Transition to Japan’s Post-Fukushima Energy System: Momentum and Barriers

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Recommended Citation

David von Hippel, "Transition to Japan’s Post-Fukushima Energy System: Momentum and Barriers", NAPSNet Policy Forum, October 07, 2014, https://nautilus.org/napsnet/napsnet-polic--forum/transition-to-japans-post-fukushima-energy-system-momentum-and-barriers/

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30 October 2013

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This paper was prepared with support from the Hanyang University's Energy, Governance and Security (EGS) Center, available in Global Energy Monitor Vol. 2, No. 2 as http://www.egskorea.org/common/download.asp?downfile=140206_GEM(14-02)0.pdf&path=board .

Transition to Japan’s Post-Fukushima Energy System: Momentum and Barriers

In the tragic aftermath of the March 2011 Sendai earthquake and tsunami and the resulting Fukushima nuclear plant disaster, as all of Japan’s fleet of nuclear reactors were shut down, apparently indefinitely, for safety checks, it seemed that the citizens of Japan, and particularly the northern part of the island of Honshu, would be destined to endure power shortages, perhaps for

years. Although there have been some brief periods of rotating blackouts and brownouts in some areas served by the utilities most affected by the earthquake and its aftermath, these have not been as severe as expected due in part to the ramping up of fossil-fueled generation to compensate for off-line nuclear plants, but also, significantly, to a combination of a huge effort on the part of the people of Japan to save electricity, and to rapidly expanding additions of electricity generation from renewable sources. These changes have in part been driven by need and a change in attitudes nationally, but also by government policies such as feed-in tariffs, as well as by the high cost of electricity in Japan. Accelerated deployment of energy efficiency and renewable energy would seem to be trending Japan towards a low-greenhouse gas emissions, clean energy future, but the current business structure of Japan's electricity industry may serve as a brake to Japan's progress towards sustainability goals.

In addition to the destruction of the six-unit Tokyo Electric Power (TEPCO) Daiichi nuclear power plant, all of Japan's reactors were shut down for extended safety reviews. Only a handful of the 50 reactor units have since been restarted, with the first restart in mid-2012. At present, utilities have applied to start 10 more reactors, including the huge seven-unit TEPCO plant at Kashiwazaki-Kariwa plant in Niigata prefecture, on the west coast of Japan. Although the administration of Japanese President Shinzo Abe supports the restart of reactors that have passed safety tests, there remains considerable public opposition and mistrust of TEPCO and other nuclear utilities.

Just after the Fukushima disaster, the author of this article collaborated with Dr. Kae Takase and other colleagues to estimate that a combination of rapidly deployed energy efficiency and renewable energy options could replace the nuclear and fossil-fueled capacity disabled by the earthquake and tsunami faster and at a likely similar or lower cost than fossil-fueled alternatives. Since that time, renewable energy developments in Japan have accelerated, with sales of home combined heat and power units and of solar photovoltaic systems in particularly markedly higher in recent months and years. A number of technological hurdles remain to be overcome for Japan to meet a large portion of its electricity needs from renewable energy sources, including the storage of electricity from intermittent sources such as solar and wind power plants, and the integration of intermittent resources into the existing electricity grid. Options such as large-capacity hydrogen-based systems are under development, and ideas such as using battery-powered cars not only for transit, but to store electricity for use homes and businesses are also being explored.

Opponents of the restart of Japan's nuclear fleet, however, see many of the hurdles to a renewable energy future in Japan as being not so much technological in nature, but rather political and institutional.

In a recent interview with Jennifer Steffensen of the National Bureau of Asian Research, Professor Koichiro Ito notes that Japan's regional monopoly system of electric utilities, in which ten regional utilities "control most power generation, transmission, and distribution networks, and other large-scale consumers can choose their electricity provider" serves as an impediment to change. President Abe has proposed deregulation that could help to even the playing field for renewable electricity generation and energy efficiency, but deregulation, on the books for more than ten years, has proceeded but slowly, as the political power of the utilities and their regulators, many of whom are closely aligned to the utilities, tends to promote the status quo, although this attempt at deregulation would seem to benefit both by a lower public opinion of the utilities in the wake of Fukushima, as well as from stronger political leadership. Deregulation of the power sector is in part responsible for restricting access of potential third-party power developers, including those developing renewable power systems, to the transmission and distribution grid. Deregulation, together with regulation and monitoring of competitive markets for power to ensure that deregulated electricity markets do not results in unfair pricing (as in California in 2000-2001), can

help to smooth the path both to domestic renewables, but also, in the longer-term future, to the realization of long-discussed large-scale transfers of renewable electricity from the resource-rich regions of the Russian Far East (hydroelectricity) and Mongolia (solar and wind power from the Gobi desert, as proposed in the "Gobitec" and "Desertec" concepts).

The fact that the Japanese electrical grid operates on two different frequencies—60 Hz in the south and 50 Hz in the north, with the dividing line just to the west and south of Tokyo and with limited interchange capacity between the two systems, limits the amount of power that can be transmitted between the regions of Japan, as does, the limited transmission capacity between some islands of Japan. These physical impediments serve to help to insulate utilities from competition from outside their region.

Ultimately, Japan's high electricity prices, kept so both by the structure of the electricity industry and by the need to purchase expensive imported liquefied natural gas (LNG) to fuel additional power generation since the nuclear fleet has been off-line, will be both a spur to the development of renewable energy, but also a reason for utilities to seek to retain control over generation and hence, pricing. Reducing electricity costs would relieve an economic burden on Japan's businesses and consumers, and help to make Japanese industry more economically competitive, but doing so may be somewhat at odds with incentivizing renewable energy through high feed-in tariffs and other support, those implementing renewable energy also accomplishes other important long-term goals, namely reduction of greenhouse gas emissions and other pollutants. The outcome of the push and pull between the forces in favor of and resisting the restart of Japan's nuclear fleet will also affect the urgency and pace with which energy efficiency and renewable energy are deployed in Japan. Similar debates are likely to take place, albeit in different forms and at different times, in the ROK and in other countries in Asia over the next two decades, and as such the evolution of the politics, economics, and technologies of the electricity sector in Japan will be continue to be a fascinating process to watch, both in terms of its outcome in Japan and as it will provide lessons for the broader international community.

References and Further Reading

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