Electricity Market Reform and its impact on Energy Market in Japan

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The Institute of Energy Economics, Japan (IEEJ)

Chairman & CEO  Masakazu Toyoda
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2. Roadmap of Market Reform
3. Current Status
4. Overseas Trends
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1. Objectives of System Reform

❖ Objectives of the system reform:
   ① Creation of new services and businesses
   ② Lower electricity rates & gas rates by enhanced competition
   ③ Protection of customers’ benefits and safety assurance
   ④ Reinforcement of industrial competitiveness and development of overseas markets

(Gas system reform has started in response to the electricity system reform)

❖ Characteristics of Electric Power Industry:
   ① Grid established nationwide
   ② Existence of dominant operators in each region
   ③ Universal service vs. competition

❖ Characteristics of Gas Industry:
   ① Incomplete nationwide gas pipeline network
   ② Numerous operators ("General Gas Utility")
   ③ Competition with other types of energy (LPG, All-electric housing*, etc.)

*"All-electric housing" to describe a home using electricity for all of cooking, hot water supply and space heating.
As the wide-area pipeline network is limited in Japan, new entrants are mainly business operators that own production facilities and LNG terminals.

**Status of installation of natural gas pipelines**

- Operating LNG import terminal
- LNG import terminal under planning/construction
- Operating high-pressure natural gas pipeline
- High-pressure natural gas pipeline under planning/construction
- High-pressure natural gas pipeline under consideration/investigation
- Major operating mid-pressure natural gas pipeline

2. Roadmap of System Reform
(1) Electric Power Industry

- **February 2013**
  - Report by Electricity Systems Reform Committee

- **Phase 1 2015**
  - Enacted in November 2013
  - ① Established OCCTO* (April 2015)
    (Long-term supply-demand balance maintenance and grid plans, wide-area emergency operation)
    *OCCTO: Organization for Cross-regional Coordination of Transmission Operators, Japan
  - ④ Regulatory organization reform
    Electricity Market Surveillance Commission established in Sep. 2015
    (Electricity wheeling price regulations, market surveillance, emergency measures)

- **Phase 2 2016**
  - Enacted in June 2014
  - ② Launching full deregulation of electricity retail
    (Regulations on small-volume user rates will be left for lifting in Phase 3)
  - ⑤ Others
    a. New framework for securing supply
    (Requirement for security supply capacity)
    b. Creation of same-day delivery market, etc.

- **Phase 3 2020**
  - Enacted in June 2015
  - ③ Legal unbundling of power transmission and distribution sector (Neutrality and transparency of network sector)

Ongoing electricity system reform until 2020 needs to be consistent with diverse types of policies such as safety assurance and environmental protection.

Capacity mechanism will be examined in fiscal 2016.

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Established under the direct management of the METI pursuant to Article 8 of the National Government Organization Act in reference to the Securities and Exchange Surveillance Committee

Nuclear power plant shutdown and policy changes, electric utilities’ fundraising and consideration of financial markets [Cabinet decision documents]
2. Roadmap of System Reform (2) Gas Industry

Report by Gas Systems Reform Committee

Jan. 2015

Apr. 2017

① Full liberalization of gas retail starts
(Tariffs for small-lot users continue to be regulated, but may be deregulated depending on the status of competition; the license system of community gas utility business will be abolished.)

② Introduction of license regulation
(Grant business license according to function: city gas production, gas pipeline service, specified gas pipeline service, gas retail sales)

③ Development of provisions on the use of LNG terminal
(Develop the provisions to promote use by third parties)

Apr. 2022

Legal separation of pipeline sector
(Legal separation of pipeline operators greater than a certain size)

Voluntary initiatives by gas utilities

Establishment of gas consignment service examination center (temporary name)
(Neutralization of gas consignment service examination)

Establishment of customer information disclosure center (temporary name)
(Gas customer information disclosure)

Propose a reform that is in line with the electricity market reform and takes into account diverse types of gas utilities.
3. Current Status
(1) New Entrants

① Electric power industry

- Announced on Feb. 5, 2016 (Announced by OCCTO*; holders of retail licenses):
  Number of new entrants (About 150)
  From big enterprises such as Tokyo Gas, Osaka Gas, Tokyu Corporation, KDDI to small-scale operators
  Note: Existing operators account for 30.

*Organization for Cross-regional Coordination of Transmission Operators, Japan (OCCTO) is established to enhance the function of controlling the supply-demand balance of electricity in both normal and emergency situations on a nationwide basis.

