

# Country Update – Japan

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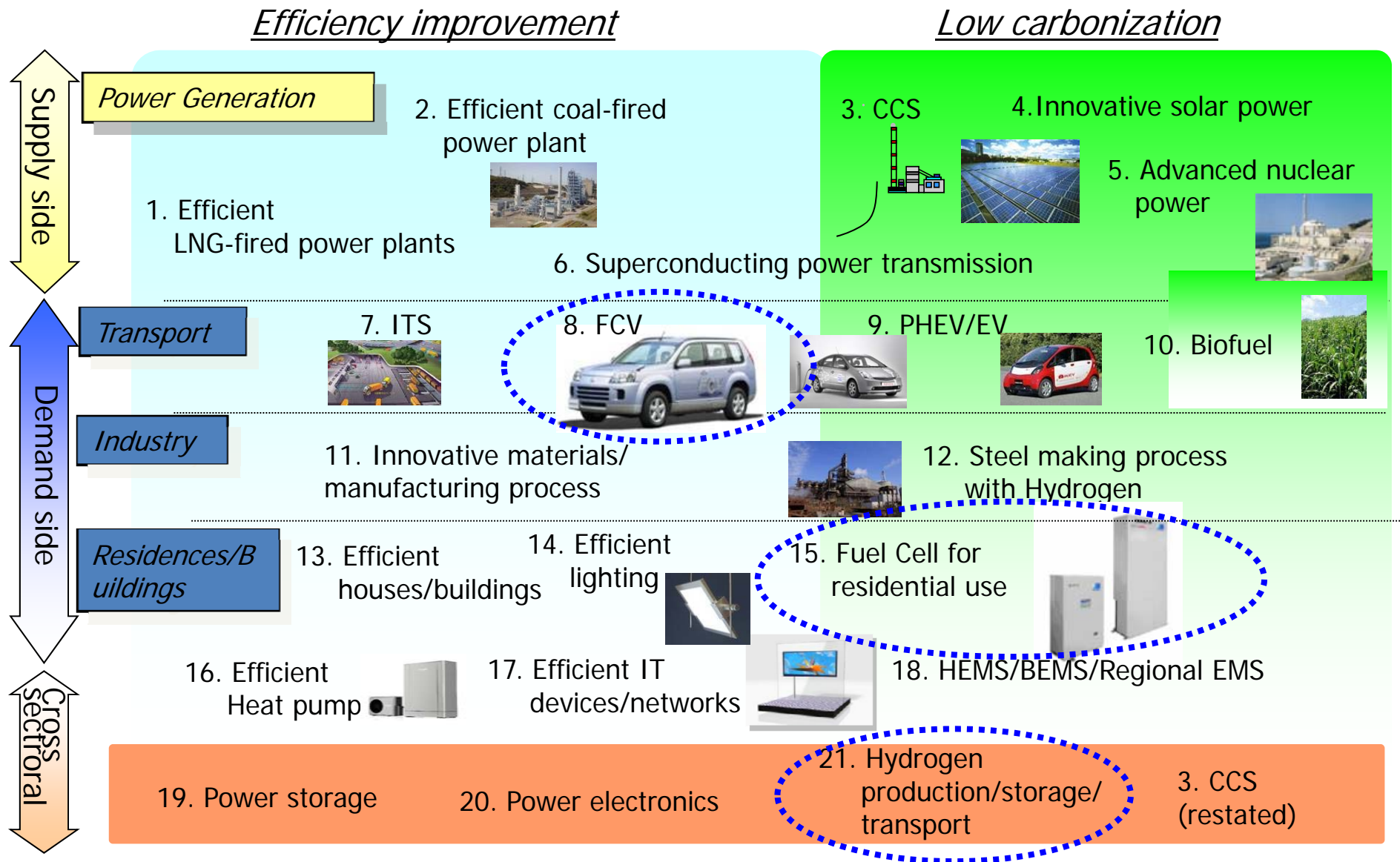
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Presented at 12<sup>th</sup> IPHE Steering Committee Meeting, Washington DC, USA

