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Outlook for Renewable Energy Market
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Expanding global market for renewable energy power generation

1. In 2015, renewables, excluding hydro, accounted for 6.8% of global power generation, including 3.5% for wind, 1.9% for biomass and 1.0% for solar photovoltaics. When including hydro (16.0%), renewables had a combined share of 22.8%.
2. Global renewable power capacity including hydro is expected to expand from 2,130 GW at the end of 2016 to more than 2,400 GW (1,300 GW in hydro and 1,100 GW in non-hydro renewables) at the end of 2018. Annual capacity growth hit a record high of more than 160 GW in 2016 and is expected to stand at similar levels in 2017 and 2018. Of the renewable power capacity growth, an increase in Asia including China and India commands about 60%.
3. China's renewable capacity growth from 2015 to 2016 hit a new high close to 70 GW, accounting for about a half of the global growth. Annual growth in 2017 is expected to be close to 70 GW including more than 40 GW for solar PV. In 2018, however, whether solar PV growth will be maintained at the previous year's level is uncertain due to a possible revision of polices shifting from the Feed-in-Tariff to the Renewables Portfolio Standard, expanding auctions and an increase in curtailment.
4. Since the inauguration of the Narendra Modi administration in 2014, India has been rapidly expanding renewable capacity, including solar PV supported by rich solar radiation, under the national target of 175 GW excluding large-scale hydro plants by 2022. Annual capacity growth will double from 8 GW in 2016 to around 15 GW each in 2017 and 2018, centering on solar PV. At the end of 2018, India's renewable generation capacity will reach 120 GW, surpassing the Japanese level.
5. The U.S posted a record increase of more than 20 GW in renewable power capacity in 2016. While the handling of federal tax incentives for renewable energy is uncertain at present, growth each in 2017 and 2018 is expected to be around 20 GW thanks to solar PV capacity expansion on state-level renewable energy policy enhancement and rapid cost reduction.
6. Europe has been increasing renewable power capacity at a stable annual pace of 20 GW or about 4% since a rapid expansion of more than 30 GW around 2011 and is expected to post a similar growth rate each in 2017 and 2018. While the U.K. has

decided to suspend support for low-carbon power sources until 2025 due to relevant costs' expansion far above a projected budget level, its renewable energy generation capacity in 2025 is expected to increase by 25% from 2016.

Solar PV and wind power generation cost decline and massive capacity expansion

7. According to the IEA's report, global average of the levelized cost of electricity (LCOE) for utility scale solar PV plants, excluding subsidies, declined by more than 50% from 2012 to 11 cents/kWh in 2016 on a global average basis and is projected to fall further to 8.7 cents/kWh by 2022. Factors behind the cost decline include competitive auctions in various countries and solar PV module price drops through massive diffusion over the world. Similarly, global average of the LCOE for onshore wind power, excluding subsidies, is estimated at 7.5 cents/kWh for 2016 on a global average basis and projected to fall to 6.5 cents/kWh in 2022 thanks to, again, a cost-cutting race through competitive auctions. The introduction of auctions for solar PV and wind power generation is accelerating globally to further reduce costs.
8. The cost decline is expected to pave the way for solar PV and wind power generation to expand globally at a steady pace. However, the expansion of naturally variable renewables is likely to destabilize electricity systems. Therefore, both developed and developing countries will be required to enhance electricity system flexibility on the premise of the massive expansion of naturally variable renewables. The enhancement, though bringing about additional electricity system costs, is likely to create new business models.

Japanese renewable energy market and policy trends

9. Japan's renewable energy generation capacity, excluding more than 30 MW hydro plants, will increase by 6.5 GW in FY2017 and by 5.5 GW in FY2018 to 68.3 GW at the end of FY2018. Renewable power generation, excluding output from more than 30 MW hydro, will reach 127.3 billion kWh in FY2018, doubling its share of Japan's total power generation from 7% in FY2012 to 13%. If including output from more than 30 MW hydro, it will account for 16% of total power generation in FY2018. While solar PV will continue to account for about 90% of renewable generation capacity growth in Japan, wind and biomass will gradually increase their respective shares of the power mix.
10. In Japan's first feed-in tariff auction for utility scale solar PV, the lowest bid rate came to 17.2 yen/kWh, down 18% from the fixed FIT rate of 21 yen/kWh. However, some bid rates were still close to the ceiling level of 21 yen/kWh, indicating higher solar PV costs in Japan than the world level. Further cost reduction is a future challenge. In the auction, the bids totaled only 141 MW against the entire auction capacity of 500 MW. Therefore, the auction conditions are required to be revised to attract more bidders. In addition to utility scale solar PV, large-scale wood biomass power generation will be subjected to an auction in FY2018.

11. Japan’s total solar PV capacity, including non-operating plants retaining FIT approvals, has increased to 71GW well over 64 GW planned for the 2030 target energy mix. Wind power capacity, including non-operating plants retaining FIT approvals, has also expanded close to a target of 10 GW for 2030 thanks to a steady increase in planned projects after completion of the legal environmental assessment. Biomass generation capacity, including non-operating approved plants, has far exceeded the 2030 target of 6-7 GW to 15 GW. If electricity grids are prepared to connect these the FIT approved renewables, Japan’s total renewable power generation may reach the 2030 target, 22-24% of total power generation, by around the mid-2020s. However, when all of the renewable power capacity is put into operation, the cumulative burden on consumers via FIT surcharge will total 42 trillion yen. The regressive cost burden is a challenge to be tackled in the future.

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