② Gas industry: Number of new entrants (38, Excluding entry by existing gas utilities in areas outside original supply areas)

## Reference

**Electricity Retail:**

**Diverse Types of New Entrants** *(as of Feb. 8, 2016)*

<table>
<thead>
<tr>
<th>Area</th>
<th>New Entrants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current major PPS*¹ (22)</td>
<td>F-Power, Erex, Ies power, e-sell, Ennet, Alpha-power, Eneserve, Nippon Steel &amp; Sumikin Engineering, Marubeni, etc.</td>
</tr>
<tr>
<td>Oil (8)</td>
<td>Showa Shell Sekiyu, TonenGeneral, Idemitsu Green Power, Premium Green Power, Itochu Enex, JX Energy</td>
</tr>
<tr>
<td>Telecommunication, Broadcasting, Railway, etc. (32)</td>
<td>F-bit Communications, Tokyo Power Supply, KDDI, Chukai TV, J-COMC group</td>
</tr>
</tbody>
</table>

*¹ PPS: Power Producer and Supplier  
*² GEU: General Electric Utility
<table>
<thead>
<tr>
<th>Area</th>
<th>New Entrants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil related companies (6)</td>
<td>San-Ai Oil, JX Nippon Oil &amp; Energy, INPEX, JAPEX, Kokura Enterprise Energy, NexT energy</td>
</tr>
<tr>
<td>companies (5)</td>
<td></td>
</tr>
<tr>
<td>Gas related companies (13)</td>
<td>Air Water, Tohoku Natural Gas, Enelop, Chikugo Gas Pipeline Service Provider, Minami Enshu Pipeline, Asahi Gas Energy, Iwatani, Tokyo Gas Engineering Solutions(TGES), Sendai Puropan, Tokyo Gas Energy, Nijio, Kumamoto Mirai LNG, Kinki Air Water</td>
</tr>
<tr>
<td>Trading companies (6)</td>
<td>MC shiohama energy service, ENEX-LNG Sales, Suzuyo Shoji, MITSUI &amp; Co, Mitsubishi Corporation, Onsite Energy Service Shizuoka</td>
</tr>
<tr>
<td>Renewable energy companies (2)</td>
<td>Joetsu Energy Service, Progressive Energy</td>
</tr>
<tr>
<td>Others (6)</td>
<td>Godo Shigen, Nippon Steel &amp; Sumitomo Metal Corporation, Yawata Works, Tetsugen, Mitsubishi Chemical, Toyama Green Food Recycle, Suzukoh</td>
</tr>
</tbody>
</table>

*Note: Koka Energy is a gas retail company invested by Iwatani Corporation 56%, Kansai Electric 34% and Kokakyodo Gas 10%,
3. Current Status
(2) Change of Contract

① Electric power industry

- Share of new entrants in FY2014 (large scale customer): 5.24%
- Announced on Feb. 5, 2016 (OCCTO)
Number of applications for switching is about 106,000.
99% were made within the supply areas of TEPCO and KEPCO.
Tokyo 74,000, Kansai 29,000, Hokkaido 1,100,
Kyushu/Chubu/Tohoku/Hokuriku/Shikoku 1,800, Chugoku/Okinawa 0

② Gas industry  – Share of new entrants in FY2014 (large-vol. customer): 11.7%

<table>
<thead>
<tr>
<th>(Unit: 1 million m³)</th>
<th>FY2009</th>
<th>FY2010</th>
<th>FY2011</th>
<th>FY2012</th>
<th>FY2013</th>
<th>FY2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total gas sales volume for large-vol. customers (non-regulated area)</td>
<td>20,895</td>
<td>22,699</td>
<td>23,918</td>
<td>23,775</td>
<td>23,502</td>
<td>23,877</td>
</tr>
<tr>
<td>Gas sales volume for large-vol. customers by new entrants</td>
<td>2,822</td>
<td>3,641</td>
<td>4,073</td>
<td>3,648</td>
<td>2,844</td>
<td>2,785</td>
</tr>
<tr>
<td>Share of new entrants</td>
<td>13.5%</td>
<td>16.0%</td>
<td>17.0%</td>
<td>15.3%</td>
<td>12.1%</td>
<td><strong>11.7%</strong></td>
</tr>
</tbody>
</table>

Business outlook of big new entrants
- In association with full liberalization of the gas retail market in April 2017, **TEPCO aims to sell for 1 million t/year in LNG volume by 2024.** (New Comprehensive Special Business Plan announced in January 2014)
- **INPEX aims to supply 2.5 billion m³ in Japan in 2015**, by reinforcing the domestic pipeline network (Mid- to Long-Term Vision issued in May 2012) Gas sales in FY2014 were 1.79 billion m³. The reduced share of new entrants was due to the increase for gas demand to compensate the shutdown of nuclear plants.
About 60% of customer to switching is in the supply area of TEPCO (about 25% is in the supply area of KEPCO).

