

Chapter 39

Present Status and Target of Japanese Wind Power Generation

Izumi Ushiyama

39.1 General

Japanese wind power market is still sleeping, due to the complicated cumbersome EIA procedure which was applied for all wind farms over 10 MW since Oct. 2012, and it needs about 4 years to finish this procedure. Only 203 MW with 10 projects have won the EIA permission, and the other 6226 MW with 88 projects are still in the EIA process at the end of Oct. 2014. The dawn light will shine in 2016, when most of these projects complete the EIA and start operation gradually. A lot of discussions and efforts are paid for cutting red tapes in Japan, especially for the EIA, grid access, and land-use restrictions now.

39.2 Market

At the end of 2015, 3120 MW of wind capacity had been installed in Japan, representing 0.5% of the total power supply in 2015. It includes 52.6 MW of offshore wind power (4 MW of floating, 4.4 MW of fixed foundation, and 44.2 MW of semi-offshore wind turbines). 130.43 MW (119.357 MW in net) with 64 new turbines were installed in 2014. It increased 2.7 times larger than in 2013, but it was still a very low level for the last 10 years. There were no additional offshore wind turbines in 2014. One 3 MW semi-offshore wind turbine starts operation in Feb. 2015 at Akita Port, and one 7 MW floating offshore wind turbine is to start operation in summer 2015 by Fukushima FORWARD project (Fig. 39.1).

I. Ushiyama (✉)
Ashikaga Institute of Technology, Ashikaga, Japan
e-mail: ushiyama@ashitech.ac.jp



Fig. 39.1 Kaminokuni wind farm, in Hokkaido, 28 MW, MHI 2.4 MW \times 12 units, ©J Power

39.3 Feed-In Tariff

The feed-in tariff (FIT) for onshore wind has maintained JPY 22/kWh (EUR 0.164/USD 0.185). And the Japanese Ministry of Economy, Trade and Industry (METI) had newly offered JPY36/kWh (EUR 0.27/USD 0.30) for offshore wind which use jack-up ship for turbine installation (i.e., it excludes semi-offshore wind turbines constructed from seashore). This tariff for offshore wind is set 1.64 times higher than onshore wind.

The tariff is to be reestimated every year according to the latest experience in Japan. On the other hand, the qualification of FIT can be gotten when the project almost finished the EIA procedure. It forces Japanese developers to take risk of forecasting FIT price at about 4 years in the future, when they start new projects. Only few developers who have strong financing ability can afford such uncertainty. Therefore, the Japan Wind Power Association (JWPA) requests Japanese government to shift the qualification timing a little earlier so as to make Japanese wind power development bankable.

39.4 Deregulation

The Ministry of Environment (MOE) and the METI have tried to shorten the EIA process period to within 2 years. The reestimation for the EIA contents was discussed. And the MOE started new subsidies supporting 50% cost for pre-EIA investigation, and it was applied for about 20 sites in FY 2014.

The strict rule for land use especially for farm was one of the big red tapes in Japan. The Ministry of Agriculture, Forest and Fisheries (MAFF) made a new law named “Act for the Promotion of Renewable Energy in Rural Districts (APRERD)” on 15 Nov. 2013, and APRERD went in operation on 1 May 2014. It will help the change of land-use purpose from “farm/agriculture” to “wind power/industry.” It means the big increase of potential land area for wind power in Japan.

39.5 Grid Restriction

Solar power developers have rushed to propose FIT approval by Mar. 2014 (about 27 GW new proposal for Mar.), responding the announcement of FIT price reduction (from JPY 36/kWh to JPY 32/kWh) from April by the METI. The accumulated proposed photovoltaic capacity in Japan by the end of April had reached 68.43 GW which was about one fourth of Japanese total electric power plant capacity.

The requested solar FIT in Kyushu district was over 12GW, which is about 1.5 times larger than the maximum electricity demand of 8 GW at that district in low-demand holiday season. Therefore, Kyushu Electric Power Company had denied to new grid connection for all renewable energies including wind power. Other six electric companies (Hokkaido, Tohoku, Hokuriku, Chugoku, Shikoku, Okinawa) have followed to Kyushu. A big discussion had broken up in Japan about this “no” declaration against renewable energies. The METI had gathered all the stake holders urgently, made discussion, and announced the new grid connection rule in Oct. 2014. This new rule expands acceptable capacity by introducing the wider output control for renewable energies by power supply reasons. The new acceptable capacity for wind power at seven electric companies was 5.73 GW in total. 2.1 GW has been already in operation in these seven regions; therefore, 3.63 GW was available for new connection. The central three regions (Tokyo, Chubu, Kansai) have huge electric demands and are free from this kind of restriction.

