Japan’s Green Innovation Policy

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1. Global Challenges
Global CO2 emissions increased by almost 40% from 1990 to 2007, and are forecasted to reach about 2 times as much as 2007 by 2050, mainly due to the increase in developing countries.

43% of global CO2 emissions are covered by OECD.

Prospect of Global CO2 Emissions

Regional Shares of CO2 Emissions (2008)

OECD 43.0%

China 22.3%

Asia 10.3%

Latin America 3.0%

Africa 3.0%

Middle East 5.1%

Bunkers 3.5%

Former Soviet Union 8.3%

Europe 0.9%

Non-OECD

(Note: IEA; Key World Energy Statistics 2010)
“Natural Resource Constraints” should be solved through world-wide cooperation

Confirmed reserves and reserves to production ratios of fossil fuel

- **Oil**
  - Total World: 1333.1 thousand million barrels
  - OECD: 90.8 thousand million barrels
  - Years: 45.7

- **Natural gas**
  - Total World: 187.49 trillion cubic meters
  - OECD: 16.18 trillion cubic meters
  - Years: 62.8

- **Coal**
  - Total World: 826,001 million tons
  - OECD: 352,095 million tons
  - Years: 174

Source: BP Statistical Review of World Energy June 2010
“Aging” has been accelerating globally

- Working Population in Asia will peak out in 2015.
"Innovation" is the Key for the Solution

Global Challenges

Global Warming

Natural Resource Constraints

Aging

Innovation is the Key for the Solution
New Growth Strategy (Cabinet Approval in June, 2010)

Aims:

- GDP growth rate: Increase nominal growth to over 3% and real growth to over 2% (average by FY2020)
- Unemployment: Reduce the unemployment rate to the 3.0% - 4.0% range (medium term)
“Green Innovation” to address “Global Warming”

- Innovative technologies are essential to halve global greenhouse gas emissions by 2050.

[Contribution of emissions reductions options in the BLUE Map Scenario of ETP 2008, between 2005 and 2050]

CO2 emissions in 2050: 62 G t

CO2 emissions in 2005: 28 G t

CO2 emission goal in 2050: 14 G t

Required CO2 reduction: 48 G t

Source: IEA Energy Technology Perspective 2008
“Life Innovation” to address “Aging Society”

- Innovative technologies are needed to construct a sustainable society against the decrease in working population.

Life-Support Robotics

Minimally-Invasive Therapy

Telemedicine system

Regenerative Medicine

- ES cell
- iPS cell
- Muse cell
- (other cells)

Measurement
Cell data
IT Analysis
2. R&D Trends and Future Innovation Policy in Japan
R&D in the past three decades in Japan

- Japan’s rapid development before 1990 had been led by technological improvement.
- Since 1990, technological improvement has slowed down and contributed less to economic growth.

Source: JIP database 2008
R&D Efficiency in the world

- TFP growth in Japan has fallen behind other states since 1995.
- Return on R&D investment in Japanese private sector has experienced more severe decline than that in others’.
R&D Investment in the world

- Gross domestic expenditure on R&D in Japan is the second largest in the world.
- Gross domestic R&D expenditure per GDP (3.8% in 2008) has been maintained at the top-level among major economies.

Gross Domestic Expenditure on R&D
(Nominal, PPP exchange rate)
(billion dollars)

Gross Domestic R&D Expenditure per GDP
(%)
Higher specialization and complexity in R&D elements make it difficult for each private sector to achieve innovation by its own resources only.
• Growth in emerging markets is more rapid than that in developed markets.
• Private sector should break into emerging markets.

Market growth in the world

Source: World Economic Outlook Database, April 2010
Japan’s governmental R&D expenditure has less contribution to its gross domestic expenditure on R&D.

Governmental Expenditure per Gross Domestic Expenditure on R&D

Source: OECD; Main Science and Technology Indicators 2009/2
* Germany: 2007, other countries: 2008
Importance of Government R&D Investment

◆ Expansion of government R&D investment in the middle- and long-term
◆ Intensification of R&D for cross-sectoral base technologies that are indispensable for solving the world-wide problems

Improvement of R&D Platforms to Create Innovation and Promote its Practical Use

◆ Practical collaboration between industries and universities
◆ Promotion of social demonstration of new technologies and systems
◆ Promotion of International Standardization Activities
◆ Systematic Assessment and/or Certification for new technologies
◆ Readjustment of regulations and systems for new technologies
Government should improve R&D platform to create innovation.

R&D for Value-creating

- **Private Sector**
  - Advanced R&D
  - Product Development
  - Business Model
  - Patent Strategy

- **Support**
  - R&D for Common fundamental Technology
  - Industry-Academia Collaboration
  - Technology Demonstration
  - International Standardization

- **Government**
  - Innovative Platform building

- **Commercialization**

- **Solution for global Problems**
Improvement of R&D Platforms to Create Innovation

- Focus on “Green Innovation” and “Life Innovation”
- Expand government R&D investment onto the fundamental technology
- Create Open-Innovation bases
- Enhance collaboration between industries and academia
- Promote International Standardization Activities
3. Japan’s Green Innovation Policy
New Growth Strategy (Cabinet Approval in June, 2010)

**Growth driven by Japan’s strengths**

### Environment & energy

**Principal measures**
- Putting Japan’s world-leading technology to use
- Toward becoming the world’s top environment and energy power through a comprehensive policy package
- Growth from green innovation and securing support resources
- Lifestyle reforms through improving the comfort and quality of life, etc.