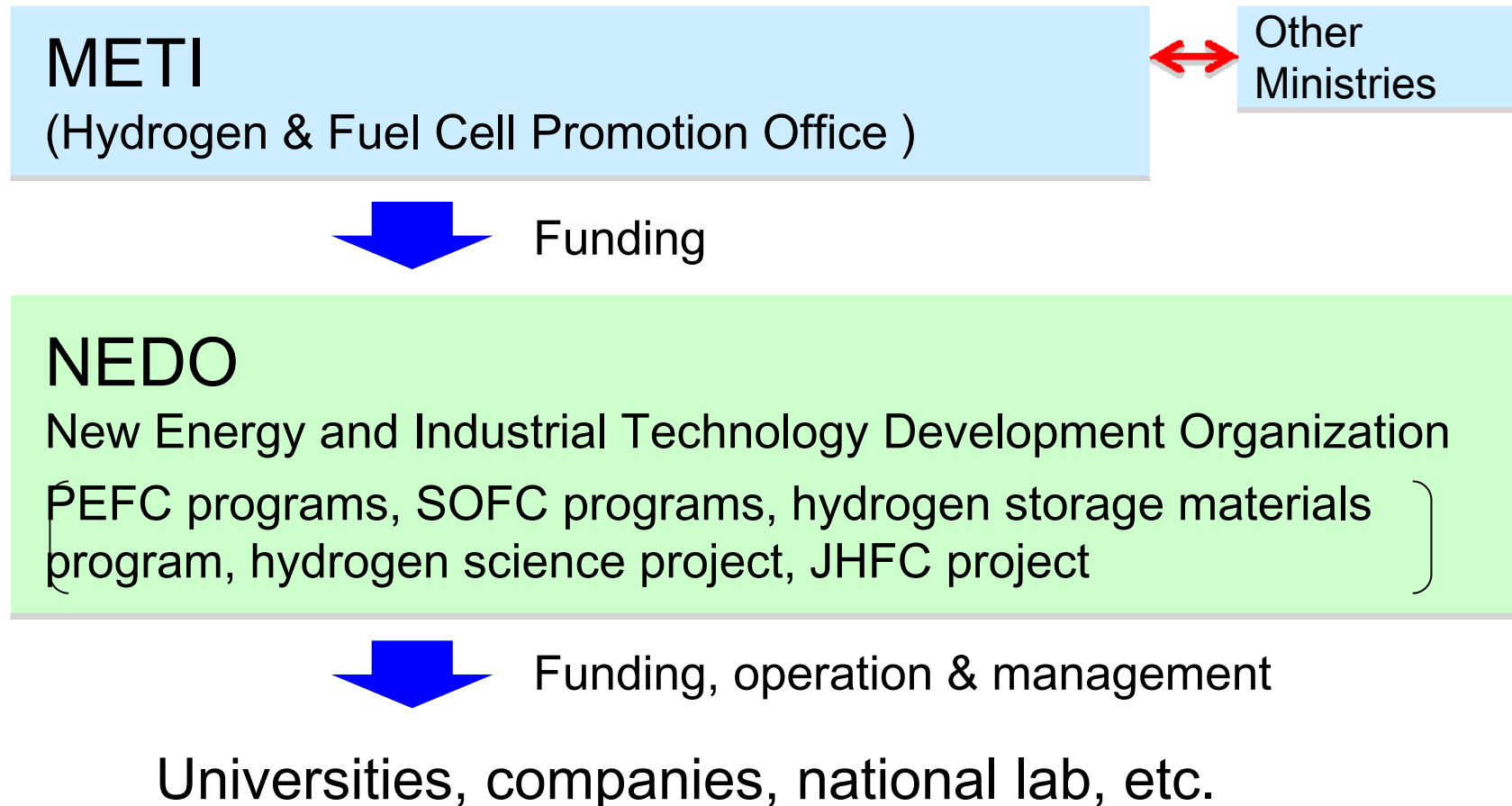
# Fuel Cell/Hydrogen Technology in Government Policies