Sales by new entrants and their share (Estimates)

Maximum power demand supplied by new entrants and their share (Estimates)
In FY2014, the number of new entrants (gas pipeline service provider or large-vol. gas supplier) was 38, and the share of new entrants accounted for 11.7%. Although the share reached 17% in FY2011, it is considered to have declined due to the tight supply-demand balance in the electric power industry after the Great East Japan Earthquake.

On the other hand, in terms of wholesale supply to small and medium-sized gas utilities, the share of large-vol. gas supplier and gas pipeline service provider reached 53%, showing that competition in the market has successfully made progress in terms of large-vol. supply and wholesale supply.
3. Current Status
(3) Business Alliances ① (In the Electric Power Business)
### 3. Current Status

#### (3) Business Alliances ② (In the Gas Business)

- **JXエネルギー**
  - Operating power plant in Kanagawa

- **東北電力**
  - Established power plant in Chiba
  - Teamed up in electricity sales with 12 companies including NTT Communications and Rakuten

- **Bushu Gas**
  - Tobu Gas
  - Sakado Gas
  - Akishima Gas
  - Ota-Toshi Gas

- **TOKYO GAS**
  - Established an electricity retail company in the Metropolitan area

- **大阪ガス**
  - Joint construction of power plant in Yamaguchi

- **JPOWER**
  - Established power plant in Kita Kyushu City

- **西日本ガス**

- **11 gas utilities in the Metropolitan area** (Kakuei Gas, Daido Gas, Ashikaga Gas, Isezaki Gas, Iruma Gas, Ome Gas, Kiryu Gas, Saitama Gas, Sano Gas, Hidaka Toshi Gas, Bushu Gas)

- **中総電力**
  - Electricity sales

- **SHIZIGAS**
  - Construction of power plant in Shizuoka

- **東燃ゼネラル**
  - Operating power plant in Shizuoka

- **TOKAI**

- **NICHIGAS**

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Status of New Entrants in the Gas Industry by Area

Status of registration of large-vol. gas utilities (As of Mar. 2015)

Note: Figures in ( ) show the number of declarations in the area concerned (based on declarations for large-vol. supply as of Mar. 2015). The underlined utilities are confirmed not to have declared for large-vol. supply.

Source: Agency for Natural Resources and Energy, “Liberalization of Large-Lot Supply in the Gas Industry”
4. Overseas Trends

(1) Change in Industrial Organization

(2) Creation of International Comprehensive Energy Enterprises

(3) Impact on Prices

(4) Securing Adequate Investment

(5) Realization of Adequate Energy Mix
4. Overseas Trends
(1) Change in Industrial Organizations ①

(Electricity) Although the situation differs country by country, energy utilities have been integrated across borders in general terms.

(Europe) ① UK : 1 originally state-owned utility has become Big 6.
② Germany : 8 originally leading utilities integrated into Big 4.
③ France : The regime consisting of 1 large state owned utility and other small utilities remains unchanged in both the electricity and gas sectors.
④ Italy : The market originally dominated by state-owned utility (Enel) is now open to many other companies triggered by the sale of thermal power plants.

(U.S.) The states that introduced full retail liberalization were limited to 13 states + Washington DC

Note: Facing liberalization, California electric crisis occurred before other states tried to implement retail liberalization.

⑤ U.S. : Although the electricity market in states such as NY, Massachusetts, and Texas used to be monopolized by the local utilities, many firms have entered the market.
**U.K. Electric/Gas Utilities Reorganization Developments**

- **1982**: Partial liberalization of gas retail market
- **1990**: Partial liberalization of electricity retail market
- **1998**: Full liberalization of gas retail market
- **1999**: Full liberalization of electricity retail market

### BG
- **1990**: Dissolution of state-owned CEGB

### CEBG
- **PowerGen**
  - **1990**: Dissolution of state-owned CEGB
  - **1996**: Restructure
  - **1998**: Separated nuclear division

### SSEB
- **NSHEB**
  - **1989**: Privatized
  - **1991**: Privatized

### Centrica Big 6
- **1998**: Acquired by RWE
- **2005**: Acquisition of managing rights

### Innogy Big 6
- **2004**: Acquired by RWE
- **2005**: Acquisition of managing rights

### AES Corp
- **2003**: Renouncement of managing rights
- **2005**: Acquisition of managing rights

### E.ON UK Big 6
- **1996**: Purchased NP/PG plants
- **1999**: Acquired by TXU Gr.
- **2002**: Went bankrupt. Sold power generation assets.

