ENERGY SITUATION IN JAPAN

Policy Change in Japan and the Asian Energy Trends

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The nuclear power ratio in domestic power generation has decreased after the Great East Japan Earthquake due to the long-term shutdown of nuclear power plants.

On the other hand, the thermal power ratio has increased to 90%. Currently, LNG thermal power alone accounts for nearly 50% of domestic power generation.
The overall cost of LNG imports to Japan has increased from 3.5 trillion yen (2010) to around 8 trillion yen (2014).

Japan recorded a trade deficit for the first time in 31 years in 2011. Trade deficit for 2014 was 12.8 trillion yen, which is not a sustainable level for Japan.

### Changes in trade balance and current account balance (trillion yen)

#### Trade Balance

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2014</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG</td>
<td>6.6</td>
<td>-12.8</td>
<td>-19.5</td>
</tr>
</tbody>
</table>

#### Net Import Costs

<table>
<thead>
<tr>
<th>Commodity</th>
<th>2010</th>
<th>2014</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>LNG</td>
<td>3.5</td>
<td>7.9</td>
<td>+4.4</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>9.4</td>
<td>13.9</td>
<td>+4.5</td>
</tr>
<tr>
<td>Petroleum Products</td>
<td>2.5</td>
<td>3.1</td>
<td>+0.7</td>
</tr>
<tr>
<td>Coal</td>
<td>2.1</td>
<td>2.1</td>
<td>-0.0</td>
</tr>
</tbody>
</table>
Reducing fuel procurement cost is an urgent issue

- High energy costs in Japan have negative impact on the competitiveness of energy intensive industries.

**Ratio of industrial energy prices relative to the United States**

<table>
<thead>
<tr>
<th>Natural gas</th>
<th>Electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>Reduction from 2013</td>
</tr>
<tr>
<td>Japan</td>
<td>European Union</td>
</tr>
<tr>
<td>5 ×</td>
<td>4 ×</td>
</tr>
<tr>
<td>4 ×</td>
<td>3 ×</td>
</tr>
<tr>
<td>3 ×</td>
<td>2 ×</td>
</tr>
</tbody>
</table>

- Source: IEA
Diversification is the key in the Strategic Energy Plan

Principles of Energy Policy and Viewpoints for Reformation

1) Confirmation of basic viewpoint of energy policies (3E + S)

- **Stable Supply** (Energy Security)
- **Cost Reduction** (Economic Efficiency)
- **Environment**
- **Safety**

Global Viewpoint
- Developing energy policies with international movement appropriately
- Internationalizing energy industries by facilitating business overseas.

Economic Growth
- Contribution to reinforce Japan’s locational competitiveness.
- Activating Japan’s energy market through energy system reform.

2) Building multilayered and diversified flexible energy demand-supply structure

- Establishing resilient, realistic and multi-layered energy supply structure, where each energy source can exert its advantage and complement others’ drawbacks.
- Creating a flexible and efficient supply/demand structure where various players can participate and various alternatives are prepared by system reforms.
- Improving self-sufficiency ratio by developing and introducing domestic resources to minimize influence from overseas’ situation.
**New Energy Mix**

- **Basic Direction**
  1. To improve the self-sufficiency ratio to around 25% surpassing the level before the Earthquake.
  2. To reduce the electricity costs lower than today.
  3. To set a high-level GHG reduction goal compared with other developed countries to lead the world.

### Electricity Demand

- **2013 (actual results)**
  - Electricity Demand: 967 TWh
  - GDP growth: 1.7%/year

- **2030**
  - Electricity Demand: 981 TWh
  - Energy conservation: 196 TWh (▲17%)

### Electricity generation mix

- **Total Electricity generation**
  - 1,065 TWh
  - Energy Conservation: 17%
  - Renewable Energy: 19～20%
  - Nuclear: 18～17%
  - LNG: 22%
  - Coal: 22%
  - Oil: 2%

- **Total Electricity generation**
  - 1,278 TWh
  - Energy Conservation: 17%
  - Renewable Energy: 22～24%
  - Nuclear: 22～20%
  - LNG: 27%
  - Coal: 26%
  - Oil: 3%

