

Ensuring Energy Security and Carbon Neutrality: Implications for Korea

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I. Introduction

The international community faces two major challenges: securing stable energy supplies and achieving carbon neutrality. Concerns about energy security that aroused due to the oil crises in the 1970s are no longer limited to the stable supply of fossil fuels. With the European Union (EU) announcing the European Green Deal in 2020 and major countries beginning to declare carbon neutrality targets, a transition to a low-carbon economy is being sought. However, as Russia invades Ukraine in 2022 and the international community imposes economic sanctions on Russia, the issue of securing stable energy is once again in the spotlight.

In order to appropriately respond to the above challenges, continuous efforts are needed to gradually reduce the use of fossil fuels and increase the use of clean energy in the medium

to long-term. Accordingly, our study analyzed energy security from the perspective of energy transition, and derived key issues and notable cases of international cooperation to ensure energy security and carbon neutrality. Based on our findings, we suggested policy implications for Korea.

II. Energy Security from the Perspective of Energy Transition

Energy security is not only a complex issue related to the national security and diplomatic strategies of a specific country, but also a global issue related to energy supply and geopolitics. Definitions and dimensions of energy security are evolving over time and as circumstances change. Since energy security additionally considers social and environmental

aspects, its concept includes four elements called as '4A': Availability, Accessibility, Affordability and Acceptability. During the energy transition period, the transition from availability and accessibility of fossil fuels to clean energy is important. In addition, fostering international cooperation can be as a cornerstone in promoting the energy transition while contributing to global carbon neutrality.

As energy prices have soared due to the recent Russia-Ukraine war, major countries are actively pursuing related policies and external cooperation to diversify their energy supply chain and decarbonize their economic structures. The EU is trying to reduce its dependence on energy imports from Russia by implementing policies such as Fit for 55 packages, REPowerEU and so on. The United States is trying to regain global leadership in the field of climate change, and is considering climate change as an important factor in setting industrial policies such as the Inflation Reduction Act (IRA). In addition, Korea has announced its carbon neutral plan in 2020 and has been exploring relevant strategies and basic plans to achieve this goal.

III. Key Issues for Energy Security and Carbon Neutrality

1. Transition to Clean Energy

As the proportion of power generation from variable renewable energy (VRE) sources, which have larger fluctuations in power generation depending on natural conditions such

as solar power, gradually increases, maintaining the stability of the power grid becomes a more important task. This means that complementary measures are needed, such as the use of Energy Storage Systems (ESS), energy demand management, and the establishment of a distributed energy system. In addition, achieving carbon neutrality by 2050 requires faster deployment of readily available technologies and commercialization of new or advanced energy technologies that are not yet on the market. At the same time, it is necessary to discuss ways to utilize traditional but low-carbon energy resources such as natural gas and nuclear power.

2. Critical Mineral Supply Chains

Demand for minerals essential for clean energy related technologies, such as lithium, cobalt, nickel and so on, is expected to increase continuously in the future. However, production of these minerals is concentrated in specific countries, making it difficult for other countries to secure a stable supply. In fact, the mining and processing sites of many minerals are located in a small number of countries such as China, Congo, and Australia. As these critical minerals related to clean energy are receiving attention as important national strategic assets, some countries mainly China, United States and Indonesia are making efforts to secure them and are also implementing import and export control measures. Therefore, there is a need to more seriously consider policies for the stable procurement of these minerals.

3. Investment and Institutional Supports

Major concerns related to carbon neutrality or clean energy investment include whether sufficient investment is being made, whether funds are being directed to countries or sectors in urgent need of financial support, and how to induce private investment through public funds. In the process of promoting carbon neutrality and energy transition, we also need to consider a just transition that embraces vulnerable groups or industries. It is necessary to redesign the existing power system, which was designed and operated for fossil fuel-based energy supply, to create conditions that can promote the diffusion of other clean energy resources, including renewable energy. In particular, efforts to utilize digital technology and data can promote efficient energy management and the stable supply of renewable energy.

IV. International Cooperation for Energy Security and Carbon Neutrality

1. International Cooperation by Issues

Regarding the supply chains of critical minerals, as mentioned earlier, major countries consider these minerals to be important strategic assets, and are pursuing international cooperation projects to secure them stably. For example, some countries are participating in projects including the United States-led Energy Resources Governance Initiative (ERGI), Minerals Security Partnership (MSP), the

EU's Raw Materials Initiative (RMI), the European Innovation Partnership for Raw Materials (EIP-RM), and the European Battery Alliance (EBA). Policies to promote cross-border investment in critical minerals are being actively pursued, and bilateral or multilateral trade agreements are being concluded to avoid supply chain restrictions.