### EDF Energy Big 6
- **2009**: Acquired by EDF
- **2011**: Re-integrated

### Scottish Power Big 6
- **2009**: Acquired by Iberdrola

### British Energy
- **2008**: Divided
- **2010**: Acquired by GDF Suez

### Nuclear Electric
- **2002**: Went bankrupt. Sold power generation assets.

### Magnox Electric
- **2000**: Divided
- **2005**: Acquisition of managing rights

### Magnox North
- **2000**: Divided

### Magnox South
- **2000**: Divided

### Drax Power
- **Power generation only**

### International Power (Overseas IPP)
- **RWE nPower
  - **2003**: Renouncement of managing rights
- **2005**: Acquisition of managing rights

### SSE
- **1998**: Integrated
German Electric/Gas Utilities
Reorganization Developments

1929
VEBA
1923
VIAG

1898
RWE
VEW

1894
HEW

1915
Bewag
Badenwerk
EVS
Ruhrgas
Thyssengas

1969
VNG
1993
Wingas

1965: Privatized
1985: Privatized

1926: Privatized
1923: Privatized

1998: Full liberalization of electricity/gas retail markets

2000
2003
2009

2010

E.ON
E.ON Gastransport (PL)

Transpower

Open Grid Europe (PL)

TenneT (Transmission)

RWE

2000: Privatized
2011: Sold

Thyssengas (PL)

Amprion (Transmission)

Vattenfall

2003
2006
2009

50 Hertz (Transmission)

EnBW Gasnetz (PL)

EnBW

2000: Capital participation
2010: Withdrawal of capital participation

EDF

EnBW Transport (Transmission)

VNG

ONTRAS Gastransport (PL)

Wingas

GASCADE (PL)
French Electric/Gas Utilities
Reorganization Developments

1999: Partial liberalization of electricity retail market
2000: Partial liberalization of gas retail market
2007: Full liberalization of electricity/gas retail markets

- EDF
- RTE (Transmission)
- GDF Suez
- GRT Gaz (PL)
- E.ON SNET
- TOTAL Energie Gaz
- TIGF (PL)

EDF
- 1946
- 2004: Offered stock to the public
- 2005
- 2008

CNR (Rhone Public Utility)
- 1933

SHEM
- 1902

GDF
- 1946
- 2004: Offered stock to the public
- 2005
- 2008

Electrabel (Belgian electric utility)
- 1822
- 2002-2006
- 2007

Suez
- 1933

GRT Gaz (PL)

ENDESA (Spanish Electric utility)
- 1902
- 2004: Acquisition
- 2008: Sold to E.ON

SNET
- 1902

TOTAL Energie Gaz
- 2004: Acquisition
- 2008: Sold to E.ON

GSO (Subsidiary of Total)
- 1822

TIGF (PL)
- 2005
- 2013: Sold
Electricity retail market were liberalized in 1999 in New York State. 68 companies (including affiliates of local electric utilities) newly entered the market, and their share rose to as high as 35%. (based on 2014 data)

Source: Prepared on the basis of EIA, “EIA-861”.

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The liberalization process was completed by the Third Energy Package enforced in 2009. Presently, the focus is on reinforcing coordination within the area, and securing stable supplies (reduction of dependence on gas produced in Russia).

In the case of the U.K., the oligopoly of the Big 6 (British Gas, EDF, E.ON, RWE npower, Scottish Power, SSE) is likely to remain almost fixed even when other operators are tending to increase their share.

Large-lot customers constitute a market for the upstream competitive companies.

**Changes in the share of sales in the residential sector**

**Sales share in the non-residential sector (Jun. 2015)**

Source: Ofgem Website

4. Overseas Trends
(1) Change in Industrial Organization

(Gas) (Europe)
Although it differs country by country, electricity and gas businesses were integrated and concentrated in many cases.

(U.S.)
Retail market is fully liberalized in 7 states + Washington DC. Competition is in progress in 4 states and Washington DC. (NY, Pennsylvania, Massachusetts, NJ)

Note: No merit as there is no discrepancy between adjusted prices by pipelines.

Provider switch rate in residential sector in 4 states + DC
13-108 companies newly entered the market. Monopoly of access to interstate PL by conventional utilities has been recognized as a challenge to promote competition.

States where liberalization is not successfully functioning (New Mexico = left, California = right)

Interstate pipelines have not been sufficiently developed. Impossible to ensure procurement from diverse sources for competition.

Source: Prepared on the basis of EIA data.
4. Overseas Trends
(2) Creation of International Comprehensive Energy Enterprises

- In Europe, electricity/gas utilities operating worldwide were formed triggered by liberalization of the electricity market.

**Share of power generation in 27 EU countries (2014)**

- **EDF**
- **RWE**
- **Vattenfall**
- **E.on**
- **ENGIE**
- **Enel**
- **Iberdrola**
- **CEZ**
- **EnBW**
- **Others**

- Expand the quantity and area of wholesale electricity market transactions
- Expand the short-term transactions of gas/coal/CO$_2$
- Maintain advantages in fuel procurement
- Brand power
- Sustain growth
- Improve profitability in power generation business associated with fuel price increase (Especially in nuclear power generation/coal-power generation)

Source: RWE Facts and Figures 2015
Among European countries and the United States that have deregulated electricity systems earlier than Japan, companies in Germany, France and Italy have become international integrated energy firms. However, such firms have not emerged from the United Kingdom or the United States. International integrated energy companies emerged in the 2000s when fuel prices soared. Over recent years, many international integrated energy companies have seen their earnings deteriorating on weak wholesale electricity prices that have accompanied renewable energy expansion. Their problem is how to secure investment in power generation equipment.

