Prospects for Accomplishing Renewable Energy Expansion Targets: Post-FIT Challenges for Solar PV and Biomass

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1. Japan's Renewable Energy Expansion Policy Gaining Momentum

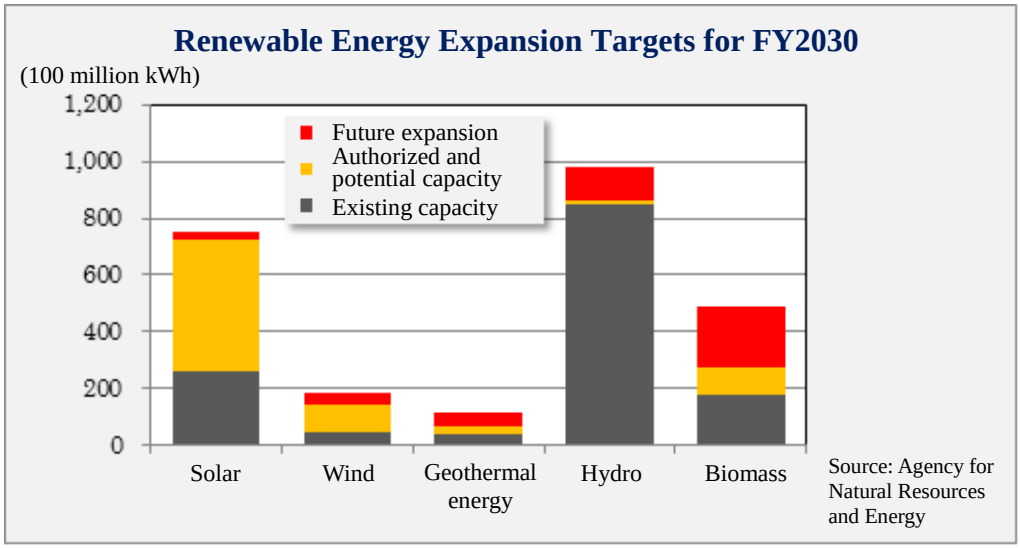
Japan's renewable energy expansion policy has gained momentum since the government established its "Long-term Energy Supply and Demand Outlook for 2030" in July 2015.

In the three years before the establishment of the outlook, Japan remained in a incoherent situation where it was operating the feed-in-tariff system (launched in July 2012) as a strong system for renewable energy deployment, while having no specific target for their deployment. Having a clear target for renewables uptake is indispensable for minimizing economic and institutional costs accompanying the expansion of renewable energy. If you run without knowing whether you are participating in a 100-meter run or a marathon, you may fail to set any records.

The outlook offered an overall target of expanding renewable energy to cover 22-24% of electricity demand and specified projected shares (effective targets) for each electricity source, allowing Japan to have specific goals for its renewable energy policy. They will work as the parameters for Japan's renewable energy expansion, enabling us to assess the expansion based on them.

2. Parameters-based Assessment

Let us try the parameters-based assessment. The following graph breaks down renewable energy expansion targets (on a kilowatt-hour basis) into three parts -- existing power generation



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capacity, authorized capacity and future capacity expansion needed for accomplishing the targets.

Hydro power accounts for 40% of the total renewable energy power generation target. Hydro power generation, which has technologically been established with a history of more than 100 years, will still play a central role among renewable energy sources in 2030. However, little potential is left for developing any large hydro power plants. Expectations are placed on small and medium-sized hydro power plants. While potential is viewed as great for small and medium-sized hydro power plants, limited capacity, shortages in relevant engineers and high maintenance costs have remained impediments to the promotion of hydro power generation.

The next major renewable energy source is solar photovoltaics covering 30% of the renewable energy power generation target. As indicated by the graph, the gap between the existing capacity and the target is large. As is well known, however, massive solar PV capacity has been authorized (the yellow part in the graph) thanks to attractive feed-in tariffs for solar PV operators since the launch of the FIT system. If 80% of the authorized capacity is realized, the solar PV capacity target may be almost fulfilled.

Meanwhile, the situation is different for biomass. Great expectations are placed on biomass that captures 20% of the renewable energy power generation target. A gap between the existing capacity and the target is the largest after that for solar PV. The problem is how to secure fuel. The outlook envisages the maximum power generation capacity using timbers and farm residues at 4 gigawatts. The maximum capacity target represents wood fuel amounting to all present Japanese wood and wood products demand. Domestic supply alone could not cover such capacity. Japan may have to depend on imports for massive wood fuel. In this respect, matters of concern include how to secure supply and impacts on international market prices. Fears regarding fuel security and prices may put a drag on the participation in biomass power generation.

The outlook indicates that hydro, solar PV and biomass would cover 90% of renewable energy power supply. It places limited expectations on geothermal and wind energy, refraining from seeing them as heavily dependable electricity sources through 2030. Constraints exist on the development of geothermal energy resources of which 80% are in national parks and on the construction of wind power plants depending on wind conditions, leading the government to be highly conservative in estimation of deployment of these two renewable power sources.