For energy transition, technology-leading countries are promoting technological cooperation projects specializing in green hydrogen and eco-friendly fuels. European countries are promoting not only the EU's flagship green hydrogen projects such as Hy2Tech and Hy2Use, but also cooperation between EU member countries and international cooperation projects. Japan is also making efforts to produce hydrogen overseas and use it domestically or in third countries. In addition, these countries actively participating in the process of establishing relevant international standards at the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

In terms of sustainable investment and support for developing countries, the international community is engaged in various international cooperation activities with a focus on reducing investment risks and supporting investment in early-stage clean energy- technologies. In particular, activities for multilateral cooperation such as Clean Energy Investment Accelerator (CEIA), specialized funds for clean energy like Global Energy Efficiency and Renewable

Energy Fund (GEEREF), private sector-led initiatives, investment environment improvement, and capacity building are being developed.

2. Opportunities in Multilateral Cooperation

Multilateral cooperation for energy transition and carbon neutrality are active in the Indo-Pacific Economic Framework (IPEF), the G20, the Major Economies Forum on Energy and Climate (MEF), and the Clean Energy Ministerial (CEM).

In the IPEF's Pillar 3 (Clean Economy) discussion, 14 member countries agreed to 'create and vitalize the clean economy market' and 'stabilize the critical mineral supply chains.' Regarding technology innovation necessary for energy transition, related policies such as the G20 Innovation Action Plan were adopted, consultative bodies such as RD20 (Research and Development 20 for Clean Energy Technologies) were launched, and effective measures to foster the circular economy were discussed.

Members of MEF, a high-level multilateral consultative body involving 23 countries and the EU, are interested in discussing the transition to a low-carbon economy and the expansion of clean energy. Its current main agenda is to increase the national greenhouse gas reduction target and decarbonizing transportation sector. CEM, a ministerial meeting that has been separated from the MEF, has also been promoting work programs for decarbon-

ization in the industrial sector such as Industrial Deep Decarbonisation Initiative. MEF plans to increase financial support to promote clean energy technology-related demonstration projects, and countries with high technological capabilities are participating in these efforts.

It is expected that member countries of multilateral organizations will be able to create synergies by selecting and participating in specific activities or programs that overlap with their own policy goals and contribute to the international community. In addition, they will be able to quickly identify the latest industry trends while cooperating with technology-leading countries.

V. Policy Implications

The concept of energy security is changing in line with the need for transition from fossil fuels to clean energy. It is noted that energy transition is divided into three key phases: the introductory phase, the transitional phase, and the maturation phase. Ensuring energy security and carbon neutrality requires a phased response that takes these phases into account. It is also emphasized that efforts to strengthen energy security should be approached from the perspective of reducing dependence on fossil fuels and accelerating the transition to clean energy. Based on our findings, we suggested following policy implications for Korea.

First, the following strategic considerations are necessary to promote external cooperation to stabilize the critical mineral supply chain.

First of all, it is necessary to utilize bilateral and multilateral cooperation channels related to critical minerals as an opportunity to strengthen networks and discover cooperative projects. In addition, there is a need to pursue strategies to avoid export restrictions by major mineral suppliers, such as the use of existing FTAs (Free Trade Agreements) and the conclusion of limited FTAs in the mineral sector. Lastly, it is necessary to encourage the private sector to participate in overseas resource development through overseas investment incentives and ODA (Official Development Assistance) project support.

Second, it is necessary to step up efforts to innovate newly emerging energy technologies and to participate in the process of establishing relevant international standards. There are still many technical challenges to overcome in using emerging energy resources, especially hydrogen, in an environmentally friendly and economically competitive manner. However, if this is overcome, it is expected to be a powerful driving force in ensuring energy security and carbon neutrality in the long term. Korea's overall hydrogen-related technical capabilities are insufficient compared to technologically advanced countries. Therefore, there is a need to effectively utilize energy-related bilateral dialogues with these countries and participate in programs of multilateral organizations, and expand government support for joint research between countries. In addition, in order to lead the establishment of international standards, it is necessary to redefine the role of the Korean

private sector, identify its support needs, and continue to support its efforts.

Third, it is also important to expand global clean energy investment. It is essential to create a regulatory and institutional environment to promote clean energy investment, such as green taxation or green bond guidelines for eco-friendly economic activities. In addition, it is necessary to deepen existing bilateral and multilateral energy cooperation frameworks to explore cross-border clean energy investment opportunities, while identifying new cooperation partners with energy investment needs and potential. Domestically, there is a need to analyze the costs and benefits of carbon-neutral scenarios and changes in energy mix, and present an investment roadmap. Finally, to support the energy transition of developing countries, it is necessary to consider the use of various innovative financial instruments and specialized funds in addition to ODA projects. **KIEP**