<table>
<thead>
<tr>
<th>Effects of electricity system reforms</th>
<th>Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U.S.</strong></td>
<td>Switching from coal to gas and renewable energy for electricity generation</td>
</tr>
<tr>
<td>Efficient wide-area operation of wholesale electricity markets (Eastern systems other than those in the Southeast have produced five RTOs), new participants in retail electricity markets</td>
<td></td>
</tr>
<tr>
<td>No U.S. firms have become international integrated energy companies.</td>
<td></td>
</tr>
<tr>
<td><strong>Germany</strong></td>
<td>Maintaining gas-fired electricity generation</td>
</tr>
<tr>
<td>Four major utilities’ oligopoly through mergers (including a foreign company)</td>
<td>Reviewing system reforms to expand renewable energy</td>
</tr>
<tr>
<td>Two have developed into international integrated energy companies</td>
<td></td>
</tr>
<tr>
<td><strong>U.K.</strong></td>
<td>Reviewing system reforms to promote low-carbon society</td>
</tr>
<tr>
<td>New electricity market participants increased in the initial phase of deregulation before the Big Six (including four foreign firms) established an oligopoly in the 2000s.</td>
<td></td>
</tr>
<tr>
<td>No U.K. firms have become international integrated energy companies.</td>
<td></td>
</tr>
<tr>
<td><strong>France</strong></td>
<td>Securing consistency with EU-wide regulatory reforms</td>
</tr>
<tr>
<td>EDF has maintained its monopoly and has become an international integrated energy company.</td>
<td></td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td>Increased dependence on imports, maintaining investment in electricity generation</td>
</tr>
<tr>
<td>The Great Blackout of 2003 prompted Italy to create a competitive pool electricity market.</td>
<td></td>
</tr>
<tr>
<td>Enel has become an international integrated energy company.</td>
<td></td>
</tr>
</tbody>
</table>

*RTO: Regional Transmission Organization*
International electricity/gas utilities in Europe

**EDF**: France, U.K., Italy, Belgium, etc.

**E.ON**: Germany, Sweden, U.K., Italy, Spain, France, Netherlands, Hungary, Czech, Slovakia, Romania, Russia, Brazil, Turkey, North America, etc.

**RWE**: Germany, U.K., Netherlands, Belgium, Central and Southern Europe

**ENEL**: Italy, South America, Slovakia, Russia, Romania, etc.

**Iberdrola**: Spain, U.K., U.S., Portugal, Germany, France, Canada, Brazil, Mexico, etc.

Integrated energy enterprises are expected to grow in Japan due to demand reduction in the future, improvement in purchasing power in the upstream sector and effective use of information technology.

Source: Prepared on the basis of E.ON, “Facts & Figures”.
4. Overseas Trends
(3) Impacts on Prices

❖ Liberalization means exposure to the spot market. As a result, fluctuations in fuel prices are reflected in energy prices in an exaggerated manner.

❖ So far, it is viewed that liberalization has not reduced prices because fuel prices have been increasing.

Note: The current situation including lower crude oil prices has not been adequately reviewed yet.
European case (U.K.): Electricity & Gas Trends

**U.K. Electricity demand and prices**
- Privatized state-owned company, liberalization for large customers, Pool market
- Full competition
- 2010 = 100

**U.K. gas demand and prices**
- Natural gas demand (bcm)
- Price ($/MMBtu)

Gradual retail deregulation
- Deregulating retail
- Privatizing British Gas
- Separation in accounting
- Centrica/T/P liability expansion
- Launching ownership separation and NBP
- Full retail deregulation

Source: DECC

Source: IEA, BP
Changes in Import Prices of Primary Energy

Period when the market was highly reliable

Yen/1,000kcal

Period when concerns over stable supply increased

Revision of policy after earthquake

2002
Basic Act on Energy Policy

2003
1st, Basic Energy Plan

2007
2nd, Basic Energy Plan

2010
3rd, Basic Energy Plan

2014
4th, Basic Energy Plan
Reference

International Comparison of Electricity Prices (2011-14)