**Targets to reach by 2020**
- Create over ¥50 trillion in new markets and 1.4 million new jobs
- Reduce worldwide greenhouse gas emissions by 1.3 billion tCO2e using Japanese technology

### Health (medical & nursing care)

**Targets to reach by 2020**
- Foster industries that meet demand and create jobs:
  - Roughly ¥50 trillion in new markets and 2.8 million new jobs

**Principal measures**
- Turning medical, nursing care, and other health-related industries into growth-driving industries
- Promoting R&D of innovative pharmaceuticals and medical and nursing care technologies from Japan
- Boosting expansion to Asian and other overseas markets
- Promoting the availability of barrier-free housing

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**Notes:**
- The document features a table summarizing the targets and measures for growth in different sectors.
- The left side focuses on environmental and energy solutions, while the right side addresses health-related strategies.
- The measures are designed to create new markets and jobs, reduce greenhouse gas emissions, and foster barrier-free housing.
- The strategic plan is anchored in the New Growth Strategy approved by the Cabinet in June 2010.
Putting Japan’s world-leading technology to use

Toward becoming the world’s top environment and energy power through a comprehensive policy package
   • new systems design and regulatory reform
   • expansion of environmental technologies and products, etc.

Growth from green innovation
   • electric power feed-in tariff system
   • low-carbon investment and financing
   • development of innovative technologies
   • efficient electric power supply and demand through smart grid, etc.
Strategy for becoming an environmental energy power through “green innovation” ② (From “New Growth Strategy”)

- Lifestyle reforms through improving the comfort and quality of life
  - zero-emission homes, offices, and other facilities
  - spread of eco-housing
  - expanded use of renewable energies, etc.

- Creating green cities by promoting the rebuilding and remodeling of superannuated buildings
  - approach toward medium- to long-term environmental standards
  - redevelopment, rebuilding, and remodeling of superannuated office buildings, etc.

- Model to reform the socioeconomic structure from local areas
  - to promote the use of public transportation
  - low-carbon urban and regional structures, etc.
Implementation plan in environment and energy fields

2010 FY

- Spread, expansion and industrialization of renewable energies (electric power feed-in tariff system, regulatory reform, etc.)

- Goal-setting of introducing renewable energy, drawing up road maps

- Establishment of domestic emissions trading system

- New tax system as a measure against global warming

- Road map of innovative energy technology

- Accelerating and prioritizing R&D of innovative technologies (CCS, next-generation vehicle, etc)

- Goal for 2020

- ¥50 trillion in new environment-related markets

- 1.4 million new environment sector jobs

From the timetable for the “Growth Strategy implementation plan”
Key tasks for green innovation

1. "Full-scale introduction of Green power"
   - Higher effective and lower cost of photovoltaic generation.
   - Practical use of electric vehicles and fuel-cell cars.

2. "Minimize electric loss"
   - Practical use of SiC power semiconductors
   - Practical use of superconducting wire rod and equipment

3. "Reformative introduction in green material and process"
   - Practical use of electronic devices using printing technologies
   - Practical use of nanomaterial such as carbon nanotubes
   - Practical use of innovative manufacturing processes

4. "Thorough circulation, substitution, and use of resources"
   - Recycle technology of rare metals and practical use of alternative materials
   - Practical use of biofuel

5. "From unit to optimum system"
   - Practical use, introduction and dissemination of smart grid

Shift to "Green power"
**Budget request for S&T in FY2011**

**Budget for S&T: ¥611 billion < ¥540 billion**

### Green innovation

<table>
<thead>
<tr>
<th>¥325 billion &lt; ¥268 billion</th>
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</table>
- Energy-saving IT
- Next generation lighting, etc.
- CCS
- Solar cells, etc.

**Prioritize R&D in environment and energy fields**
Promoting R&D in fundamental technologies for growing fields, such as EV and solar cells

### Life innovation

<table>
<thead>
<tr>
<th>¥17 billion &lt; ¥9 billion</th>
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</table>
- Fundamental technology for drag discovery, etc
- Guidelines related to medical equipment, etc.

**Promotion of R&D**
Promoting R&D in the fields of nursing care, diagnosis and treatment of cancer, and stem cells

### Others

<table>
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<tr>
<th>¥269 billion &lt; ¥263 billion</th>
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- Resource development, etc.
- Human resource development, etc.

**Demonstration, installation and dissemination**

- Supporting consumers to get eco-friendly equipments
  Support system for getting eco-friendly cars
- Globalization of environment and energy industries
  Promoting international demonstrations
- Establishment of “Future City”
  Promoting demonstration of smart grid
- Strengthening medical, nursing, and heath care services
  Promoting cross-sectoral cooperation and IT utilization

- Promoting infrastructure industries and system exports
  Promoting international demonstrations in the fields of environment, medical services and aerospace
- Strategic international standardization
  Promoting international cooperation
Integrated project from R&D to strategic actions for commercial use

**R&D**
- R&D support for regional energy management system under large-scale introduction of solar power facilities, electric cars, etc.

