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Challenges in Further Expanding Renewable Energy
What multilateral viewpoints are needed?

<Summary>

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Status of global use of renewable energy

1. Renewable energy including large-scale hydropower accounted for 28% of the global power output in 2020, growing 9 points in the last decade. Wind power and solar PV are spreading more rapidly but each account for just 6% and 3% of the total; hydropower is still the largest renewable power source at 16%.
2. Europe is the world's forerunner in adopting renewables, which account for 41% of its total power output (wind power 13% and solar PV 5%). Renewables account for 26% of the total power output in North America (wind power 8% and solar PV 3%) and 25% in Asia and Oceania (wind power 4% and solar PV 4%).
3. In Japan, renewable power generation, including large-scale hydropower, amounted to 205 TWh and accounted for 22% (wind power 1% and solar PV 9%) as of the end of 2020.

Renewable capacity required for achieving carbon neutrality by 2050

4. To meet the IEA's 2050 net-zero carbon scenario, the world must increase the share of renewables in the total power output to as high as 88% in 2050. This means that wind and solar PV must expand nine-fold from current levels.
5. As for Japan, the share of renewable energy required to achieve carbon neutrality by 2050 is 54% or 730 TWh out of a total power output of 1,350 TWh, according to a reference estimate from an analysis of the 2050 carbon neutrality scenario conducted by the Strategic Policy Committee.

Challenges in further expanding renewable energy

6. Further expansion of renewable energy is essential for Japan to achieve the 2030 GHG emissions reduction target (raised to 46%). At present, METI anticipates that renewable power generation will increase to 330–350 TWh in 2030 by implementing

policies that are already concrete and by ramping up initiatives.

7. However, a multitude of issues must be resolved to expand renewable capacity. First, regarding the securing of appropriate land, a decision has been made to standardize rooftop solar PV to be installed on public buildings; however, other pending issues include offering incentives for new houses, construction methods that make it easier to mount solar panels on existing houses, and development of lighter solar PV. Abandoned farmland, land with unknown owners, and municipal land for ground-mounted solar PV and forest reserve areas for wind power could be used, but rules and regulations must be established to make this possible.
8. Together with the use of renewable capacities whose purchase period under the Feed-in-Tariff program will expire in the near future, it is also necessary to establish a system to replace facilities that have come to the end of their life so as to continue to produce power, and also to raise their power generation efficiency or increase their output by repowering.
9. Regarding the economics of renewables, the Power Generation Cost Verification Working Group has indicated that mega-solar PV would have the lowest generation cost in 2030 at JPY 8–11 /kWh, though far from the government goal of JPY7 /kWh. The cost of offshore wind power is JPY26 /kWh, far off the target set by the Public-Private Council of JPY8–9 /kWh. Further, grid integration costs, including the costs for addressing the loss of grid inertia, must also be included in.
10. To abate the regional imbalance in renewable energy abundancy and electricity demand, a study for establishing a nationwide transmission network is under way. Cost-benefit evaluations have been published for scenarios with varying amounts of renewables. Benefits exceeded costs for most of the scenarios, but for a scenario in which renewables account for as much as 50–60% in the power generation mix, the results showed that solely reinforcing transmission networks would not be sufficient for significantly reducing the curtailment rate of renewables. Demand-side measures as well as the introduction of batteries and hydrogen (Power to Gas: PtG) that would lead to the use of surplus renewable electricity, were suggested.
11. Batteries are expected to play a key role in energy storage, which is crucial for expanding renewables, but it is also important to make use of existing facilities that are ready for use, such as thermal storage facilities in the residential and commercial sector and the energy storage function of gas networks. Furthermore, repurposing coal-fired thermal power plants, which are expected to be closed, to energy storage facilities is another possibility. To address the loss of grid inertia, not only batteries but the possibility of synchronous energy storage using compressed air, liquefied air, and Carnot batteries (which can utilize the steam turbines of coal-fired thermal plants)

needs to be discussed. However, it must be noted that all of these energy storage technologies require additional costs.

12. The expanded deployment of EVs and batteries is expected to cause a surge in global demand for lithium and other critical minerals. It will therefore be necessary to address the best mix of a wide variety of energy storage technologies, including non-lithium batteries and PtG, taking into account their technological characteristics and the supply risk of critical mineral resources.
13. Renewables curtailment should decrease as electricity demand grows with the progress in electrification. Even so, energy system integration (sector coupling), including accommodating renewable energy in the city gas sector through PtG, remains an important issue to be examined.
14. It is essential to develop and revive a highly competitive related industry in the process of expanding renewables, in light of contribution to the domestic economy. It is also necessary to create a venous industry such as recycling, preparing for supply constraints of critical mineral resources.

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