

Growing Importance of Security of Electricity Supply

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As the outbreak of the Ukraine crisis has severely shaken the international energy market, pushed up energy prices sharply, and caused serious energy supply insecurity, ensuring and enhancing energy security has come back as a top energy policy priority. The Ukraine crisis can be seen as an important opportunity to significantly change the world's interest in energy issues, which had been dominated by the realization of carbon neutrality and the promotion of decarbonization. Since the crisis, the world has been confronted with the challenge of how to achieve both enhanced energy security and decarbonization under the international political and geopolitical realities of deepening global divisions.

While energy security has become the most important challenge, there are many uncertainties about the future energy situation in Japan and the world, indicating a mountain of challenges to be tackled. Since the outbreak of the Ukraine crisis, Western countries have tried to phase out their dependence on Russia, leading the Middle East to dramatically increase its importance as an alternative source of energy supply. In a symbolic case, Japan's rate of dependence on the Middle East for crude oil imports rose to 94% in 2022. As a result, the world has become more dependent on the Middle East for a stable oil supply, allowing the region's oil-producing countries to expand their market influence and power. Furthermore, the stabilization of the Middle East has become more directly linked to the stability of crude oil prices and the international oil market, leading the Gaza Palestinian crisis since October to become an important factor that could shake the energy situation. So far, the crisis in Gaza has not affected the oil supply, but future developments will have to be closely monitored.

In this way, stabilizing the market for and securing a stable supply of oil as the world's largest international energy trade good has retained high importance so far. From the perspective of energy security, however, we must recognize that the oil issue is broader and more complicated. In addition to oil security, natural gas and LNG supply security became a world-shaking issue amidst the Ukraine crisis last year. Then, Europe was forced to desperately implement energy security measures. Securing stable natural gas and LNG supply will remain an important global challenge.

Recently, key energy security issues as seen from completely new and broader perspectives have also come to the attention of the world. As the world has become increasingly fragmented, concentration in supply chains for clean energy investment targets such as renewable energy, electric vehicles, and batteries has become a global matter of interest from the perspective of emphasizing economic security, together with concerns about the tighter supply-demand balance and price hikes for rare earths and other critical minerals and about their limited supply sources. These issues are significant economic security issues that are related not to energy but to supply chains linked directly to energy. In this sense, they may be part of widely defined energy security issues. Global interest in these issues will grow more and more in the future.

When future energy security issues are considered, however, electricity supply security has the potential to become the most important challenge. Even at present, it is easy to understand how dependent we are on electricity when we think about our day-to-day lives and the economy. There is no doubt about the importance of electricity as an energy source that supports a comfortable, safe, clean, and convenient life.

The importance of electricity will continue to increase in the future. The share of electricity in final energy consumption (electricity's share of consumers' direct energy consumption) is currently about 20% in Japan and the rest of the world. Even if the world changes in a "business as usual" manner in the future, however, the share is expected to exceed 30% by 2050. If decarbonization is promoted to achieve carbon neutrality, the share will increase further. When carbon neutrality is achieved, the share is widely expected to top 50%. The reason for this is that the most efficient decarbonization method is to increase electricity's share of energy consumption and zero-emission electricity sources as much as possible because there are renewable energy, nuclear, and other zero-emission electricity sources that have already been put into practical use, commercialized, and diffused. In this way, the world will go in the direction of increasing the electricity share significantly, making stable electricity supply even more important.

Furthermore, another important move for increasing the significance of electricity is attracting global attention. That is the rapid progress in digitalization and informatization that could significantly boost demand for electricity. Originally, the possibility that the promotion of digitalization and informatization will lead to a boost in electricity demand has attracted attention from the energy industry. However, recent technological innovations and proliferation, such as the spread of generative artificial intelligence, are attracting attention to the possibility of pushing up electricity consumption much more than previously assumed. Electricity consumption may also increase dramatically in regions or countries that develop the capacity to produce and supply goods related to digitalization and informatization. Attention should be paid to the impact of the construction or installation of large semiconductor plants and data centers on electricity demand. These changes could further accelerate the rise in the electricity share for decarbonization.

The energy mix in Japan's current Strategic Energy Plan indicates that Japan's total electricity generation (considered approximate to electricity consumption) will decline from around 1,024 billion kilowatt-hours in FY2019 to around 934 billion kWh in FY2030. Electricity consumption is expected to be suppressed as energy efficiency improvement is promoted strongly to achieve the 3E's: economic efficiency, energy security, and environmental protection. Given the social, economic, and energy conditions described above, however, careful consideration may be required even in Japan on how to view future electricity demand. There is no doubt that energy efficiency will continue to improve. However, it is necessary to assess the impact of digitalization and informatization. In addition, it is necessary to secure a stable electricity supply that satisfies demand stably and sufficiently.

On the other hand, it is also important to note that various issues and challenges have emerged in securing a stable electricity supply. If the spread of renewable energy contributing to decarbonization and energy self-sufficiency improvement centers on naturally derived and intermittent supply sources such as solar photovoltaics and wind power, measures to stabilize the electricity supply will be required inevitably. Available technological responses to such intermittent electricity supply include electricity storage systems, adjustments using fossil-fired power generation, and the enhancement of power grids. However, these responses will lead to an increase in electricity costs including those for integrating renewable energy electricity into power grids. Furthermore, these responses can increase dependence on limited supply sources for strategic commodities such as critical minerals, as noted above. While sufficient electricity supply capacity, including surplus capacity, is

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required for stable electricity supply, electricity market liberalization encourages market players to eliminate redundancy, cut costs, and minimize surplus capacity, making it more difficult to secure investment in supply capacity development. It will be necessary to respond to such difficulties by designing a capacity market and other mechanisms. In this respect, how to strike a balance between electricity market liberalization and stable electricity supply and how to efficiently utilize and expand zero-emission power sources will become challenges. Inevitably, policies and initiatives to tackle the increasingly complex challenge of stable electricity supply in Japan and around the world will become critically important.

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