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Key Points of "IEEJ Outlook 2019"

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On October 15, the Institute of Energy Economics, Japan, released the "IEEJ Outlook 2019," its latest long-term global energy outlook. The IEEJ annually publishes the long-term global energy outlook. The latest one projects global energy supply and demand, and markets through 2050. As indicated by its subtitle, "Energy transition and a thorny path for 3E challenges," the outlook explains that it would not be easy to achieve the so-called 3E's – energy security, environmental protection and economic/market efficiency – in a balanced manner amid the long-term energy transition. It develops and analyzes the following two basic scenarios under major assumptions including annual global economic growth averaging 2.7% through 2050, population projected at 9.7 billion for 2050 and energy prices including the oil price of $125 per barrel in the Reference Scenario.

The first is the Reference Scenario where the current trends of energy supply and demand, fundamentals, policies and technologies are assumed to continue. This scenario projects the present trends into the future, representing a business-as-usual future. The second is the Advanced Technologies Scenario where advanced energy and environmental technologies are assumed to be introduced to the maximum and work well under the fundamental enhancement of energy security and environmental policies. The IEEJ conducted its own assessment of the maximum introduction of various technologies based on discussions with and information collection from experts and industry people to analyze global energy supply and demand changes through the introduction of advanced technologies under the so-called bottom-up approach. Based on the two scenarios, the latest outlook overviews the global energy situation over the long term and provides special analyses on oil and electricity supply disruptions and the impact of banning new coal power plant construction. The following summarizes the key points of the outlook.

In the Reference Scenario, global energy demand will increase at an average annual rate of 1.0% from 13.8 gigatons of oil equivalent in 2016 to 19.3 Gtoe in 2050. Driving the increase will be non-OECD Asian countries including China, India and ASEAN members, which will account for 63% of the increase. However, China's energy demand will peak out in the 2040s, while Indian and ASEAN demand will keep on increasing robustly over the long term. While the gravity center of global energy demand will shift to Asia, that of Asian demand will shift to South and Southeast Asia over the long term. Electricity demand will grow remarkably, representing the electrification of energy demand. Electricity's share of global final energy demand (the electrification rate) will expand, with the share in Asia is projected to rise from 10% in 1990 and 21% in 2016 to 30% in 2050. Therefore, a key challenge will be how to provide stable electricity supply to meet growing demand while limiting the environmental load in the world and in Asia.

In the Advanced Technologies Scenario, global energy demand in 2050 will be 17 Gtoe, falling 12% from the Reference Scenario due to stronger energy conservation. Fossil fuel demand will decrease substantially from the Reference Scenario. In its place, non-fossil energy demand including renewables and nuclear will expand substantially. Particularly, coal demand will decline remarkably. Oil demand will also peak around 2030 in the Advanced Technologies Scenario. While energy supply and demand will dramatically change through technological advancement, fossil fuels' share of global energy demand in 2050 will still be as high as 69%, leaving fossil fuels to remain important. Energy investment through 2050 will total $82 trillion in the Reference Scenario and $90 trillion in the Advanced Technologies Scenario. Electricity-related investment will account for half the energy investment.

Energy-related CO_2 emissions will continue increasing in the Reference Scenario, while the CO_2 emissions will peak in the 2020s and fall moderately in the Advanced Technologies Scenario. But the emission level in the Advanced Technology Scenario in 2050 will fall short of achieving the ambitious target of reducing emissions by half. Given that climate change initiatives will have to be implemented over an ultra-long term with hopes placed on the development and penetration of innovative technologies, it will be important to consider initiatives to minimize the total cost covering greenhouse gas emission reduction (mitigation), adaptation and damages.

An analysis on energy supply disruptions indicates that if 10 million barrels per day in oil supply from the Middle East are lost with no substitute made available, real global GDP will shrink by 9%. Given the present and future geopolitical risks in the Middle East and the potential destabilization of the regional situation, potential oil supply disruptions and their impact are a risk that cannot be ignored. While electricity is expected to grow more important amid the electrification of energy demand, structural risks such as growing dependence on some specific single electricity source, the impact of intermittent renewable energy power generation expansion, power plant shutdowns in a competitive electricity market, as well as unexpected or emergency risks including cyberattacks, have emerged as new threats to electricity supply security. Abnormal weather and large-scale natural disasters are also seen as threats. Given the recent case where a large-scale earthquake caused a blackout in Japan's Hokkaido, appropriate measures to enhance stable electricity supply are very important.

An analysis on the impact of banning new coal plant construction deals with how the 3E's would be affected if the construction of new coal power plant capacity assumed at 1.6 terawatts through 2050 in the Reference Scenario is banned with renewable energy or natural gas power plants made available as a substitution. In both the renewable energy and natural gas substitution cases, global CO_2 emission reduction will make progress. Particularly, the progress will be greater in the renewable energy substitution case. However, challenges to energy security and economic efficiency will arise. If all the banned coal power plants are replaced with natural gas plants, a massive natural gas supply expansion will be required to meet demand growing particularly in Asia. Specifically, LNG supply capacity will have to be expanded to 750 million tons by 2030. Even if such supply expansion is realized, Asia will face a sharp decline in its natural gas self-sufficiency rate and a substantial increase in gas import payment through price hikes triggered by a tighter supply-demand balance for gas and LNG as well as volumetric increase in imports.

If the banned new coal plants are replaced with renewable energy plants, renewable energy power generation capacity will have to expand to as much as 10 TW against the present global capacity of about 6 TW covering all electricity sources. Such sharp growth in renewable energy power generation capacity will require an unprecedentedly large capacity for electricity storage and power supply/demand adjustments including massive output restrictions. Furthermore, grid adjustment costs will increase substantially, leading electricity supply costs to increase particularly in Asia. This will cause serious challenges for the affordability of electricity prices.

As the world is in the midst of energy transition in general and going in the direction of a new future picture, the 3E's – energy security, environmental protection and economic/market efficiency – are required to be achieved in a balanced manner. The path for 3E challenges is not flat. Policies, advanced technologies and human wisdom will have to be totally mobilized to tackle energy transition.

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