- **Geothermal** 1.0～1.1%
- **Bioenergy** 3.7～4.6%
- **Wind** 1.7%
- **Solar PV** 7.0%
- **Hydro** 8.8～9.2%

**Total base load power ratio**: 56%
## Comparison of INDCs by major countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Comparison with 1990</th>
<th>Comparison with 2005</th>
<th>Comparison with 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>▲ 18.0% (2030)</td>
<td>▲ 25.4% (2030)</td>
<td>▲ 26.0% (2030)</td>
</tr>
<tr>
<td>USA</td>
<td>▲ 14~16% (2025)</td>
<td>▲ 26~28% (2025)</td>
<td>▲ 18~21% (2025)</td>
</tr>
<tr>
<td>EU</td>
<td>▲ 40% (2030)</td>
<td>▲ 35% (2030)</td>
<td>▲ 24% (2030)</td>
</tr>
</tbody>
</table>

*INDCs: Intended Nationally Determined Contributions
Nuclear Electric Power Plants in Japan

25 units out of 15 plants are under review for restart by the Nuclear Regulation Authority (NRA) in accordance with its new safety regulations. Sendai power plant Unit 1 started up in Aug. 2015.
LNG Imports from the US

- Japan’s claim from 5 LNG projects.
- 5 projects involving Japanese firms received export approval and FERC approval.
- Exports will start in 2016.

Japan related Major LNG projects in North America

- **Sabine Pass** (Cheniere Energy)
  - Capacity: 18 MTA
  - Start Operation: around 2016
  - Export license for Non-FTA: Approved (2011.5.20)
  - Sales: The media reports Kansai Electric Power 0.4 MTA × 2 years, Chubu Electric Power 0.35 MTA × 2 years

- **Cove Point** (Dominion)
  - Capacity: 5.75 MTA
  - Start Operation: around 2017
  - Export license for Non-FTA: Approved (2013.9.11)
  - Sales: Sumitomo 2.3 MTA

- **Freeport Expansion** (Freeport)
  - Capacity: 4.4 MTA
  - Start Operation: around 2019
  - Export license for Non-FTA: Approved (2013.11.15)
  - Sales: Toshiba 2.2 MTA

- **Cameron** (Sempra Energy)
  - Capacity: 12 MTA
  - Start Operation: around 2018
  - Export license for Non-FTA: Approved (2014.2.11)
  - Sales: Mitsubishi Corporation 4 MTA, Mitsui Co. Ltd 4 MTA

- **Freeport** (Freeport)
  - Capacity: 8.8 MTA
  - Start Operation: around 2018
  - Export license for Non-FTA: Approved (2013.5.17)
  - Sales: Osaka Gas 2.2 MTA, Chubu Electric Power 2.2 MTA

New LNG export projects under consideration

- **Canada**
Energy Market Reform

➢ The first comprehensive electricity and gas market reform in 60 years.

3 Objectives

1) Securing a stable supply of electricity and gas
2) Suppressing electricity and gas rates to the maximum extent possible
3) Expanding choices for consumers and business opportunities

Full liberalization of the retail energy market

Electricity  Law enacted in June 2014, to be implemented from 2016
Gas          Law enacted in June 2015, to be implemented from 2017

Legal unbundling of transmission/distribution sector, and abolishing retail price regulations

Electricity  Law enacted in June 2015, to be implemented from 2020
Gas          Law enacted in June 2015, to be implemented from 2022
Status after the start of the Feed-in Tariff

- Since FIT start (July 2012), 14,931MW of renewable energy capacity has been deployed until the end of March 2015.
- 88% increase in the total RE capacity.

