Research introduction

Complex Environmental Challenges Posed by the Expanding Decarbonization Market

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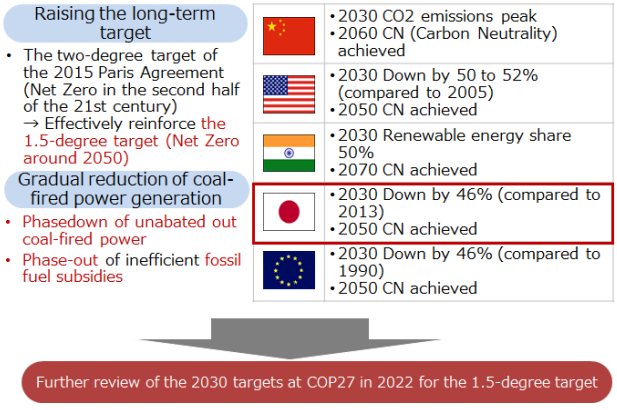
As concerns grow over a variety of environmental issues, including climate change, air pollution, freshwater resource shortages, and biodiversity loss, there are increasing challenges that companies must address in business activities. Hitachi Research Institute is researching how companies respond to complex environmental issues in which the response to one environmental problem negatively impacts other environmental problems.

1. Expansion of global environmental measures

1.1 Measures against climate change

At the 26th Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP26) held in November 2021, it was confirmed that efforts should be made to limit the increase in the average global temperature to 1.5 °C above pre-industrial levels (1.5 °C target), and that efforts should be made to achieve an overall balance between greenhouse gas emissions produced and those removed from the atmosphere around 2050 (Net Zero). As a means of achieving this goal, it was agreed to accelerate efforts towards phasedown of unabated coal-fired power. In preparation for COP27 to be held in 2022, a review of the 2030 target in line with the 1.5 °C target will be considered (Figure 1).

Climate change measures will require renewable energy facilities such as solar and wind power generation, electrification of energy consumption, energy conservation by reducing the weight of products, and the use of hydrogen.



Source: Compiled by Hitachi Research Institute based on government data from various countries and regions

Figure 1. Decarbonization commitments at COP26

1.2 Conservation of biodiversity

Meanwhile, governments, the United Nations, and others are expanding their environmental efforts from decarbonization to sustainable management of natural resources. According to the World Economic Forum, $44 trillion, or a majority of global economic activity, currently depends on “ecosystem services” provided by ecosystems, such as food, fresh water, and disaster prevention, and there is concern that ecosystem degradation will adversely affect economic activity. In response to such growing concerns, the 15th Conference of the Parties (COP15) to the United Nations Convention on Biological Diversity, scheduled to be held in 2022, aims to adopt the “Post-2020 Biodiversity Framework,” which will set international targets for biodiversity conservation for the year 2030. As one of the targets, a provision is being discussed to halve negative impacts on ecosystems by assessing and reporting the dependence and impact of companies and others on biodiversity.

In June 2021, the United Nations and other organizations established the “Taskforce on Nature-related Financial Disclosures (TNFD).” TNFD is an initiative to formulate rules for corporate information disclosure that address not only the opportunities and threats posed by changes in the natural environment, but also the impact of corporate activities on the natural environment. It is expected to become an influential framework for disclosure rules regarding environmental loads other than carbon dioxide in a company’s supply chain, as collaboration with the International Sustainability Standards Board (ISSB) under the IFRS Foundation, a non-profit organization responsible for the development of the International Financial Reporting Standards (IFRS) is underway in preparation for the official release in 2023. Therefore, companies are also required to strengthen measures for biodiversity conservation.