3. Post-FIT Market Dynamics

As explained above, each renewable energy source in Japan is plagued with various problems. Let’s assume that the FIT system would serve as a key engine allowing Japan to accomplish renewable energy expansion targets for FY2030. However, the accomplishment of targets differs from achieving policy objectives. Renewable energy power generation projects protected by the FIT system would change variously depending on their cost structure after the FIT purchasing period ends. Such changes could affect the electricity market and the renewable energy expansion policy, leading the government’s implementation process to deviate from their original goals.

As for solar PV power generation, for example, the capital cost accounts for a large share of

total cost, with little variable cost. Even after the FIT purchasing period, therefore, solar PV power generation will remain competitive to some extent. As a matter of course, decisions will have to be made on whether to continue solar PV power generation projects. After the FIT purchasing period, project operators will have to procure electricity sources for making adjustments to solar PV power generation fluctuations and replace inverters and other components with shorter service lives than solar PV panels. Through the long history of solar PV panel development since the 1970s, however, solar PV systems' maintenance of performance over a long term has been confirmed. Even though with some performance gaps emerging depending on manufacturers or countries, existing solar PV systems can be expected to continue commercially sustainable operation.

A matter of concern here is the impact that an electricity source with a low variable cost exerts on the market. An electricity source with a low variable cost is always superior to a fossil electricity source plagued with a fuel cost. A low market price resulting from the low variable cost helps lower the capacity utilization rate for fossil power plants and makes it difficult to maintain fossil power plants. At the same time, it makes new investment in renewable energy power generation capacity difficult. We may find that it is essentially difficult to operate an electricity source with high capital and low variable costs in a deregulated market, particularly a spot market.

In contrast with solar PV, wood biomass features a variable fuel cost accounting for 70% of the total costs. During the FIT purchasing period, the FIT income may cover the fuel cost. After the period, however, the fuel cost will become a heavy burden on power producers. The Ministry of Economy, Trade and Industry has estimated the woody biomass fuel cost at 21 yen/kWh, high enough to make it difficult to continue power generation in a deregulated market. Woody biomass power plants may withdraw from the market when the FIT purchasing period ends. The FIT system may allow the woody biomass power generation target to be accomplished in 2030. If woody biomass power plants fail to continue operation later, however, it may not contribute to policy objectives.

4. Renewable Energy Expansion Policy as an Investment in the Next Generation

The FIT system aims to artificially create a market for infant power generation technologies by supporting the purchase of electricity at the fixed FIT prices and develop the marketability of these technologies through cost cuts as a learning effect. A surcharge levied on electricity consumers is used to develop new low-cost electricity sources and enhance energy security. Eventually, the surcharge is thus returned as a social benefit to consumers. In this sense, the surcharge can be viewed as social investment with future returns expected.

From this viewpoint, the FIT system born in Europe has greatly contributed to allowing solar PV to successfully achieve the fastest cost reduction among renewable energy sources. The solar PV technology to convert light energy into electricity is still young for human beings and still features a high cost that has potential to decline. In fact, the conversion efficiency of crystal silicon and chemical compound cells for solar PV systems has still been setting new records every year.

Quantum dot and other next-generation technologies for ultra-high conversion efficiency are making achievements. Solar PV is a renewable electricity source that is worthy of development under the FIT system. However, the FIT system has not necessarily been operated in an ideal manner. Both in Europe and Japan, the FIT system has levied excessive surcharges on society. Although FIT system effects easily come out for solar PV, we must continue to question whether the next generation could receive a return reflecting the surcharge burden.

How about woody biomass? The combination of a boiler with a generator to convert thermal energy into motion energy and generate electricity has a long history since the 19th century. This power generation process cannot be expected to improve its efficiency a lot. The reduction of the wood fuel cost accounting for 70% of the total woody biomass power plant costs depends on the market as far as wood fuel is a commodity. Woody biomass's competitiveness against other electricity sources will remain unstable. If a surcharge is viewed as investment, therefore, support for this electricity source cannot be expected to bring about a substantial cost cut as an investment return. If woody biomass power plants stop operation at the end of the FIT purchasing period, as described above, it may never contribute to policy objectives. As a matter of course, biomass power generation can contribute to reducing carbon emissions. A policy measure to support biomass power generation with fuel cost subsidies is conceivable. However, this measure should be separated from the FIT system that aims to develop independent electricity sources for the future.

5. Conclusion

The outlook that specifies power generation targets for electricity sources represents progress in the promotion of renewable energy expansion. As described above, however, the uniform treatment of electricity sources that are set to behave differently after the FIT purchasing period is accompanied by the fundamental vagueness of policy objectives and effects. Concern over surcharges accompanying the FIT system is great. Can a benefit that a surcharge burden should deserve be secured for the future? The FIT system must be made even more sophisticated.

Writer's Profile

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Hisashi Hoshi is Director of The Institute of Energy Economics, Japan (IEEJ). Since he graduated from the Tokyo Institute of Foreign Studies, Russian language in 1979 and joined Mitsubishi Oil Co., now JX Nippon Oil & Energy Co. he had been involved in crude oil and petroleum products trading. His career includes Managing Director of overseas subsidiaries in Singapore and London. At IEEJ, which he joined in 2010, he is responsible for research projects on renewable energy and international capacity building programs.