**International Demonstration**
- Real scale demonstration is planned at Los Alamos and Albuquerque in the State of New Mexico, US.

**International Standardization**
- International Standardization of Smart Grid is being discussed in the alliance.

Promoted by the Alliance among industrial, academic, and government entities

**Demonstration Project at Los Alamos**

Period: FY2010～2013 (FS in FY2009)
Estimated Total Budget: 300 million USD
Strengthen world-class R&D centers

◆ In “Tsukuba Innovation Arena (TIA)” based on collaboration among AIST, NIMS, Tsukuba Univ. and Japan Business Federation, international standardization, evaluation and certification for the performance of new technologies are integrally promoted in addition to high-level advanced R&D.

◆ AIST especially leads to build the collaborative center in the research fields of evaluation for performance and safety of storage batteries, solar cells, medical robots.
Strengthening R&D by capitalizing on regional strengths

For regional development not only R&D by capitalizing on regional strengths at “Innovation hubs”, but also integrated promotion of infrastructure development including system reform are required.

Example activities of innovation hubs

<table>
<thead>
<tr>
<th>Organization</th>
<th>Current Activities</th>
<th>Activities for Commercialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kyoto University</td>
<td>R&amp;D of next-generation batteries</td>
<td>Establishing standards of safety and credibility at AIST Kansai</td>
</tr>
<tr>
<td>Kyushu University</td>
<td>R&amp;D for hydrogen-related products</td>
<td>Test and certification of hydrogen-related materials and equipment</td>
</tr>
<tr>
<td>Fukuoka IST</td>
<td>R&amp;D for advanced-system LSI</td>
<td>Providing fields for demonstration and experiment of systems</td>
</tr>
</tbody>
</table>
International Standardization is getting more important under globalization, modularization, digitalization, and networking.

Japan promotes International Standardization of technology and regulation under global cooperation, especially with Asian-Pacific economies.

(1) Bilateral Cooperation with Asia-Pacific economies
- Concluded AIST*1 (Japan)-NIST*2 (US) MoU on R&D cooperation in the field of smart grid, etc.
- Published Joint Statement on Standards Cooperation among China, Korea and Japan
- Under discussion with Singapore, Malaysia, Thailand, Indonesia, etc.

(2) Multi-lateral Cooperation

<Potential Cooperation Platform>
APEC, ERIA (Economic Research Institute for ASEAN and East Asia), PASC (Pacific Area Standards Congress) etc.

Ex) APEC wide cooperation
- To hold 8th conference on standard and conformance for green harmonization
- To hold Supply Chain Visibility Workshop (RFID) etc.
CCS Demonstration Project with Australia

(1) Oxyfuel combustion : Callide Oxyfuel Combustion Project

Demonstration of reliability and operability of Callide-A unit No.4 power plant with CCS using oxyfuel combustion technologies as the actual power plant. The world’s first demonstration test of an integrated CCS and underground storage system at an existing power plant.

- R&D: Japan (J-Power, IHI., etc.) /Australia
- Site: Queensland
- Scale: 30MW  CO2 capture: 30,000 t-CO2/year
- Period: 2011～2014

(2) ZeroGen Project

Demonstration of Air-blown Integrated Coal Gasification Combined Cycle (IGCC) with CCS function, the world's first commercial sized plant.

- R&D: Japan (Mitsubishi Heavy Industries, Mitsubishi Corporation, Australia(ZeroGen Corporation)
- Site: Queensland
- Scale: 530MW
- CO2 capture: 200～300 mill tons/year
- Period: 2008～
METI has been implementing 3R cooperation projects with China since 2007 and with Thailand since 2009.
Transfer Japanese experience and know-how for developing “Eco-town” through cooperation between local governments.
Start studying for future possibility of cooperation with other cities in Asia.

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Japan and China
1) Kitakyushu (J) and Dalian (C) ('09-'10)
2) Ibaraki (J) and Tianjin (C) ('09-'10)
3) Kawasaki (J) and Shanghai (C) ('08-'09)
4) Kitakyushu (J) and Tianjin (C) ('08-'09)
5) Hyogo (J) and Guangdong (C) ('07-'09)
6) Kitakyushu (J) and Qingdao (C) ('07-'08)

Japan and Thailand
1) Yamaguchi, Kitakyusyu (J) and Rayong (T) ('09-'10)
2) Akita (J) and Chonburi (T) ('09-'10)
3) Osaka (J) and Amata Nakorn (T) ('09-'10)

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Feasibility Study
Training Program
Dispatch of Experts
“Green Innovation” is the key to solve global challenges such as “global warming”

Japan to promote green innovation through the new growth strategy.

Promote the creation of a low-carbon society through a comprehensive policy package including new system design, regulatory reform, R&D etc.

Improve R&D platforms to create innovation

Contribute to world economic growth through innovation with international collaboration