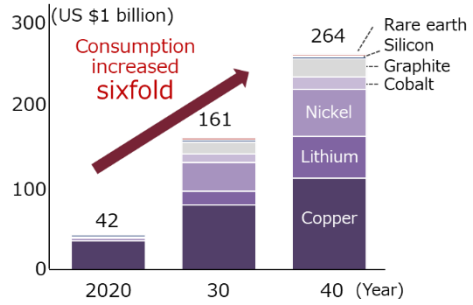
2. Complex environmental challenges posed by decarbonization

Climate change mitigation and biodiversity conservation have an interactive relationship, and while the conservation of forest carbon sinks may produce synergistic effects that lead to the avoidance of ecosystem loss, there is also a risk of trade-offs in which climate change action adversely affects biodiversity. In the future, it will be important to take initiatives to solve complex environmental issues by considering the minimization of trade-offs.

In 2021, the Intergovernmental Panel on Climate Change

(IPCC) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), an international framework for providing scientific knowledge in the areas of climate change and biodiversity, published their first joint report. The report points out the impact of resource extraction as a result of increased consumption of critical mineral resources for climate change mitigation , along with other environmental problems such as ecosystem destruction caused by the construction of mega-solar and hydroelectric power plants accompanied by deforestation. Renewable energy facilities, electrification through the use of motors and batteries, and hydrogen production all require critical mineral resources such as copper, rare metals, and rare earths as raw materials. In addition to economic growth, the International Energy Agency (IEA) projects that the consumption of critical mineral resources such as copper, lithium, and nickel will increase approximately 6 times 2020 levels in 2040 in order to combat climate change toward Net Zero by 2050 (Figure 2).

The rapid increase in the consumption of critical mineral resources will lead to an increase in the extraction and smelting of resources, and it is feared that due to the increase in development, water consumption, waste and wastewater in mines, and the increase in waste liquid and waste in the smelting process, it will lead to deforestation, deterioration of water quality, air and soil pollution, and result in loss of biodiversity.



Source: Compiled by Hitachi Research Institute based on International Energy Agency (IEA) data

Figure 2. Increase in consumption of critical mineral resources toward Net Zero

3. Resolving complex environmental issues through resource circulation

Hitachi Research Institute believes that in addition to the development of alternative materials, the importance of reducing mining and smelting of critical mineral resources through resource circulation will expand as a direction for addressing complex environmental issues related to critical mineral resources. Countries around the world are pursuing policies and demonstrations of circular supply chain for critical mineral resources in conjunction with their own domestic resource security objectives (Table 1). For example, the EU is revising product circularity regulations based on the "Circular Economy Action Plan" (2020).

In order to reduce the environmental impact through resource circulation, first, it is important to extend the life of products as long as possible (longevity) through appropriate maintenance, inspection, and service during the product use stage. Second, in the post-use stage of products, it is important to promote secondary use by collecting and classifying used products, and selecting and implementing circular methods such as reuse of products, repair and reassembly of core parts of products (parts recycling), direct reuse of materials after product disassembly, and chemical recycling of materials (extraction of secondary materials by chemical treatment) according to the state of deterioration.

Table 1. Resource circulation policies of each country

	2020	• Review of supply chains in nine key technology areas • Circular Economy Action Plan
	2021	• Review of domestic supply chains, including semiconductors, batteries, etc. • Considering Battery Recycling Act in California
	2020	• Circular Economy Vision
	2021	• Review of domestic processing capacity and supply chains of mineral resources
	2021	• The BCG (Bio-Circular-Green) Economy to be positioned as a National Strategic Model • Commencement of E-waste recycling demonstration

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4. Future prospects for solving complex environmental issues

The use of digital technology is the key to resolving complex environmental issues through resource circulation. For example, the use of predictive diagnostics and asset management systems is expected to optimize maintenance and inspection in order to extend the life of products. In addition, in the post-use stage of products, it will be effective for the utilization of secondary materials to reduce costs of collection and processing of waste, which is expected to increase, through optimization of matching and optimization of treatment processes by sharing product data. For this reason, it is important to establish a system for sharing information on the timing of waste generation and disassembling methods among finished product manufacturers, suppliers, and venous industries that conduct sorting and recycling. Hitachi Research Institute will continue its research on solutions to complex environmental issues such as resource circulation.

Author Profile

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Recent research topics include sustainability management, environmental and energy policies, supply chain environmental measures, and environmental digital solutions