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Series “Ushering in a New Era of Carbon Neutrality” (1)

Decarbonization Trends and Innovative Technologies

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“Carbon Neutrality” trends

Last October, Japanese Prime Minister Yoshihide Suga in his policy address expressed his intentions to focus on realizing a green society and pledged to achieve carbon neutrality by 2050.

His pledge was made against the backdrop of a global decarbonization trend. The Paris Agreement, adopted in 2015 at the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP21), set out two long-term goals. One goal is to limit global warming to well below 2 degrees Celsius, preferably to 1.5℃, compared to pre-industrial levels. The other is to reach global peaking of greenhouse gas emissions as soon as possible to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs) in the second half of the 21st century. Carbon neutrality means achieving this balance between emissions and removals. The Special Report on Global Warming of 1.5℃, released by the Intergovernmental Panel on Climate Change (IPCC) in 2018, concluded that global net-zero emissions would be required between 2050 and 2070 to limit global warming to well below 2℃ and that carbon neutrality would be required around 2050 to limit warming to 1.5℃ (see table).

So far, 120 economies have pledged to reach carbon neutrality by 2050. China, the world’s largest GHG emitter, has vowed to achieve carbon neutrality in 2060. These economies view climate actions as opportunities for growth.

The business sector has also launched carbon neutrality campaigns. In addition to oil majors and technology giants in Western countries, leading Japanese companies have pledged to realize carbon neutrality in their business operations by 2050 or earlier. As one of the measures to do so, a rising number of companies have announced their commitment to procure all electricity used in their business operations from renewable energy. The number of Japanese companies participating in the global RE100 initiative stood at 53 in March 2021.

The European Union and the United States are considering the introduction of a carbon border adjustment mechanism (CBAM) in the near future. A CBAM would impose a carbon-related charge on imports to a country taking climate action from countries failing

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to implement sufficient climate change countermeasures (and may also provide export rebates corresponding to the carbon prices). Hence, more companies are accelerating their green energy procurement efforts to explore production processes free from carbon dioxide emissions,

These initiatives have also become important for attracting investment. ESG (environment, society and governance) investment has rapidly expanded across the world in recent years. According to the Global Sustainable Investment Alliance, global ESG investment has increased from $22.9 trillion in 2016 to $30.7 trillion. The Japanese ESG market has expanded about four-fold from $0.5 trillion to $2.1 trillion.

Renewables are increasingly important for decarbonization

How would carbon neutrality be realized?

Most importantly, GHG emissions will need to be substantially reduced. Carbon dioxide emissions that are hard to abate would be removed by sinks through afforestation and forest protection, or through the decarbonization of fossil fuels (carbon recycling) and by using carbon capture and storage (CCS) technologies that promise to contribute to negative emissions (removal of CO_2 from the atmosphere). Hence, the goal is to balancing emissions with removals.

Reaching Zero with Renewables, a report released by the International Renewable Energy Agency (IRENA) in September 2020, introduced the Deeper Decarbonization Perspective for reducing energy and process-related CO_2 emissions to zero in 2050-2060 against a baseline scenario based on policies around 2015 when the Paris Agreement was adopted. Under the perspective, energy efficiency improvements and renewables (renewable electricity, renewable heat, biomass and renewable synthetic fuels) will contribute to "reducing" CO_2 emissions by 94%, with the remaining 6% being "removed". As indicated by the perspective, the deployment of renewables and other carbon-free energy sources as well as energy efficiency improvements will be the key to achieving carbon neutrality.

The abovementioned IPCC Special Report on Global Warming of 1.5℃ projects that to limit global warming during this century to below 1.5℃, renewables would have to account for 70-80% of global power generation in 2050. The renewables share for 2030 would need to be 48-60%. The International Energy Agency (IEA)'s Sustainable Development Scenario (that holds the temperature rise to below 1.8℃) sets a path towards meeting the objectives of the Paris Agreement goal and projects the renewables share of the global power mix in 2030 to be 49%. In the IRENA Transforming Energy Scenario for limiting global warming to well below 2℃, the renewables share is projected to be 57% for 2030 and 86% for 2050.

Japan gets serious about decarbonization

Last year on December 25, the Japanese government formulated the Green Growth

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Strategy, announcing ambitious decarbonization targets and action plans for 14 key areas where growth is expected. These key areas include offshore wind power generation, hydrogen, automobiles and storage batteries. The strategy calls for the decarbonization of the power sector and seeks to electrify other sectors while using hydrogen and CO_2 capture for heat demand. With a view to a 30-50% increase in electricity demand in 2050, the strategy provides a reference power generation mix, in which renewables would account for about 50-60%, hydrogen and ammonia for about 10% and nuclear energy and fossil fuels with CO_2 capture for 30-40%.

Under the third supplementary budget for FY2020, the government set up a 2-trillion-yen Green Innovation Fund at the New Energy and Industrial Technology Development Organization (NEDO) to support technology development and commercialization projects over 10 years in the three priority areas for reaching carbon neutrality by 2050: electrification and green power; realizing a hydrogen economy, and CO_2 fixation and reuse.

Given these recent developments, this series will introduce innovative technology trends in Japan and overseas that contribute to decarbonization.

[Table] International organizations' decarbonization scenarios

International organization reports	Projected renewables shares (global)
IRENA (2020) *Deeper Decarbonization Perspectives* (DDP)	Limiting global warming to 1.5℃ 66% of 2050-2060 final energy consumption
IPCC (2018) *Special Report on Global Warming of 1.5℃*	Limiting global warming to 1.5℃ 48-60% of power generation in 2030 70-80% of power generation in 2050
IRENA (2020) Transforming Energy Scenario (TES)	Limiting global warming to well below 2℃ 57% of power generation in 2030 86% of power generation in 2050
IEA (2020) Sustainable Development Scenario	Limiting global warming to 1.8℃ 49% of power generation in 2030

（Note）IRENA: International Renewable Energy Agency

IPCC: Intergovernmental Panel on Climate Change
IEA: International Energy Agency

（Source）Compiled by the authors

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