<table>
<thead>
<tr>
<th>&lt;Deployment of renewable energy (as of the end of March 2015) &gt;</th>
<th>Accumulated capacity before FIT started</th>
<th>Capacity of facilities that started operation since FIT start (July 2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar power (residential)</td>
<td>Approx. 4,700MW</td>
<td>3,097MW</td>
</tr>
<tr>
<td>Solar power (non-residential)</td>
<td>Approx. 900MW</td>
<td>15,011MW</td>
</tr>
<tr>
<td>Wind</td>
<td>Approx. 2,600MW</td>
<td>331MW</td>
</tr>
<tr>
<td>Mid- to small-sized hydraulic (Less than 30MW)</td>
<td>Approx. 9,600MW</td>
<td>89MW</td>
</tr>
<tr>
<td>Biomass</td>
<td>Approx. 2,300MW</td>
<td>224MW</td>
</tr>
<tr>
<td>Geothermal</td>
<td>Approx. 500MW</td>
<td>5MW</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Approx. 20,600MW</td>
<td><strong>18,757MW</strong></td>
</tr>
</tbody>
</table>
Promoting highly efficient low emission coal power plants

- Coal-fired thermal power generation in Japan achieved the highest level of efficiency in the world through utilization of efficient technology (Super Critical / Ultra Super Critical) and operation / management know-how. Its efficiency is maintained for long periods after operation.

- If the most advanced technology in operation in Japan is applied to coal-fired thermal power generation in the US, China and India, it is estimated that CO2 emission could be reduced by about 1.5 billion tons.

Change in efficiency across the ages

Gross thermal efficiency (%, HHV)

<table>
<thead>
<tr>
<th>Years in operation</th>
<th>Japan</th>
<th>US</th>
<th>China</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance of efficiency by appropriate operation</td>
<td>38.5%</td>
<td>36.5%</td>
<td>34.5%</td>
<td>33.5%</td>
</tr>
<tr>
<td>Efficiency degradation</td>
<td>36.5%</td>
<td>34.5%</td>
<td>32.5%</td>
<td>31.5%</td>
</tr>
<tr>
<td>Designed thermal efficiency</td>
<td>38.5%</td>
<td>36.5%</td>
<td>34.5%</td>
<td>33.5%</td>
</tr>
</tbody>
</table>

Promoting highly efficient low emission coal power plants

3Es of Coal
- Energy Security: global availability, geopolitical consideration
- Environment: Clean Coal Technology (NOx, SOx - equivalent to LNG PPs)
- Economy: affordable prices

Banning Export Credits Only in OECD Would Make Things Worse
- Non-OECD countries would sell less-efficient CPPs worldwide.
- China is already the biggest source of export credits.
- China exports less-efficient CPPs.

World electricity generation by source (New Policies Scenario)

Comparison of public financing for foreign coal power plants between 2007 and 2013 among countries

Source: IEA World Energy Outlook 2014

Fall in crude oil prices

- With the sharp fall in crude oil prices from last year, price is now less than 50-dollar-per-barrel level.

Change in International Crude Oil Prices

Government balanced budget

<table>
<thead>
<tr>
<th>Oil-producing nations</th>
<th>Government balanced budget (dollars per barrel)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kuwait</td>
<td>47.1</td>
</tr>
<tr>
<td>Iraq</td>
<td>70.9</td>
</tr>
<tr>
<td>UAE</td>
<td>73.1</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>103.0</td>
</tr>
<tr>
<td>Iran</td>
<td>92.5</td>
</tr>
<tr>
<td>Libya</td>
<td>215</td>
</tr>
<tr>
<td>Russia</td>
<td>105.2</td>
</tr>
<tr>
<td>Venezuela</td>
<td>117.5</td>
</tr>
</tbody>
</table>

Source: Estimated by IMF, Deutsche Bank
The Engine of Energy Demand Growth Moves to South Asia

IEA analyzed Southeast Asia on World Energy Outlook 2013.

China is the main driver of increasing energy demand in the current decade, but India takes over in the 2020s as the principal source of growth.
Energy demand in ASEAN region will be increasing in mid-long term and fossil fuels take a major role in energy mix.

Electricity demand in South-East Asia will increase to about 140% by 2035 and cumulative investment of 990 Billion dollars will be required. (IEA)

(IEA Southeast Asia Energy Outlook (2013))
Global LNG trade is set to expand by one-third to 450bcm by 2019 and likely to increase further.

Increase of global LNG trade will be supported by Asia, mostly by strong demand from China and non-OECD Asia.