- 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

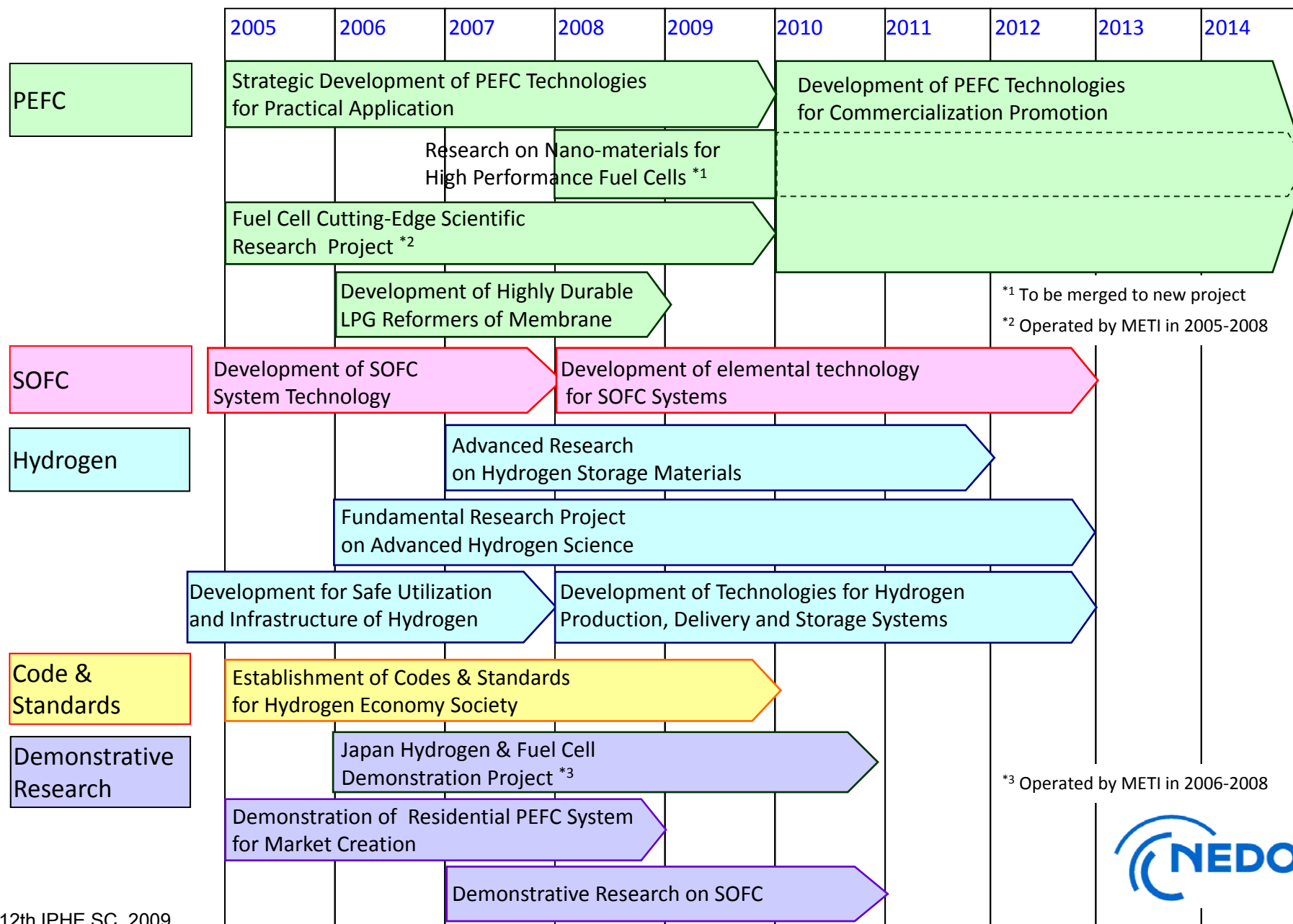
# 21 Key Innovative Energy Technologies



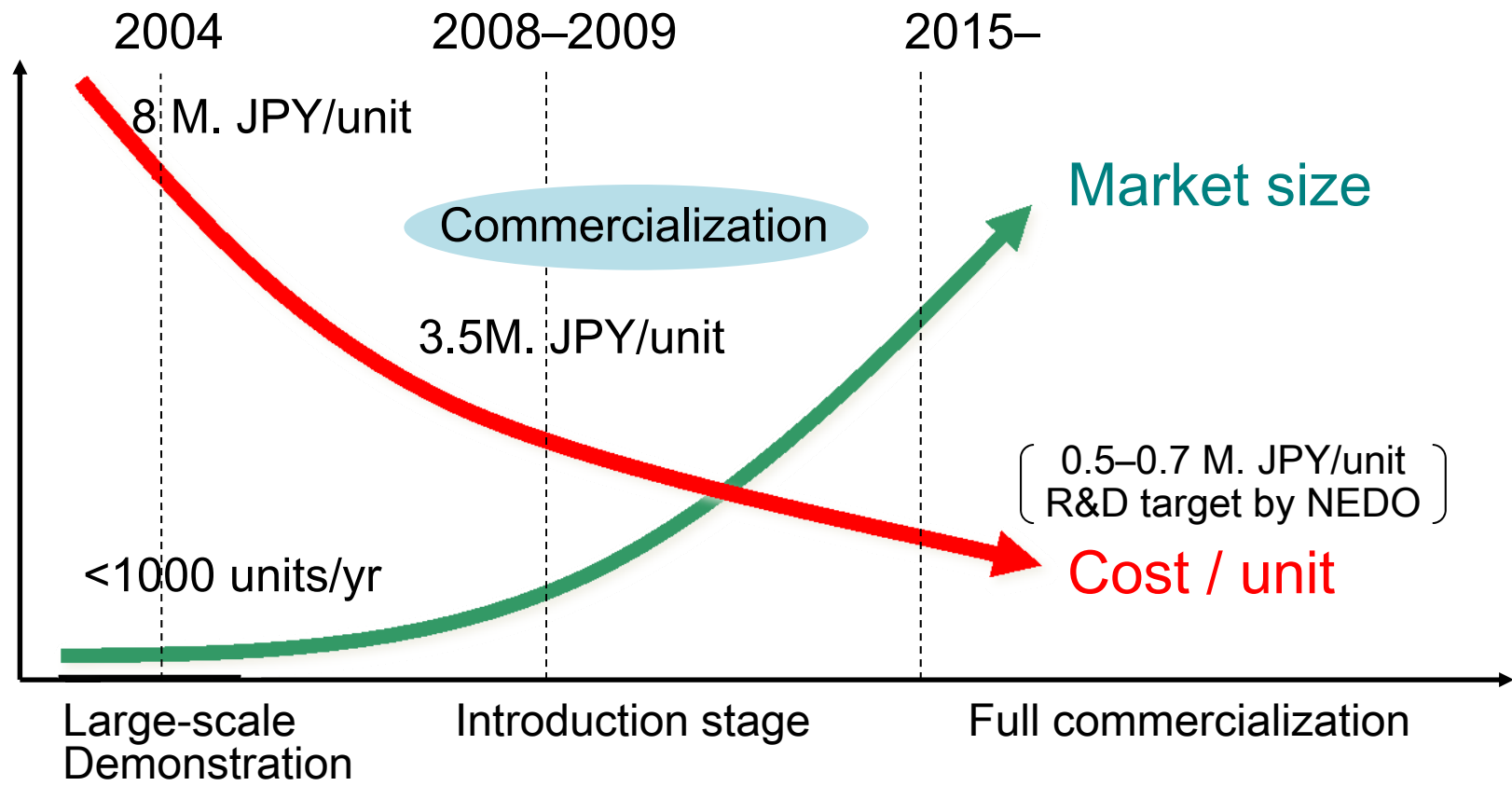
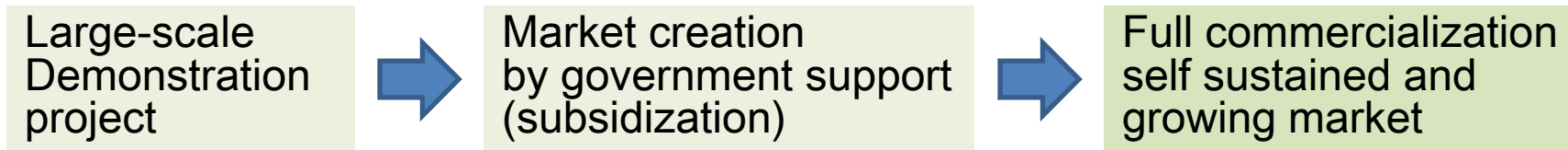
# Framework for R&D of Hydrogen and Fuel Cells under METI in Japan



# R&D on Fuel Cell and Hydrogen Technologies by NEDO



# Scenario of Market Creation for Residential Full Cell



# 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

1,500 units installed (as of Sep. 2009)

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



“ENE-FARM” - The unified logo for Residential Fuel Cells



# Commercialization of Residential Fuel Cells

Production lines are working at three manufactures

“The first shipping” ceremony at Panasonic in Shiga Pref. on July 1, 2008.



