

Forecast and Backcast Future Energy Situation

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There are various uncertainties in the real world around us, making it extremely difficult to accurately predict how the situation will change in the future. As the international energy situation is plagued with many important uncertainties that affect the future, it is becoming increasingly necessary to think about the future of energy under these uncertainties. Once the investment is made and embodied as infrastructure or equipment in the energy sector, as known well, such infrastructure or equipment will continue to be used over the long term. Moreover, it often takes a considerable amount of time from an investment decision to its implementation and embodiment. Investment with an eye on the future of energy represents an effort to cope with a long-term future.

In Japan, discussions are underway for the formulation of the Seventh Strategic Energy Plan. With the aim of achieving carbon neutrality by 2050, Japan must set greenhouse gas emission reduction targets for 2035 or 2040 and consider how the energy mix should be to attain them. In addition to promoting decarbonization, the new plan must respond to developments that could not be taken into account for the current Sixth Strategic Energy Plan (approved by the Cabinet in October 2021), such as the emergence of energy security as a top priority following the Ukraine crisis, the increasingly complex geopolitical situation, and the deepening division of the world. Based on this situation, the government must consider the future vision of energy that Japan is aiming for and the policies to realize it.

The importance of such efforts is not limited to Japan. In Europe, America, and Asia, major countries must develop their respective future visions of energy they pursue and formulate and implement policies to achieve them. An important basis for these efforts is how to envision the future of energy for the world as a whole. It is also extremely important to strategically consider how the future of energy will be for the world as a whole and how each country needs to respond to the broad direction. This is the reason why how to envision the future of energy for the world as a whole is attracting interest.

Efforts are being made in Japan and other countries and in the world as a whole to envision the future of energy. These efforts can be roughly divided into two approaches based on differences in basic ideas and ways of thinking about the future vision. The first approach defines an ideal picture that should be pursued and depicts how the world should change to realize the ideal picture. Because of its characteristics, it is sometimes referred to as the top-down backcast approach. The reason why it is described as “backcast” is that the goal is determined before considering how the world should change from now to achieve the goal. The other approach focuses on the trend of changes based on past trends and envisions the future by making various assumptions about the important factors that lead to changes. This can be called a bottom-up forecast approach because it projects changes based on assumptions in a bottom-up manner.

Most frequently cited as representing the backcast approach is the “Net Zero Emissions(NZE) Scenario” in the World Energy Outlook of the International Energy Agency. This scenario first appeared as a report titled “Net Zero by 2050: A Roadmap for the Global Energy Sector” in May 2021 and has since been positioned as one of the three scenarios in the annual WEO known as the IEA's flagship deliverable. Though being one of the three scenarios, the NZE scenario is undoubtedly attracting the most attention and interest in the world. As suggested by the scenario name, it sets out the goal of net-zero GHG emissions for the entire world by 2050 and shows how the world would have to change from now on in order to achieve the goal. Its vision for the future is that the world would have to dramatically increase zero-emission energy sources such as renewables and rapidly and substantially reduce fossil fuel consumption in order to achieve the goal. In line with this vision for the future, it has been pointed out that clean energy investment would have to be dramatically accelerated, implying that new oil and gas investment would no longer be required.

While there are various forecast approach reports, I would like to cite the “IEEJ Outlook” of the Institute of Energy Economics, Japan, as one of the representative forecast approach reports covering the world as a whole. The IEEJ Outlook depicts the future of energy in the world in two scenarios: the “Reference Scenario,” where the current trends will continue, and the “Advanced Technologies Scenario,” where various energy technologies will be introduced to the maximum extent possible to decarbonize the world and enhance energy security. Both scenarios represent the bottom-up forecast approach, differing from the abovementioned NZE scenario fundamentally and conceptually. Therefore, even the Advanced Technologies Scenario indicates that the world would reduce CO₂ emissions by nearly 60% from the present level while falling short of achieving a net-zero emissions goal. So, energy demand projections in the Advanced Technologies Scenario differ far from those in the IEA NZE scenario.

What I would like to emphasize here is that both the backcast and forecast approaches are necessary for considering how to respond to energy issues in an uncertain future and have their respective advantages and challenges. Rather, it is important to have an attitude and perspective on how to utilize these approaches based on a good understanding of their advantages and challenges. An advantage of the backcast approach is that it clearly shows what needs to be done to achieve an ideal state. In a sense, it is a normative analysis that can explicitly show how far the reality is from what needs to be done and how much additional effort is needed to bridge the gap. On the flip side, a challenge of the backcast approach is that the gap between reality and what needs to be done is often extremely large especially when the ideal state is extremely ambitious, causing problems. Regarding the IEA NZE scenario, which depicts a world in which new investment in oil and gas would no longer be necessary, it is naturally conceivable that demand for oil and gas would fail to decline as much as depicted in this scenario. If a wrong interpretation of the scenario leads to the absence of new oil and gas investment that is originally required, a supply-demand mismatch may arise and trigger oil and gas price hikes to affect energy security.

In contrast, the forecast approach is attractive in that it does not depict an ideal future normatively but provides an analysis of the future relatively more based on reality. This means that the more ambitious the ideal state becomes, the more valuable the outlook based on reality is. However, the forecast approach has an essential challenge in that how to set important assumptions that affect changes is the key question that needs to be asked. Another challenge of the forecast approach is that it is difficult to reflect discontinuous changes caused by innovation. From this point of view, it can be said that the future picture under the forecast approach may take on a conservative nature that is connected closely to an extension of the present trend. I would like to reiterate that it is more important than ever to fully understand the advantages and challenges of the two approaches for analyzing the

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future of energy and considering relevant responses in the current situation where uncertainties are growing.

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