Industrial

Electrical prices (US cents/kWh)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total tax</th>
<th>Ex-tax price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>20.4</td>
<td>19.0</td>
</tr>
<tr>
<td>S. Korea</td>
<td>19.4</td>
<td>(n.a.)</td>
</tr>
<tr>
<td>U.S.</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>UK</td>
<td>13.4</td>
<td>13.0</td>
</tr>
<tr>
<td>France</td>
<td>11.6</td>
<td>11.8</td>
</tr>
<tr>
<td>Germany</td>
<td>14.9</td>
<td>10.0</td>
</tr>
<tr>
<td>Italy</td>
<td>9.2</td>
<td>20.0</td>
</tr>
<tr>
<td>Spain</td>
<td>29.2</td>
<td>(n.a.)</td>
</tr>
</tbody>
</table>

Residential

Electrical prices (US cents/kWh)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total tax</th>
<th>Ex-tax price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>29.1</td>
<td>27.2</td>
</tr>
<tr>
<td>S. Korea</td>
<td>21.8</td>
<td>9.3</td>
</tr>
<tr>
<td>U.S.</td>
<td>20.7</td>
<td>11.9</td>
</tr>
<tr>
<td>UK</td>
<td>17.5</td>
<td>12.0</td>
</tr>
<tr>
<td>France</td>
<td>15.4</td>
<td>18.5</td>
</tr>
<tr>
<td>Germany</td>
<td>33.9</td>
<td>20.9</td>
</tr>
<tr>
<td>Italy</td>
<td>28.8</td>
<td>(n.a.)</td>
</tr>
<tr>
<td>Spain</td>
<td>(n.a.)</td>
<td>(n.a.)</td>
</tr>
</tbody>
</table>

(Note 2) For S. Korea and the US, data on the ratio of electricity price and tax in the tariffs is not available.
(Note 3) Totals may not match due to rounding.

4. Overseas Trends
(4) Securing Adequate Investment

❖ Adequate investment cannot be secured by liberalization alone.
Many countries are addressing the shortage of investment by introducing such means as the Capacity Market.

Note: It is difficult to invest in power generation facilities with high fixed costs requiring mid- to long-term recovery of costs, when there is significant uncertainty in both prices and quantities.
The Capacity Market is an initiative to offer a certain level of certainty.

❖ However, there are countries which successfully operate the Capacity Market, and those which do not.
**Basic Form of Capacity Market**

### 3-4 years before

**Start of Capacity Market process**
- Define/trade the supply capacity required at the peak period
- **It is necessary to secure the time frame to realize the new power generation program in the delivery year.**

### Delivery year

**Delivery of supply capacity during peak period**
- Supply capacity must be confirmed by TSO. If supplier fails to deliver the capacity, it will be fined.

---

<table>
<thead>
<tr>
<th>$/MW-Day</th>
<th>Supply Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5× Net CONE</td>
<td>Demand Curve</td>
</tr>
<tr>
<td>1.0× Net CONE</td>
<td>Price cap</td>
</tr>
<tr>
<td>Clearing Price</td>
<td>Target</td>
</tr>
<tr>
<td>0.2× Net CONE</td>
<td>(CONE) Cost of New Entry (IRM) Installed Reserve Margin</td>
</tr>
</tbody>
</table>

---

**Retail company A**
- Capacity supply obligation

**Retail company B**
- Capacity supply obligation

**Retail company C**
- Capacity supply obligation

**Power plant 1**
- (Self owned plant)

**Power plant 2**
- (Negotiated purchase)

**Power plant 2**
- (Market)

**Decide daily procurement**

**Bear the costs required for running the capacity mechanism**

**Remuneration for supply capacity provided. Impose fine if undelivered.**
### Reference

#### Types of Capacity Market and Current Status

- **Resolution of classical missing money issue:** Introduce the capacity market because the wholesale price is decided based on the marginal cost principle in the pool market, and the fixed costs of the peak power source cannot be recovered.

- **Measures against stagnant wholesale prices due to the spread of renewable energy:** Introduce the capacity mechanism as a measure to secure investment for power generation or to avoid shutdown due to stagnant wholesale prices due to the spread of renewable energy and increase in uncertainty of power generation volume.

- **Enhancement of reliability:** The capacity mechanism may be introduced as a measure to reduce the risk of blackout caused by extreme weather like a heat wave or cold wave in case the electricity demand for air conditioners is high (capacity mechanism is adopted by necessity) and also as a measure to secure high reliability in big cities.