“The first shipping” ceremony at ENEC in Gunma Pref. on July 1, 2009.



# 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



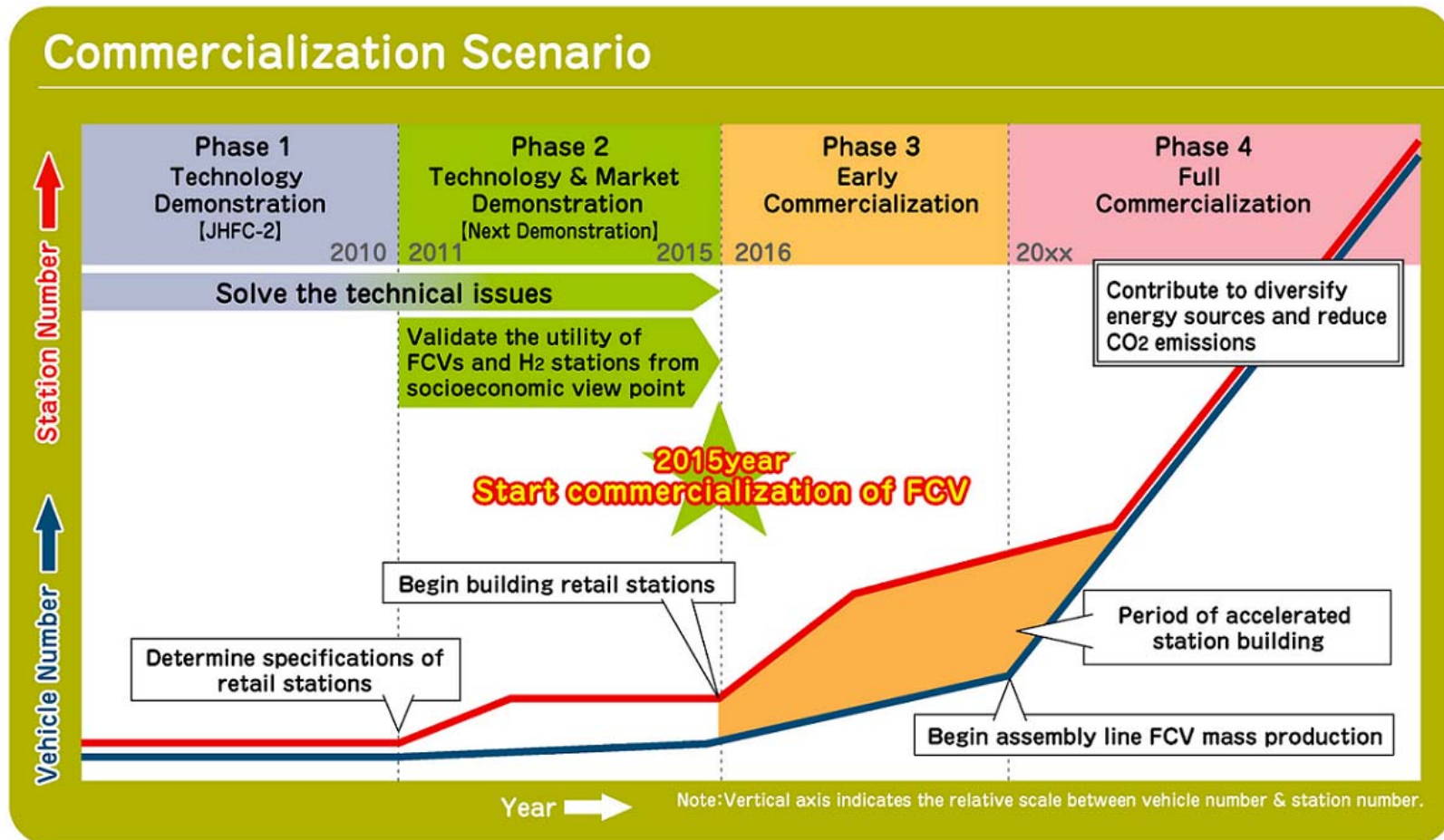
Durability improvement by modification of cell stack structure and system design

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



Leading automakers in and outside Japan and Japanese energy companies have agreed on a scenario which sees commercialization of fuel cell vehicles (FCVs) and hydrogen stations beginning in 2015.

