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Pricing in Competitive Power Market and Impact of Renewable Power's Inflow

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On August 13-15, I had an opportunity to talk with government energy policy makers, energy industry people and energy researchers in Malaysia. Since the new administration's inauguration in May, Malaysia has been reviewing and revising national policies, reorganizing government agencies and implementing personnel reshuffles. Under such situation, I had interesting discussions there on various energy issues facing Malaysia.

The issues included various challenges for transition to competitive pricing in deregulated power markets, particularly wholesale markets, as indicated by the title of this report. Participants in the discussions indicated their great interests in various challenges emerging as massive power generated with renewable energy flows into a competitive power market amid global renewable energy expansion. As a matter of course, Malaysia is still far away from power market deregulation or renewable energy expansion. However, interests have been growing in energy market deregulation policies, leading the significance of these challenges to be recognized. I here would like to make some comments on the discussions in Malaysia.

In a power market before deregulation, pricing represents the "full cost pricing" or "fully distributed cost method". Total costs required for power supply are basically passed on to prices or consumers to secure cost recovery. If the market is liberalized or deregulated to improve the market's efficiency and introduce competition to increase consumer benefits, however, power pricing is based on supply and demand or driven by the market fundamentals.

As a wholesale power market for trading in generated power is created and developed in the power supply chain, competitive pricing is promoted. Then, a power supply curve is formed on a "merit order" where the cheapest power generators are dispatched first. As market competition makes progress, costs tend to approach the marginal cost level. As a power demand curve is given here, the equilibrium price is determined at the supply-demand equilibrium point. This is a very simple method of pricing based on a supply-demand equilibrium, as indicated by economics.

Those that generate power at cost levels below the equilibrium price and positioned on the left side of the supply-demand equilibrium are operating their plants, gaining profits representing gaps between the equilibrium price and their cost levels. However, high-cost power generators positioned on the right side of the equilibrium point fail to operate, receiving no income. If the equilibrium price is based on the marginal cost, even power generators at the equilibrium point can recover their marginal cost while failing to recover their fixed or capital costs. Even for low-cost power generators, capital cost recovery cannot necessarily be guaranteed. In such situation, incentives are lost for investment in new power generation capacity. Some power generators may fail to recover capital costs and have problems with maintaining capacity. They cannot acquire income required for capital cost recovery. This represents the so-called "missing money" problem.

When the equilibrium price fails to secure capital cost recovery, capacity may fall short of levels required for stabilizing power supply and demand. Basically, power supply is required to immediately match demand. The market must have capacity to supply power as necessary. To address the maintenance of capacity required for the equilibrium price, the so-called "capacity mechanism" has been introduced. There are various types of capacity mechanism including the capacity payment, capacity market and strategic reserved capacity. In summary, the mechanism is for payment for the value of maintaining capacity or supply potential irrespective of power generation volume. Western countries and Japan are introducing or considering introducing the mechanism. They are conducting some kind of "social experiments" for the introduction.

Complicating the "missing money" problem is the flow of massive renewable energy-generated power into the wholesale market. CO_2-free domestic energy is being expanded massively in many countries thanks to policy support and a decline in total power generation costs including capital costs. In a competitive wholesale power market, solar photovoltaics, wind and other renewable energy power sources top the merit order due to the absence of variable costs (fuel costs) and work to shift the supply curve rightward. As far as the demand curve (downward slope to the right) remains unchanged, therefore, the equilibrium point shifts rightward, leading the equilibrium price to fall from the level before the inflow of renewable power. As a result, non-operational capacity increases, with profit at the equilibrium point declining, making the maintenance of existing capacity more difficult. Capacity mechanisms now under consideration in many countries have no choice but to take the inflow of renewable power into account. Furthermore, renewable power supply features intermittency, leading to an additional challenge of adjusting power supply flexibly to maintain power quality including the maintenance of frequency.

The power price under the "full cost pricing" approach covers the power or energy value (kWh value), the kW value of maintaining installed capacity to provide power as necessary and the ΔkW value of adjusting supply and demand fluctuations to maintain power quality. As the power price is determined in accordance with supply and demand in a competitive wholesale market, however, the price represents the kWh value alone. This is because both the supply and demand curves represent the kWh value alone. Therefore, a mechanism to determine the kW and ΔkW values apart from the kWh value has become indispensable for broadly-defined stable power supply.

In the face of such challenges, European countries and U.S. states that now have competitive power markets are exploring various policy initiatives. In the United States where renewable power's inflow into the wholesale power market is combined with the shale revolution, wholesale power price falls arising from gas price drops have become a key factor causing problems with the maintenance of existing power generation capacity. In a deregulated power market, power sources are selected essentially through competition so that a policy-desirable power mix for energy security and environmental conservation cannot be secured. The question always asked is what roles government policies should play in securing stable power supply and a desirable power mix in a competitive power market. Market deregulation is a great social experiment in a sense. The experiment by definition could be successful or unsuccessful. If the experiment is unsuccessful, means to overcome the unsuccessfulness may have to be explored. Malaysia and many other countries that may go ahead with market deregulation must fully consider these points.

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