

Key Points of IEEJ Outlook 2021

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On October 16, the Institute of Energy Economics, Japan, released the “IEEJ Outlook 2021” at its 436th meeting on research reports in the form of a teleconference. The outlook projects global energy supply and demand through 2050 and is positioned as the IEEJ’s flagship product. The IEEJ releases the annual outlook every October, providing a long-term energy supply and demand analysis in the form of regular scenario 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 scenario exercise, the latest Outlook gives (1) a special analysis on the Post Corona World Transformation Scenario in which global energy supply and demand would be structurally transformed by the COVID-19 pandemic, (2) a special analysis on the Circular Carbon Economy/4Rs Scenario focusing on the decarbonization of fossil fuels, and (3) an updated analysis on a total cost minimization approach on climate change. The following summarizes key points of the latest Outlook.

In the Reference Scenario in which current trends will be sustained, global primary energy demand will steadily increase under steady economic growth, posting a 30% rise from 2018 in 2050. The increase will be driven by Asian Emerging Market and Developing Economies including India and the Association of Southeast Asian Nations. Fossil fuel demand will firmly expand, continuing to account for most of global primary energy demand. Particularly, natural gas demand will rise. In the Advanced Technologies Scenario in which advanced energy technologies will be introduced to maximum extent to enhance energy security and environmental measures, primary energy demand in 2050 will be 15% 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 and oil demand will peak. Particularly, coal demand will plunge. As a result, global energy-related CO₂ emissions in 2050 will be 14.8 billion tons or 37% less than in the Reference Scenario. Nevertheless, fossil fuels will still account for 67% of primary energy demand in 2050, keeping its position as an extremely important energy source.

The first special analysis of the latest Outlook develops a scenario of and quantifies the COVID-19 pandemic’s long-term structural impacts on international energy markets. The COVID-19 disaster has pushed down global energy demand through economic contraction and lockdowns, bringing about substantial oversupply and price crashes in international energy markets. The Post Corona World Transformation Scenario analyzes the long-term structural impacts of the disaster that has dramatically changed the international energy situation over a short term. In this scenario, the global economy will decelerate growth while deviating from global supply chains for maximum efficiency and minimum costs and from free trade as the global geopolitical environment grows more difficult under the impacts of the COVID-19 pandemic, with “me-first” policy and alliances being emphasized. As a result, global primary energy demand in 2050 will be 4% less than in the Reference Scenario. Global supply chain changes will impact economic growth and energy

demand by country/region. Energy demand will decrease in China from which supply chains will flow out, while increasing in India and ASEAN into which supply chains flow.

In this scenario, oil demand will be particularly affected. Social transformation through the promotion of information and communications technologies and digitalization for growing telework and teleconferences will prompt oil demand to peak. Oil demand in 2050 will be some 14 million barrels per day less than in the Reference Scenario. While oil demand decreases, electricity will grow more important as an energy source to support the abovementioned social transformation. In this scenario, electricity's share of global final energy consumption in 2050 will be 2 percentage points higher than in the Reference Scenario. Stable supply, affordability and environmental friendliness of electricity growing important will become more significant. In this scenario, countries will give priority to the enhancement of energy security amid a difficult geopolitical environment, promoting the improvement of energy self-sufficiency and the diversification of energy sources. Renewable energy, nuclear and hydrogen consumption will be accelerated, with competition intensified for supremacy in innovative energy technologies.

The second special analysis of the latest Outlook is based on the Circular Carbon Economy/4Rs Scenario. As the world grows interested in decarbonization, comprehensive decarbonization initiatives are becoming more important. The promotion of non-fossil energy sources such as renewables and nuclear is important as a matter of course. Also important are comprehensive initiatives to decarbonize fossil fuels that will remain significant as energy sources in the future. Then, a circular carbon economy that will use 4Rs technologies to reduce, reuse, recycle and remove CO₂ emissions from fossil fuel consumption is attracting interest in the world.

This scenario assumes the maximum introduction of 4Rs technologies and estimates their effects. Fossil fuel consumption in 2050 in this scenario will be almost similar to about 16 billion tons of oil equivalent in the Advanced Technologies Scenario, but global CO₂ emissions will be as much as 5.2 billion tons or 21% less due to the expanded use of blue hydrogen (clean hydrogen produced from fossil fuels with CO₂ emissions captured and stored). In this scenario in which natural gas is assumed to play a central role in producing blue hydrogen, natural gas demand will expand, with the Middle East and North America becoming blue hydrogen exporters. There are some challenges regarding the 4Rs technologies, including how to thoroughly improve economic efficiency regarding global blue hydrogen supply chains and how to secure the social acceptability of blue hydrogen. However, this scenario indicates a world in which fossil fuels will be effectively used, with great contributions being made to initiatives for substantial global CO₂ emission cuts and decarbonization.

The third special analysis is an updated one on the total cost minimization approach on climate change. Climate change costs cover emission reduction, adaptation, and damage costs. This analysis points out that a path to minimizing the three cost components will contribute to practical responses to extra-long-term climate change along with future innovative technologies. However, it is pointed out that this approach faces various challenges including how to accurately identify a damage function and the presence of tipping elements (that would accelerate their changes soon after beginning to change, pushing up climate change damage or costs beyond assumed levels). The latest Outlook provides an additional analysis on tipping elements, analyzes how levels of the discount rate (a numerical concept that influences the assessment of future damage or values) and technological advancement would influence the cost-minimizing path, and reaffirms the adequacy of the total cost minimization approach. Given that the total cost minimization approach has the potential to remain

significant for analyzing climate change, challenges and weaknesses of the approach should be overcome.

Long-term global energy supply and demand outlooks entail great uncertainties. No one knows how the world would be in the far future. However, it will remain important and significant for all energy stakeholders to develop future energy maps of the world based on various assumptions and premises. The IEEJ is determined to continuously contribute to solving energy problems in the world through analyses in the IEEJ outlook.

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