Ensuring Electricity Security in Japan’s Electricity Market Reform Project

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PLANNED ACTIONS ON JAPAN’S ELECTRICITY MARKET REFORM
Problem revealed by 3.11

- Negative aspects of regional monopoly system with 10 big and vertically integrated EPCOs were revealed in the Great Earthquake 3 years ago:
  1. Lack of system to transmit electricity beyond regions
  2. Little competition and strong price control
  3. Limit in handling the change in energy mix including the increase in renewables

Frequency in West: 60Hz

* DC – direct current, FC – frequency conversion
2 April 2013, Cabinet decided the “Policy on Electricity System Reform” to realize three objectives in Japan’s market with a three-step approach.

3 objectives:

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

(At around 2015: Transition to new regulatory organizations)
1\textsuperscript{st} step: Establish the OCCTO

- Establish the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) by about 2015

* DC – direct current, FC – frequency conversion, TDSO – Transmission and Distribution System Operator
2nd step: Full Retail Competition

- Expand retail competition to the residential sector around 2016, opening a new market
- Maintain regulated tariffs to 10 big EPCOs until around 2018-2020

Liberalized Sector
(50kW ~ 2,000kW)

- Large factory
- Large building
- Building
- Medium factory
- Small Factory

Share of total power: 63%

Regulated Sector
( ~ 50kW)

- Small shop
- Residential Customer

Market Volume: 7.5 trillion (=$75bn, €55bn)
Number of contracts
Residential Customers: 76.8m
Small shops and offices: 7.4m

Share of total power: 37%

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3rd step: Unbundle the T/D sector

- Unbundle the transmission/distribution sectors of big EPCOs by ITO-style (legal unbundling) at around 2018-2020
ENSURING ELECTRICITY SECURITY IN JAPAN’S EMR PROJECT
Japan’s supply and demand balance

- Supply and demand balance has been very tight especially in summer since Fukushima accident.
- Estimated capacity in 2016 when full retail competition starts:
  - Even without counting nuclear restarts and additional renewables, almost 10% of reserve margin will be expected
  - 18 nuclear plants (18GW) have already applied to the safety inspection

10 big EPCOs’ capacity – Submitted supply plans based

<table>
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<tr>
<th>Year</th>
<th>Estimated peak demand</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>198GW</td>
<td></td>
</tr>
<tr>
<td>2014 (Summer)</td>
<td>168GW</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>177GW</td>
<td></td>
</tr>
</tbody>
</table>

(Note) All numbers are rounded off.

- Thermal: 127GW
- Hydro: 35GW
- Nuclear: 35GW
- Renewable: 3GW

Supply and demand balance has been very tight especially in summer since Fukushima accident.

- Estimated capacity in 2016 when full retail competition starts:
  - Even without counting nuclear restarts and additional renewables, almost 10% of reserve margin will be expected
  - 18 nuclear plants (18GW) have already applied to the safety inspection

Full retail competition

<table>
<thead>
<tr>
<th>Year</th>
<th>Reserve capacity</th>
<th>Reserve margin</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>16GW</td>
<td>5%</td>
</tr>
<tr>
<td>2014 (Summer)</td>
<td>8GW</td>
<td>5%</td>
</tr>
<tr>
<td>2016</td>
<td>16GW + α</td>
<td>10% + α</td>
</tr>
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</table>

*: in comparison of demand in 2014 summer
RES integration in Japan

- Although RES is increasing after introducing Feed-in Tariff scheme in 2012, the share of RES excluding hydro is under 2%.
- However, there already exist some challenges on grids especially for tie lines.
• While expecting sufficient capacity in 2016 when full retail competition starts, the Government decided to include measures to secure long-term electricity supply:

1. Promote cross-regional electricity supply by OCCTO <2015>

2. Ensure adequate capacity investment
   a. Obligation for all retailers to secure adequate capacity <2016>
      - Ensure procurement of enough quantity in the electricity market
   b. Auction for the long-run generation capacity by OCCTO <2016>
      - Prepare for the possible shortage of long-run capacity as a safety net for the electricity market
   c. Further discussion on capacity mechanism (capacity market etc.)
      - Enhance the incentive to establish and maintain generation plant
Main functions of OCCTO to be established in 2015:

1. Aggregate and analyze the EPCO’s supply-demand plans and grid plans, and order to change EPCO’s plans such as tie lines construction
   - Eg. Frequency conversion b/w Tokyo and Chubu: 1.2GW $\rightarrow$ 2.1GW $\rightarrow$ ?
   - Frequency in East: 50Hz
   - Frequency in West: 60Hz
   - DC tie line b/w Hokkaido and Tohoku: 0.6GW $\rightarrow$ 0.9GW $\rightarrow$ ?

2. Order EPCOs to reinforce generations and power interchanges under a tight supply-demand situation

* DC – direct current, FC – frequency conversion
Obligation for all retailers to secure adequate capacity <2016>

- All retailers are legally obliged to ensure adequate capacity (incl. reserve margin) to match their demand.
- Government checks all retailers’ plans at both points of registering to enter the market and of submitting 10-year supply and demand plan each year
- TDSO will balance the gap b/w actual supply and actual demand in the imbalance mechanism.

**Retailer A**

- Forecast the demand as ‘100’
- Purchase the supply same as forecasted demand (=‘100’)

**TDSO**

- Compensate the shortage
- Buy the surplus

- **Reserve margin which retailer A should have secured for upward demand (additional supply necessary for fulfilling the obligation)**

- **The demand Increases to ‘110’, when accident happens.**

- **Forecast the demand as ‘100’**
- **Purchase the supply same as forecasted demand (=‘100’)**

- **At the actual supply and demand**
- **Some years or months ahead**

- **Forecast the demand**
- **Actual supply**
- **Actual demand**

- **Actual supply**
- **Actual demand**
- **The gap (shortage)**
- **Actual supply**
- **Actual demand**
- **The gap (surplus)**

- **Retailer A**
- **Retailer B**
- **Retailer X**

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Auction for the long-run capacity by OCCTO <2016>

- OCCTO will call for bids when supply power shortage is likely to occur because of insufficient investment.
- OCTTO will pay for their capacity (MW), through recovering from network fee.
- The detailed design is under discussion.
Thank you!

Ministry of Economy, Trade and Industry
REFERENCE
LNG mainly compensates for the decline of nuclear power.

Energy mix in Japan

Electricity Generation by Fuel

Source: Compiled by METI based on “Outline of Electric Power Development in FY 2010” etc.
• All of 50 units of nuclear power plants are in stoppage as of September 17, 2013.
• 18 units (in blue square) are under review for restart by Nuclear Regulation Authority in accordance with new safety regulation.
No competition in the electricity market before 1995: 10 vertically integrated GEUs (General Electricity Utilities) dominated and controlled the market.

METI embarked series of reforms...

<table>
<thead>
<tr>
<th>No.</th>
<th>Year enforced</th>
<th>Overview</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1995</td>
<td>• Open the IPP (Independent Power Producer) market</td>
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<td></td>
<td></td>
<td>• Allow specified-scaled and vertically integrated power generators</td>
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<tr>
<td>2</td>
<td>2000</td>
<td>• Introduce partial retail competition</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Accounting separation of transmission/distribution sector</td>
</tr>
<tr>
<td>3</td>
<td>2005</td>
<td>• Expand retail competition</td>
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<tr>
<td></td>
<td></td>
<td>• Establish the wholesale power exchange (JEPX) and its supporting body</td>
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<tr>
<td></td>
<td></td>
<td>for transmission in wider areas</td>
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<tr>
<td>4</td>
<td>2008</td>
<td>• Modify the rule of wheeling rates</td>
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OCCTO’s role for RES integration

• OCCTO has a role to resolve the imbalance between RES well-endowed area and large demand area
  
  1. One stop reception desk for network access
  2. Order to reinforce the main transmission lines including tie line capacity
  3. Cross-regional frequency adjustment by transferring high-frequency fluctuation from an area, in which the TSO cannot afford to control it, to large demand area