO2 emissions.**
  - **Approx. 1,000 H2 stations and approx. 2 million FCVs are set as common perspective.**
- Basic research programs for innovation toward full commercialization of residential fuel cells ***/*** commercialization of FCV