#### Table: Types of Capacity Market and Current Status

<table>
<thead>
<tr>
<th>Price type</th>
<th>Resolution of classical missing money issue</th>
<th>Measures against stagnant wholesale prices due to the spread of renewable energy</th>
<th>Enhancement of reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity payment</td>
<td>Old U.K. pool market, Spain, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity market (Supply capacity obligation)</td>
<td>Centralized capacity market</td>
<td>U.K.</td>
<td>U.S. PJM</td>
</tr>
<tr>
<td></td>
<td>Distributed capacity market</td>
<td></td>
<td>France</td>
</tr>
<tr>
<td>Partial capacity market</td>
<td>Controlled type</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>(Strategic reserved capacity)</td>
<td>Effective use of market type</td>
<td></td>
<td>Sweden, Finland</td>
</tr>
<tr>
<td>No capacity mechanism</td>
<td>State of Texas, Australia (Allowing for price spike)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The profitability of thermal power generation is analyzed based on the factor called “spread”, which is the difference between electricity wholesale prices and fuel costs (fuel prices ÷ power generation efficiency).

The spread of natural gas power generation in Europe is called “Clean Spark Spread”. Recently, the spread became negative in some countries including Germany, causing the difficult situation of not being able to recover even fuel prices. Under these circumstances, applications for terminating gas power generation have increased, and the framework of the wholesale market is being reconsidered even in Germany.
Supply-Demand Balance Outlook in Major European Countries

- Because of the liberalization of investment in power generation, supply-demand balance is still uncertain. According to a scenario based on conservative assumptions on investment in the U.K., supply capacity may become insufficient.

- There is a concern in Poland of a shortfall in supply capacity due to stagnant wholesale prices in countries especially in Germany.

Spot Price of Japan Electric Power Exchange and Spread of Thermal Power Generation

- There is a strong tendency in Japan that the wholesale spot price is linked with fuel prices of oil thermal power generation. In association with the termination of oil thermal power generation, the spot price is becoming linked with the fuel prices of gas thermal power generation. Productivity of gas thermal power generation is decreasing due to declining fuel prices.

- FIT electricity will be purchased by distribution / transmission operators. Purchased FIT electricity will be sold in the wholesale market, in principle. That will increase the pressure to lower the spot price.
Securing High Supply Reliability

❖ On the East Coast in the U.S. where there are many big cities, initiatives to upgrade supply reliability such as imposing a capacity supply obligation on retail operators have been made since long ago. There is a public power authority in New York State, which used to play a role in installing emergency power sources.

❖ Is there any area in Japan where high supply reliability should be secured in the same way? And how do we achieve that?
Example of Emphasizing the Market Principle: State of Texas

- A cold wave in early February 2011 had significant effects on the energy supply mainly in the State of Texas. On February 2, a serious unplanned blackout of the generation system occurred due to freezing of equipment and a shutdown of the natural gas supply. The supply capacity became insufficient because the peak demand was expected to increase to almost 60,000 MW on the day. As a result, ERCOT conducted rolling blackouts for a total of 4,000 MW, which affected 3.2 million customers. The energy trade market continued to operate even during this period.

- If the market principle is emphasized, it is necessary to widely announce that planned outages will be implemented when a certain threshold is exceeded.
4. Overseas Trends
(5) Realization of Adequate Energy Mix

❖ In some countries where the degree of liberalization is high, investment in zero-carbon electricity sources is not adequately made, which tend to require stronger involvement by the government.
Reference

European case: U.K.’s electricity deregulation, and stable supply and low-carbon electricity source difficulty in securing

- The United Kingdom is considering forming the electricity system to maintain stable supply in response to the planned shutdown of outdated power plants with a total capacity of nearly 20,000 MW over 20 years and to promote decarbonization of electricity sources.
- The country seeks to take advantage of CfDs (contracts for difference) for increasing low-carbon electricity sources (renewable energy and nuclear) and secure capacity by permitting additional income as capacity credits using a capacity market for fossil fuel power generation.

CfD (contract for differences) strike prices and payments

- Floating type: Overnight spot price
- Base type: Future delivery prices

Capacity market pricing

Based on fixed cost of OCGT

Electricity transmission companies procure capacity for the fourth year from now while retailers shoulder costs.

Net CONE

Price (£/kW/year)

Cap

Minimum

Target

Maximum

Capacity
5. Future Challenge
(1) Overview

<table>
<thead>
<tr>
<th>2016</th>
<th>2017</th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
</table>

Switching of providers is increasing in the supply area of TEPCO

Regional difference in competition becomes clear

Start of operation of new thermal power generation facilities

Start of full-scale competition as competitive power sources increase

Target year of measures against global warming

As the concerns for excessive power generation systems and fuel procurement increase, the industry is seeking ways to diversify the risks through alliances among operators.

Worsening profit of thermal power generation will emerge.
Difficulty in securing zero-carbon generation
⇒ Obligation to secure supply capacity
⇒ Measures to secure zero-carbon generation

Surplus of gas intensifies gas business competition.
⇒ Growing necessity of reselling and advancing into Asia
Expansion of Renewable Energies and Rising Electricity Tariffs

Consumer burden related to renewable electricity generation is soaring.