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

- To clearly show energy-saving effect and environmental impact
- 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 H<sub>2</sub> production and supply and its verification
- Awareness & education: To raise public awareness regarding FCVs and H<sub>2</sub> Stations



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

Association of private companies on H<sub>2</sub> 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**



# Advanced basic technology for hydrogen storage materials

Establish compact and highly-efficient hydrogen storage/delivery technology through revolutionary performance improvements of hydrogen storage materials

Key: increase of adsorption capacity in hydrogen storage material

- 5 teams under Project Leader, Dr. Akiba (AIST) Metal Hydrides, hydrides with light elements, materials science, computational science, neutron scattering
- Collaboration with US labs, e.g. Los Alamos National Laboratory
- J-PARC (spallation neutron source): in-situ measurements under hydrogen
- Spring-8 (synchrotron radiation source): analysis on hydrogen-Metal interaction under high-pressure



J-PARC (source: website of J-PARC)



SPring-8 (source: website of SPring-8)

Dr. Akiba (AIST), received "Herbert C. Brown Award for Innovations in Hydrogen Research" in 2008.

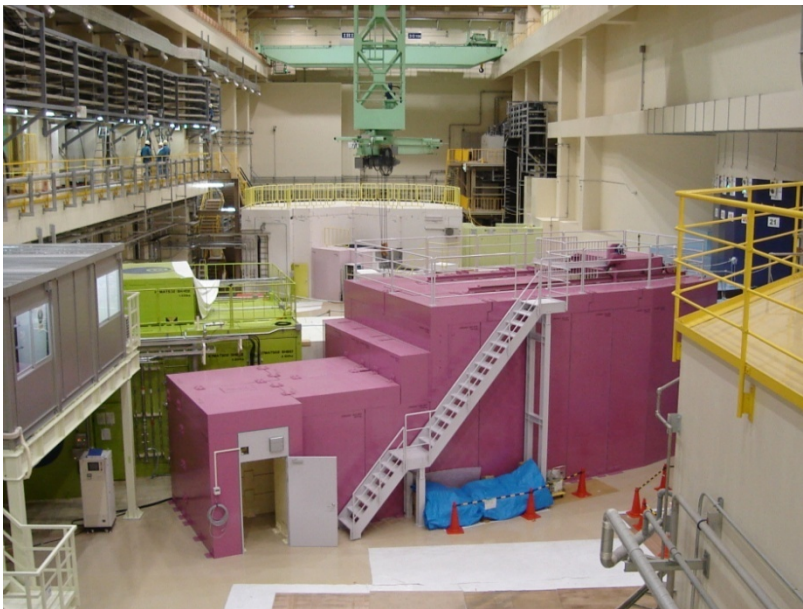
# Advanced basic technology for hydrogen storage materials



Total scattering spectrometer “NOVA” was constructed in Spallation Neutron source, J-PARC in 2009.

Commissioning works are underway.

In-situ measurements under  $H_2$  environment will be available.



# Basic materials research for High Performance Fuel Cell

HiPer-FC

- Development of high performance PEMFC based on the state-of-the-art science.
- Materials researches based on the advanced analysis of reaction and degradation with nanometer scale.

Reaction and degradation mechanism  
+  
Nano-technology



Material development  
Mechanism analysis

73 researchers from 3 universities and 6 companies

Fuel Cell Nano-materials Center

- Constructed in Univ. of Yamanashi in August 2009.
- Prototype manufacturing, testing, and analysis of electrode catalysis and electrolyte membranes are possible.



Fuel Cell Nano-materials Center



# Concluding Remarks

- Residential fuel cell systems have been commercialized  
+ Supported by subsidization by government
- Residential SOFC is under demonstration
- Basic research programs for innovation toward  
    ( full commercialization of residential fuel cells )  
    commercialization of FCV