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**Carbon Neutrality Trends in Major Economies**  
**--How Do They Realize Carbon Neutrality?--**  
**<Summary>**

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Analysis of carbon neutrality scenarios

1. Carbon neutrality scenarios (energy supply and demand analyses) through 2050 (or 2045 or 2060) have been released by governments or major research organizations for the European Union, the United Kingdom, France, Germany, Japan and China. I analyzed these scenarios, focusing on (1) energy savings, (2) electrification, (3) zero-emission power generation (renewable and nuclear energy), (4) impacts on electricity costs and prices, (5) non-electrification measures (hydrogen and other measures) and (6) the removal by forests and CO<sub>2</sub> removal technologies including BECCS (bioenergy with carbon capture and storage) and DACCS (direct air capture with carbon storage) applied to remaining emissions.
2. Each economy assumes that GHG emissions in 2050 would decline by about 80% from present (2015-2020) levels (with remaining emissions planned to be removed). China plans to keep the current emission level until 2030 before reducing emissions rapidly.
3. Energy savings: Each economy assumes final energy consumption in 2050 to decline by 30-40% from present (2015-2020) levels.
4. Electrification rate (electricity's share of final energy consumption): The rate is assumed to rise to 45-58% in 2050 from current levels between 18-27% in those economies other than China. The rate for China is projected at 71%, indicating that electrification would be the key for China.
5. Zero-emission power generation: Renewable energy's share of the power mix is assumed at more than 80% in the UK and EU, at 75% in China and at 54% in Japan. Nuclear energy's power mix share is assumed to range from 9% to 16% for those other than France that would depend heavily on nuclear. China plans to boost nuclear

power generation 6.4-fold, while the UK and EU expect to retain their current nuclear power generation levels. As for Japan, the Research Institute of Innovative Technology for the Earth in its scenario analysis (interim report) in the reference case assumes nuclear power generation at about ‘10% of the total power generation in consideration of social constraints.’ The renewable and nuclear energy share in France is left undecided for 2050 (assumed at 50% for 2035).

6. Electricity costs/prices: Electricity costs including those for integrating renewable energy into grid networks are assumed to rise nearly two-fold in Japan from the present to 2050. In the EU, electricity prices are assumed to rise 1.5-1.6-fold from the present to 2050. In China, electricity costs are projected to rise 1.4-fold from the present to 2028 and fall to lower levels than at present in 2050. The high electrification rate may depend on the electricity cost decline.
7. Hydrogen: Hydrogen’s share of final energy consumption in 2050 is assumed at about 20% for the UK and at about 10% for China, Japan and the EU. The share for hydrogen plus synthetic fuels and methane is projected at 18% for the EU and 15% for Japan. Hydrogen is expected to play a key role in realizing carbon neutrality.
8. Remaining emissions: Most of these economies assume that nearly 20% of the present emissions would be removed in 2050. Removals in China are projected at 12%, offsetting remaining CO<sub>2</sub> emissions. Removals by forests, etc. are expected to increase substantially in France and the EU. In Japan, removals by forests, etc. was limited to 4% of GHG emissions in 2019 and is expected to continue a downtrend. CO<sub>2</sub> removal technologies in 2050 are assumed to account for 14% of present (2015-2020) emissions in Japan and 12% in the UK.
9. Comparison of major economies’ prescriptions for carbon neutrality indicate that energy savings, electrification and hydrogen are commonly assumed to make almost the same contributions among economies. Zero-emission power generation measures as well as removals by forests, etc. and CO<sub>2</sub> removal technologies applied to remaining emissions differ by economy, reflecting differences in regional conditions and relevant costs.
10. International comparison indicates that zero-emission energy sources’ share of total power generation for Japan is lower than for other economies and that Japan should also consider an option expanding nuclear power generation to raise the zero-emission share. Japan is also required to steadily develop and deploy CO<sub>2</sub> removal technologies and consider measures to maintain and increase removals by forests, etc.

#### U.S., European and Chinese policy trends

11. In the United States, whether Congress could pass the clean electricity standards which set the share of renewable energy, etc. in power generation, is attracting

attention. An executive order came on May 20 to require the Financial Stability Oversight Council to assess climate-related financial risks and to report within 180 days, including the necessity of enhancing climate-related disclosure. It is worthy of attention that the United States has begun to tackle climate-related financial risks.

12. The EU on July 14 announced a series of draft policies and measures to achieve the targets for 2030. For details such as the expansion of the EU ETS (EU Emissions Trading System) into the transportation and buildings sectors, the revision of energy tax directives and the draft carbon border adjustment mechanism, see a separate report for this forum.
13. China on May 26 established the leaders group for the works of carbon peaking and carbon neutrality. It launched an emissions trading system on July 16. Attracting attention is what policies and measures for carbon peaking and carbon neutrality would be formulated.

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