- The total consumer burden for the next 20 years will reach 55 trillion yen by operating just the 86 GW capacity installed and licensed as of the end of November 2015. This inevitable burden is equivalent to a 3.1 yen/kWh rise in tariffs, or 19% for industrial and 13% for residential sectors.
- The rapid increase in solar power with high purchase price is greatly increasing the burden. The burden will grow further as power sources with longer lead times, such as wind power, start operation in addition to solar power.

### Expansion of Renewable Energies and Rising Electricity Tariffs

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Before the introduction of FIT</th>
<th>After the introduction of FIT</th>
<th>After the introduction of FIT</th>
<th>After the introduction of FIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>① Installed Capacity (MW)</td>
<td>② Purchased power (GWh)</td>
<td>③ Purchased price (100 million Yen)</td>
<td>④ Licensed capacity (MW)</td>
</tr>
<tr>
<td>Solar power (residential)</td>
<td>3670</td>
<td>4700</td>
<td>17788.1</td>
<td>7723</td>
</tr>
<tr>
<td>Solar power (non-residential)</td>
<td>20740</td>
<td>260</td>
<td>34812.5</td>
<td>14310</td>
</tr>
<tr>
<td>Wind power</td>
<td>380</td>
<td>2530</td>
<td>15456.2</td>
<td>3363</td>
</tr>
<tr>
<td>Medium- and small-scale hydraulic power</td>
<td>130</td>
<td>210</td>
<td>3108.8</td>
<td>809</td>
</tr>
<tr>
<td>Geothermal</td>
<td>10</td>
<td>0</td>
<td>46.2</td>
<td>20</td>
</tr>
<tr>
<td>Biomass</td>
<td>430</td>
<td>1130</td>
<td>10323.8</td>
<td>2106</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25370</strong></td>
<td><strong>8830</strong></td>
<td><strong>81535.5</strong></td>
<td><strong>28329</strong></td>
</tr>
</tbody>
</table>

* The figures for each energy are rounded up, and may not add up to the total.

Solar Power Generation Nationwide

5. Future Challenge
(2) Specific issues: Electric Power Industry

❖ Harmonization of power system and renewable energy (intermittency)
  • Wholesale of FIT electricity by transmission/distribution operators
    ⇒ How to use wholesale market
  • Enhancement of network and cost sharing

❖ Prevention of shortage of investment
  • Whether or not to introduce capacity market (capacity mechanism)
  • Revision of FIT to lower tariffs for some renewable energy and renewable energy diversification
  • Study of CfD of nuclear power in mid-term

❖ Securing adequate energy mix
  • Ensuring ratio of zero-carbon power source
    ⇒ the law for upgrading energy supply Structures
  • Introduction of benchmark for thermal power generation
    ⇒ Energy Conservation Act

❖ Advancing into overseas markets
  • Reinforcing competitiveness and coping with reduced demand

◄ What kind of measures will be taken in light of the experiences in Europe and the U.S.?
5. Future Challenge
(3) Specific issues : Gas Industry

❖ Full liberalization of gas retail market
   • Concerning gas supply to households, etc. which is now only permitted for general gas utilities, regional monopoly of the retail market is abolished to allow registered utilities to enter the gas retail market.
     ⇒ New deployment of gas pipelines and interconnection
   • Regulations on the prices are eliminated, in principle. However, the utilities are required to offer regulated price plans in areas where competition is insufficient as a transitional measure in terms of customer protection.

❖ Third-Party Access to LNG Terminal
   • It will be legally prohibited for operators who own LNG terminal to refuse the use by a third party without a valid reason.

❖ Safety regulation and accelerated introduction
   • Legal obligation for securing safety of pipeline network, inspection of internal piping owned by small-vol. customers, and emergency preparedness will be imposed on gas pipeline operators.

❖ Advancing into overseas markets
   • Reinforcing competitiveness and coping with reduced demand

◄ What kind of measures will be taken in light of the experiences in Europe and the U.S.?
Conclusion

1. Market reform is natural development in terms of streamlining the electric power and gas industry.

2. Considering the situation in Europe and the U.S., no obvious positive effects can be seen such as reduction in tariffs, while various challenges are notable such as lack of investment and difficulty in achieving an adequate energy mix.

3. It is critical for Japan to carry out the detailed design of the system reform, taking into account the successes and failures in Europe and the U.S.
IEEJ was evaluated as the world’s number 1 in the energy sector of the “Global Go To Think Tank Index” (published in Jan. 2016) announced every year by the University of Pennsylvania. IEEJ has been ranked top for two years in a row in Asia.

Since the start of the survey, it is the first time for a non-U.S./European research institute to be chosen as the top in the world ranking, based on research field. (IEEJ was ranked third in the world, and top in Asia, in the 2014 index.)

“2015 Global Go To Think Tank Index Report”(p.83)
http://repository.upenn.edu/think_tanks/

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