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IEEJ Outlook 2023
Challenges for Achieving Both Energy Security and Carbon Neutrality

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On October 19, the Institute of Energy Economics, Japan, published the IEEJ Outlook 2023 at its 442nd meeting on research reports. The IEEJ Outlook projects global energy supply and demand through 2050, being positioned as the IEEJ's flagship publication. The IEEJ releases the annual outlook every October, providing a long-term energy supply and demand analysis in the form of an annual regular exercise and special analyses on up-to-date topics. In addition to a long-term analysis based on the Reference Scenario and the Advanced Technologies Scenario for regular exercise, the latest IEEJ Outlook features special analyses that focus on the Ukraine crisis and energy security enhancement initiatives and considers how to achieve both energy security and carbon neutrality from various perspectives. The following summarizes key points of the latest IEEJ Outlook.

The IEEJ outlook takes a forecast approach that projects global energy supply and demand under various assumptions on future changes, based on changes to date. The forecast approach contrasts with a backcasting approach in that the International Energy Agency has adopted for an analysis on global carbon neutrality to consider how global energy supply and demand should change for the achievement of the global carbon neutrality goal. It must be noted that both the forecast and backcasting approaches are useful tools for future analysis and have their respective significance.

In the Reference Scenario in which current trends will be sustained, global primary energy demand will steadily increase under sustained economic growth, posting about a 1.3-fold rise from 2020 to 17.6 billion tons of oil equivalent in 2050. The increase will be driven by Emerging Market and Developing Economies, including India and the Association of Southeast Asian Nations (ASEAN) that will account for 56% of the global increase. In China that has led global energy demand growth, demand will decline due to falling population and decelerating economic growth. As natural gas and oil demand increases steadily, despite a decrease in coal demand, fossil fuels will continue to account for most of global energy supply, capturing 77% of global energy supply in 2050.

In the Advanced Technologies Scenario in which advanced energy technologies will spread as much as possible to enhance climate change prevention and energy security measures, primary energy demand in 2050 will be 19% less than in the Reference Scenario due to powerful progress in energy efficiency improvement. Demand will sharply grow for non-fossil energy sources such as renewable energy and nuclear, while slackening for fossil fuels. Coal demand will decrease substantially. Oil demand will peak in the 2030s and natural gas demand in the 2040s. Nevertheless, natural gas demand in 2050 will increase by 14% from 2020 and liquefied natural gas demand by 13%. As a result, global energy-related CO_2 emissions in 2050 will total 16.9 billion tons, 20.1 billion tons or 46% less than 37 billion tons in the Reference Scenario. The emissions in 2050 are close to those in the Announced Pledge Scenario (in which announced national emission reduction goals will be achieved) in the IEA World Energy Outlook 2021 released last year. In the Advanced Technologies

Scenario, fossil fuels will still account for 59% of primary energy demand in 2050, keeping their position as an important energy source.

Special analyses in the latest IEEJ Outlook deal with four key topics. The first analysis points out that the natural gas and LNG market is urgently required to be stabilized in response to the Ukraine crisis. From the medium to long-term viewpoint, how to secure necessary, sufficient and appropriate investment in natural gas and LNG is a key urgent challenge. The analysis also notes that a two-stage energy transition for decarbonization to appropriately utilize natural gas/LNG will be effective in Asia, given renewable energy potential, costs for the integration of massive renewables into the power grid, and stable electricity and critical minerals supply as described later. The analysis emphasizes that the stabilization of natural gas and other fossil fuels markets will be extremely important for expanding the use of blue hydrogen and ammonia that are expected to play a key role in promoting global decarbonization.

The second special analysis concerns the significance of stable electricity supply. It is globally recognized that a key decarbonization measure is the promotion of electrification accompanied by initiatives to eliminate emissions from electricity sources. In this respect, the importance of electricity increases further, with stable electricity supply becoming a significant challenge. In fact, however, electricity market deregulation and growing variable renewable energy sources for electricity have led to electricity supply problems, including a decline in surplus power supply capacity in many countries and a decrease in capacity to respond to heat and cold waves and other abnormal climate phenomena, as well as power supply disruptions. In this sense, how to secure investment in the power sector is a key challenge for the future. Attracting attention in this respect is the introduction of an investment recovery method under a total cost approach to be adopted in the United Kingdom for promoting nuclear energy. This analysis also emphasizes that it is important to secure stable electricity supply regarding not only installed electricity generation capacity but also actual power output and fuel procurement. As stable electricity supply becomes a key challenge, initiatives to utilize nuclear energy have been seen globally, including new nuclear reactor construction plans in Europe and the extension of service life for reactors. The analysis points out that Japan's initiative to promote the restart of nuclear power plants attracts attention as a contributor not only to stable electricity supply, decarbonization and power cost cuts in Japan but also to global natural gas/LNG market stabilization.

The third special analysis concerns the significance of critical minerals. As the world promotes renewable energy power generation and electrification, demand for rare earths and other critical minerals will increase dramatically. The supply-demand balance will thus become extremely tight for lithium, neodymium, dysprosium, etc. in the mid-2030s. For some minerals such as cobalt, reserves are feared to fail to meet growing demand over a long term. As these minerals and capabilities to process them are unevenly distributed, substantial growth in their demand is expected to lead to not only a tighter supply-demand balance but also grave economic security issues. The analysis indicates that initiatives may have to be enhanced to develop relevant resources, diversify supply chains, recycle critical minerals and develop alternative technologies to secure stable critical mineral supply that will be indispensable for energy transition.

The fourth special analysis is related to the economic effects of green investment. While green investment for decarbonization is expected to accelerate economic and employment growth, its effects will differ depending on constraints on funds for investment, according to the analysis. Additional green investment worth 14 trillion yen in the Advanced Technologies Scenario will boost global gross domestic product by 0.4% per year until 2050 if no constraints exist on funds for

investment (investment increases by a net 14 trillion yen). If constraints exist to offset green investment with falls in investment in other areas, the global economy will contract by 0.1% per year. Green investment's effects to squeeze economic growth may differ by region, resulting in economic gaps among countries. The analysis points out that the world will have to overcome constraints on funds for green investment and secure sufficient investment to realize green growth.

Long-term global energy outlooks entail great uncertainties. At present, particularly, the geopolitical situation has become chaotic due to the destabilization of the international energy situation and global divides amid the Ukraine crisis, making it extremely difficult to depict a future picture of the world. Even in the face of such difficulties, however, it is important to take advantage of various ideas to analyze future possibilities for the world. The IEEJ is determined to continuously contribute to solving energy problems in the world through analyses in the IEEJ Outlook.

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