

Well-functioning Electricity Market and Network Neutralization

Background and Objective

In Japan, the government has presented an outline of new energy policy, while electricity system reform is well underway. In foreign countries, there has been a growing concern about keeping nuclear power plants after liberalization and the problems associated with an increase in renewable energy generation. It is important for Japan to ensure consistency between national energy policy and electricity system reform. This project conducts a detailed investigation of

the issues in institutional design for the electricity system reform and, at the same time, evaluates the experiences in other countries regarding the issues relating to the national energy policy, such as nuclear power generation in a competitive environment and utilization of renewable energy generation, thereby contributing to an improvement of business environment after the reform.

Main results

1 Evaluation of financing methods for nuclear power generation in Europe after liberalization

We evaluated the financing methods for nuclear power plants under competitive environment in Europe after liberalization (Table 1). In the UK, the Feed-In-Tariff with Contract for Difference (FIT-CfD) with the government was recently introduced to support low-carbon generation including nuclear power plants. However, determination of the strike price (guaranteed purchase price) would be

a difficult task. In several other countries, a long-term power purchase contract with a group of large industrial customers that may also include joint investment program has been used to help financing nuclear power generators. However, care must be taken in promoting competition and adverse impacts on smaller customers (Y14007).

2 The evaluation of issues and solutions regarding high penetration of renewable energy sources (RES) amidst electricity liberalization

In these reports, we surveyed issues and problems of the process of transmission investment planning, cross-border balancing mechanisms and actual conditions of wholesale trading primarily in Germany. German Transmission System Operators (TSOs) and neighboring TSO of Germany are striving for an international expansion of grid control cooperation. However these TSOs begin to trade off imbalance energy in order to prevent activation control reserve when the available transmission capacity of cross-border transmission lines remains

after a wholesale transaction (Fig. 1) (Y14021). Germany's four TSOs and the National Regulatory Authority have cooperatively established a long-term investment transmission plan. The transmission investment increased recently. However the delay of transmission investment increases the cost of congestion management (Fig. 2) (Y14019). In electricity trading, the value of flexibility in thermal power plants as backup for renewable energy becomes more important and is evaluated by financial engineering tools (Y14012).

3 Analysis of the issues in retail competition after full liberalization

We examined the current status and issues of the competition law enforcement by the UK's electricity regulator. To avoid its dual applications by the sector regulators and competition authority, the UK provides for coordination procedures (Fig. 3), which could be a helpful reference for Japan in avoiding overlapping regulations by the new regulatory body and the Fair Trade Commission of Japan (Y14006). Industrial and commercial customers' tendencies to switch electricity suppliers were analyzed based on questionnaire survey. The analysis results showed that, in addition to electricity price, the types of

electricity tariffs were important criteria for large customers when selecting electricity suppliers, and that small customers hoped they could consult with retail electricity suppliers and receive energy related services with less trouble. These could make retail competition more active (Y14022). Regarding the U.S. electricity retail market, it has become clear there are some regions considered as competitive, given the transition from regulated tariff to competitive tariff, even if subsidiaries of existing utilities account for most of the competitive tariff market share and that of new entrants is limited.

Table 1: Financing methods for nuclear power plants in major European countries

| | FIT-CfD Feed-in-tariff with Contract for Difference | Mankala Model Cooperative with Customers as Shareholders | Long-term Contract with a Consortium of Large Customers | |
|---------------------|--|--|---|---|
| Country | United Kingdom | Finland | France | Belgium |
| Counter Party | Government Entity | Large Customers as Shareholders | A Consortium of Large Customers | A Consortium of Large Customers |
| Contract Summary | Government purchases power by settling the difference between strike price and wholesale reference price | Shareholders are entitled with rights to buy power at cost according to the shares | Large customers in the consortium are entitled with rights to buy power at cost | Large customers in the consortium are entitled with rights to buy power at cost |
| Scope | New Plant | New Plant | New and Existing Plant | New and Existing Plant |
| Issues and Concerns | -Strike price needs to be determined by bilateral negotiation without competition, -if the strike price was set too high, burden on taxpayers would increase | -The company is run as non-profit business, -criticized as "tax evasion system" | -Long-term contract of dominant generator may limit competition -Small customers may be at disadvantages -Only a limited role in financing nuclear power plants | |

In Europe, there are financing schemes available for nuclear power plants through long-term contracts with government or large industrial customers. The Feed-In-Tariff with Contract for Difference (FIT-CfD) in the UK is not necessarily a direct subsidy but if the strike price was too high, the government's expenditure would increase. In several other countries, long-term power purchase contracts with groups of large industrial customers have been used to help finance nuclear power generators. These schemes allow the customers to draw the power at a cost, which is assumed to be less expensive than wholesale market prices. However, it may limit the competition in the market by eliminating the opportunity for new entrants. There has also been criticism that small users are disadvantaged.