The acceptable capacity may be reestimated for expanding in the future, because the above new grid connection rule did not consider the interregional grid operation. The electric power system reform was conducted by the Japanese government now. The new Organization for Cross-regional Coordination of Transmission Operators (OCCTO) who is in charge of dealing Japanese electric grid lines integrally shall start its work from April 2016. If Japanese grid lines are operated

more favorably for renewable energies, the above grid restriction shall be eased dramatically in the future.

Most of Japanese wind resources exist in the northern rural regions called Hokkaido and Tohoku. Low population needs only small grid lines. The METI had started to build new grid lines for wind power at northern rural area in Japan (Hokkaido and Tohoku). The METI subsidizes about 50% of the building cost (25 billion JPY for every year). The grid building consortium for Hokkaido (for about 3 GW) had decided last year, and new two consortiums for Tohoku (for 600 MW at Akita and for 900 MW at Aomori) have also decided in 2014.

NEDO started a new national project to build up nationwide wind power output forecast system for 5 years. The fund for the first year was 4 billion JPY. The JWPA cooperates with this project.

39.6 Industry/Manufacturer

Three Japanese wind turbine manufacturers keep more than 60% domestic market share for several years. Their flagship new wind turbines start operation from 2013 to 2015. MHI's MWT167/7.0 7 MW turbine is to be applied for Fukushima FORWARD floating offshore wind power demonstration project in summer 2015. Hitachi's HTW5.0-126 5 MW turbine, as shown in Fig. 39.2, is to be used for several offshore wind power projects in Japan (Table 39.1).

39.7 Cooperation with Foreign Companies

The overseas experience and investment are useful to promoting wind power development in Japan, especially for offshore wind power.

Hitachi Zosen Corporation made technology alliance for floating offshore wind power with Norwegian StatoilHydro in Nov. 2012.

Maeda Co. who develops 60 MW Yasuoka wind farm in Yamaguchi pref. made technology alliance with Australian Macquarie group in Oct. 2013.

39.8 Offshore Wind Power Development

Japan has 52.6 MW of offshore wind power at the end of Feb. 2015, including two 2 MW floating wind turbines. Fukushima's floating turbine is located 20 km offshore from seashore. Further 914.5MW of 13 offshore wind power projects are under planning, and 504 MW of 6 projects within it are under the EIA process and preparing for the construction by around 2020 as shown in Table 39.2.



Fig. 39.2 Hitachi's HTW5.0-126 5 MW turbine at Kashima port side ©Hitachi

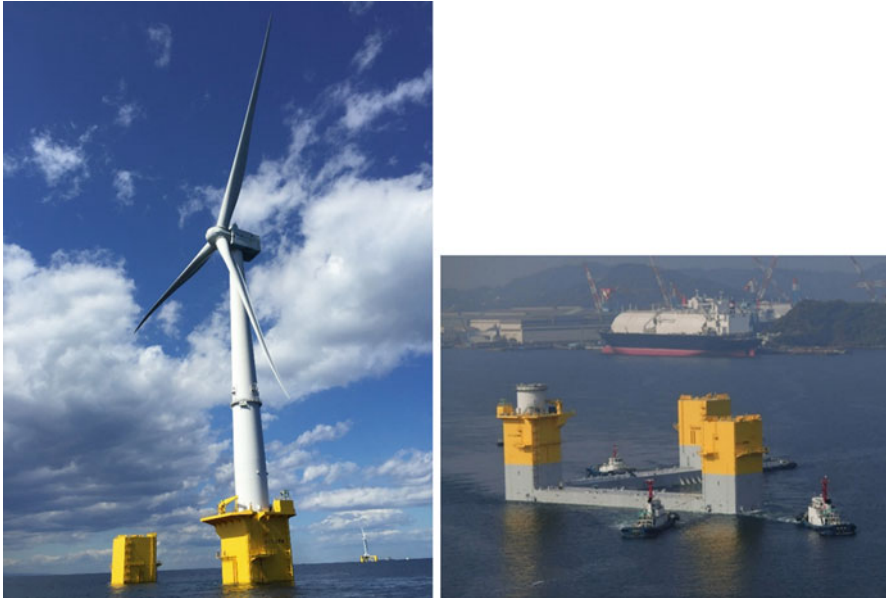
Table 39.1 New wind turbines developed by Japanese manufacturers

