

Innovation as Key to Energy Transition and Its Challenges

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In light of the enormous impact of the Ukraine crisis, energy security has emerged as the most important global challenge. At the same time, however, the world is required to continue promoting carbon neutrality and other deep decarbonization initiatives. Therefore, how to strike a balance between the two important challenges has become a key energy issue for the present world. European initiatives such as the REPowerEU Plan, which was announced promptly after the outbreak of the Ukraine crisis, represent efforts to promote energy efficiency, renewable energy, nuclear energy, hydrogen, electrification, and the utilization of U.S. liquefied natural gas, and other measures to enhance energy security through the phaseout of dependence on Russian energy resources and decarbonization. Not only in Europe, but also in Japan, the United States, and other major countries, similar efforts are being pursued, although specific measures differ depending on national conditions and circumstances.

In reality, however, the pursuit of the simultaneous achievement of the two important challenges is extremely difficult. First, the current energy market indicates that no country is in a position to easily accept rising energy costs and prices under difficult economic conditions. It is doubtful whether the market and consumers can willingly accept energy costs and price hikes through the promotion of an energy transition to achieve both energy security and decarbonization. Given that energy price spikes have led to energy subsidies even in developed countries and tended to affect developing and emerging economies with lower income more seriously, the world is now very sensitive to rising energy costs. The recent delay in bans on sales of internal combustion engine vehicles and on the installation of new petroleum-based boilers in Europe indicates that our society is becoming more cautious about the cost of promoting the energy transition.

Second, even if indispensable technologies for promoting the energy transition are introduced, it will not be easy to dramatically transform the energy supply and demand structure and reduce CO₂ emissions. This point is reflected in the "Advanced Technologies Scenario" in our IEEJ Outlook 2024, which assumes that technologies for the energy transition will spread to the maximum extent possible. Even in the scenario, energy-related CO₂ emissions will fail to be cut to zero by 2050, even though plunging from 33.6 billion tons in 2021 to 14.7 billion tons in 2050. This is because it will not be easy for the non-power sector, including heat demand, and for developing and emerging economies to reduce CO₂ emissions.

In this case, we have no choice but to hope that advanced technologies and innovations that have not been commercialized or widely diffused in the market at present will make great progress towards the energy transition to realize carbon neutrality in the world. This means that it is difficult to envision a carbon-neutral future without the benefits and effects of innovations.

There are various innovations that are considered indispensable for promoting the energy transition. A representative one among such innovations is clean hydrogen, such as green hydrogen derived from renewable energy and blue hydrogen made from fossil fuels with CO₂ emissions captured and stored. Other innovative fuel technologies expected to support carbon neutrality in the future include ammonia, synthetic fuels, and e-methane. Other technologies subject to growing interest include CCS and CCUS to capture, store, and utilize CO₂ emissions, as well as negative emission technologies to reduce the CO₂ density in the atmosphere. It is difficult to achieve carbon neutrality without contributions from these innovative technologies.

However, there is still a great deal of uncertainty about when, where, and how these innovations will actually be introduced. Behind the fact that they have not yet been commercialized are serious challenges such as far higher costs for these innovations than for competing energy technologies, the lack of social and supply infrastructure required for their dissemination, and the absence of institutions for the certification of effects of new technologies and the identification of contributors to greenhouse gas emission cuts.

As a matter of course, it is true that various actors around the world are strengthening their efforts to overcome these challenges. This is because innovations are absolutely required for the energy transition. This is also because it is impossible to achieve both energy security and decarbonization without overcoming these challenges. No matter how difficult it is to overcome the challenges, actors that lead the development and wide diffusion of innovative technologies will establish their positions as contributors to a successful energy transition and gain an international competitive advantage if they successfully overcome these challenges to allow their innovations to bloom. Whether or not any actors will become winners in the energy transition depends on whether they can realize innovations. This will have extremely important implications for both nations and businesses.

For this reason, various companies around the world are now beginning to fiercely compete to realize innovations. In fact, many companies are enhancing efforts to develop supply chains for clean hydrogen and ammonia. However, what is most noteworthy to me is that national governments or strategies are moving to take leadership in achieving successful innovations. The move takes the form of industrial policy, as indicated by the U.S. Inflation Reduction Act (IRA). Industrial policy to provide government subsidies or support to foster underdeveloped and immature technologies and industries or strengthen their international cooperation was regarded as having supported Japan's postwar economic growth and development until around the 1980s. Such industrial policy came under fire as the "Japan Inc." policy by the United States and some other countries that gave priority to rejecting government intervention in markets and industries, utilizing market principles, and emphasizing free trade and competition. As the division of the world has deepened with the passage of time, however, there is now a growing recognition in the United States that a national strategy should come to the fore in order to achieve both energy security and decarbonization. The IRA represents government support and subsidies for promoting clean energy investment and realizing innovations, indicating the strong will of the United States to tackle innovations to serve its national interests.

As competition intensifies between nations and between companies around the world to achieve successful innovations, priority is given to how to cut technology costs. In this respect, it is necessary to consider and develop a system to cover gaps between costs for new and existing technologies or energy sources on the user side. This kind of ingenuity is important for the supply and demand sides to keep in step with each other in promoting innovations. However, it is necessary to

fully understand that the introduction of new technologies will lead to an increase in the cost burden on society as a whole, as long as the cost gaps exist. It will become increasingly important for our society as a whole to ensure a common understanding and recognition that some additional costs are required for achieving both energy security and decarbonization.

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