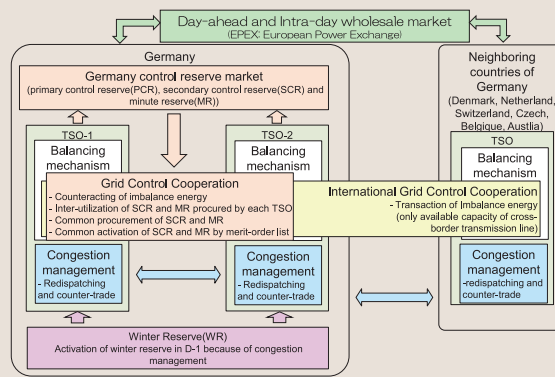


Fig. 1: The balancing mechanism of TSOs of Germany and neighboring countries

The high penetration of RES causes the difficulty of independently balancing each German TSO. After the introduction of GCC, German TSOs have gradually begun to operate GCC from 2008. A German TSO activates redispatching of the output of generators. WR, which is procured through a bilateral contract between TSOs and generator companies, is enforced when it is impossible to solve the transmission congestion by redispatching. IGCC only contributes by preventing activation control reserve by international counter-trading of imbalance energy when there is remaining available transmission capacity following Gate-Closure.

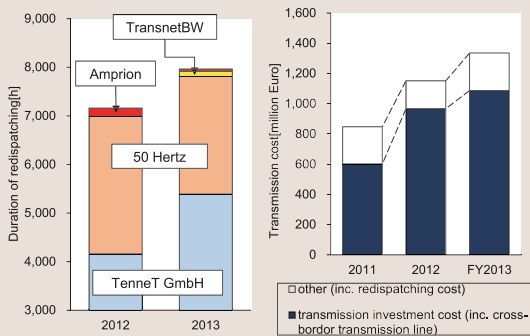


Fig. 2: The change of the transmission cost and duration of redispatching in Germany

German TSOs and the National Regulatory Authority had considered that an upgrade and a new transmission line were necessary in 2009 for the sake of securing supply. A transmission investment was made (right figure). However, in 2014, only 438 km of the enhancement transmission line, which will ultimately have a total length of 1855 km, was complete. The delay of transmission investment and high penetration of RES increase the duration of redispatching of generators by TSOs (left figure). Though the control reserve procurement procedure and the development of transmission network are being carried out in Germany, the cost of securing supply has increased.

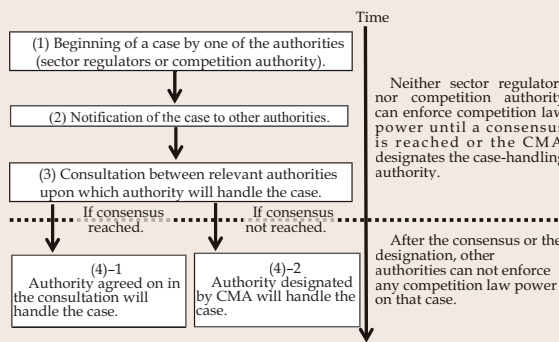


Fig. 3: Procedures to avoid dual applications of competition law by the sector regulators and competition authority in the UK

When granting powers on market competition monitoring and competition protection to the new electricity regulatory body, it is important to avoid unnecessary dual, redundant regulations by the Fair Trade Commission of Japan and the regulatory body. In the UK, since both the electricity regulator (Ofgem) and the competition authority (CMA) concurrently have competition law power, law provides for the procedures to avoid dual applications by these authorities. In particular, (1) when an authority finds a case that could distort competition, and intends to apply competition law, (2) the authority should notify that intent to other relevant authorities. (3) Based on the notification, the CMA and the relevant sector regulators will consult on which authority will handle the case. The case-handling authority will be decided by (4)-1 the consensus between the authorities of the designation by the CMA. This procedure helps to avoid dual application of competition law in the UK.