Company	Wind turbine	Rated output	Start operation	Type
MHI	MWT167/7.0	7.0 MW	Feb. 2015 at the UK	Hydraulic drive
Hitachi	HTW5.0-126	5.0 MW	Mar. 2015	Downwind
	HTW2.0-86	2.0 MW	Mar. 2014	Downwind
JSW	J100-3.0	3.0 MW	Sep. 2013 (2.7 MW)	Gearless PMSG

Fukushima FORWARD is a national project and the others are commercial projects. Kashima, Ishikari-Shinko, and Mutsuogawara projects are located in a designated area (port area). Fukushima and Yasuoka projects are located in an undesignated area. To get permission, social acceptance and compensation for

Table 39.2 Coming offshore wind power projects in Japan

Project name	Prefecture	Output	Wind turbines
Fukushima FORWARD	Fukushima	14 MW	5–7 MW
Kashima port no. 1	Ibaraki	125 MW	5 MW
Kashima port no. 2	Ibaraki	125 MW	5 MW
Yasuoka	Shimonoseki	60 MW	4 MW
Ishikari-Shinko	Hokkaido	100 MW	2.5–5 MW
Mutsuogawara	Aomori	80 MW	2.5 MW

**Fig. 39.3** Fukushima FORWARD 7 MW and floater set sailed from Nagasaki Port

fishermen are much easier at a designated area, because almost all rights are controlled by the port chief in the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) who is positive to offshore wind power.

As for undesignated area, there is no law or regulation for offshore wind power development in Japan now. The JWPA started holding study meeting with voluntary lawmakers in Dai-Ichi Tokyo Bar Association to fulfil the lack of necessary regulations.

The world's biggest class offshore wind turbine named "Fukushima Shinpu" was installed at 20 km offshore of Fukushima in July 2015 as shown in Fig. 39.3.

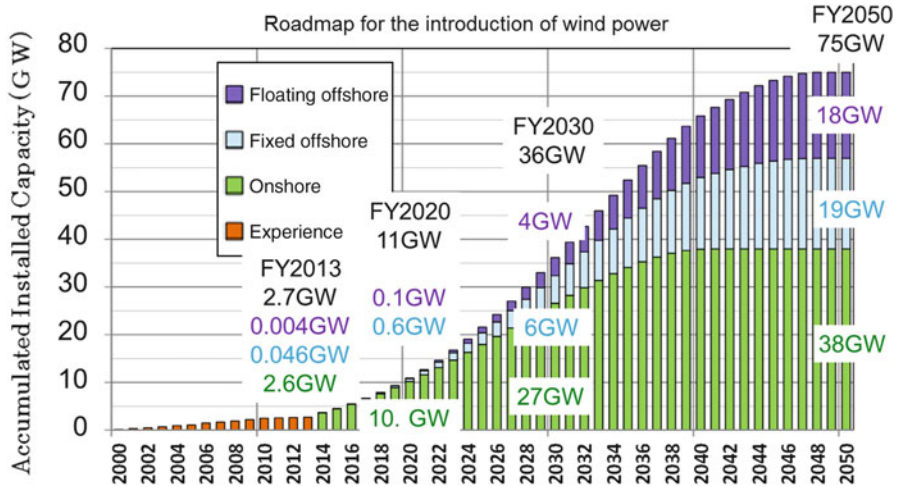


Fig. 39.4 Road map for the introduction of wind power in Japan

39.9 Wind Road Map 2050

One of the major issues in Japanese wind industry is a lack of long-term installation goal and road map. Without them, effective planning of subsidy by the government as well as of capital investment by manufacturers is not possible. Then, JWSA proposed wind road map 2050 based on wind potential in Japan. The Ministry of Environment published onshore and offshore wind potential of several wind speeds on March 2010, with consideration to almost all the social limitations including development regulation zones and distance from local residence.

The wind power target at 2050 was set as 50 GW so that it would produce 10% of the national electricity demand by wind. The installation targets for onshore and offshore wind at each utility zone were then calculated based on the wind potential. The road map 2050, which shows annual installation of onshore and offshore wind, was then estimated based on a well-known theory of “diffusion of innovation” that describes penetration of new technology in time follows S-shaped curve as shown in Fig. 39.4.

39.10 Conclusion

Japanese wind power market is waiting for the coming dawn. But, we are trying to cut many red tapes against the wind power development in Japan. Japan will grow up as the world’s leading wind power market after 2016. We keep on making every effort to realize this dream in the future.

Reference

- Ushiyama, I., Nagai, H., Saito, T., & Watanabe, F. (2010). Japan's onshore and offshore wind energy potential as well as long-term installation goal and its roadmap by the year 2050. *Wind Engineering*, 34(6), 701–720.