AN OVERVIEW OF WIND ENERGY IN JAPAN

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ABSTRACT

This article examines the history and present problems surrounding wind energy growth in Japan, as well as the role of policy and wind energy's future trajectory. Wind energy's share in Japan has not increased as a result of previous policy's lack of market emphasis. Just after Big East Earth quake in early 2011, and the following Fukushima Nuke Plant Accident, the circumstances around wind and other renewable energy altered drastically. The new Feed-in Tariff system has been implemented, and the Power Sector Reform is proceeding slowly. Despite the fact that wind energy has a considerably higher potential in Japan than other renewable, the FIT has not boosted wind installation to yet, and the amount of bottlenecks has hampered large-scale market deployment. The grid access of wind projects has been restricted due to a lack of grid capacity, the present energy market structure, and grid operation practices by incumbent Power Generation Companies. A layer of rules governing development permits lengthens the time it takes to complete a project, increases project uncertainty, and raises risk premiums. Due to certain previous errors that failed to answer local community issues, societal acceptability is especially difficult. Wind energy costs are also expensive in comparison to other nations, owing to a lack of economies of scale and other factors. To expand the proportion of wind energy in Japan's energy mix, the country has to adopt a more comprehensive policy package to address various bottlenecks and hazards.

KEYWORDS: *Japan , Policy, Solar , Trend ,Wind energy*

1. INTRODUCTION

The goal of this study is to look at the history and present problems of wind energy in Japan, as well as the role of policy and the future direction of the industry. The following is the structure of the article[1]. A short history of wind energy policy and development in Japan is given after the introduction. The effects of the 3.11 Great East Japan Earthquake and Tsunami, as well as the following Fukushima Nuclear Accident, are then examined in relation to contemporary energy policy issues. The fourth part focuses on recent advances in wind energy policy, which is considered essential for expanding the proportion of renewable energy. The fifth part delves into the present state of affairs and future plans for wind energy. The review's last part examines the connections between the problems addressed and the policy approaches that should be taken to expand the role of wind energy in Japan[2].

1.1 History Of Wind Energy In Japan:

After the First Oil Crisis of 1973, Japan, like many other nations, began to promote renewable energy. Prior to the oil crisis, Japan mostly depended on coal for energy requirements during the post-World War II recovery era, and oil as the primary energy source during the following period of rapid economic development. In 1973, oil accounted for about 77.4 percent of the country's main energy source[3]. The dependence on the Middle East was particularly high, with 77.5 percent of oil imported from the area each year[4]. The oil crisis has highlighted the urgent need to reduce Middle East oil reliance by securing oil supplies from other parts of the globe, increasing energy efficiency, and diversifying energy sources via the development of new energy technologies. The Sunshine Program was established in 1974 by the Ministry of International Trade and Industry (MITI) for the latter aim. Solar, geothermal, coal, and hydrogen were the four technologies that the Sunshine Program focused on. The Moonlight Program, which promoted the development of energy-saving technologies, was launched by the MITI in 1979. In 1980, the MITI established the New Energy and Industrial Technology Development Organization (NEDO) to oversee public research and development of new energy and energy conservation technologies, as well as to encourage their commercialization[5]. The MITI launched another research and development program, the Earth Environmental Technology Development Program, in 1989, and combined it with the Sunshine and Moonlight Programs to become the New Sunshine Program in 1993.

- Wind energy technology policy in Japan up to 2011: government financing for wind energy research and development in Japan. Because wind energy was not selected as the Sunshine Program's primary technology, RD&D funding for it started in 1978 with a considerably lower overall budget than solar or geothermal. In addition, wind RD&D funding has been inconsistent throughout time. From the 1990s to the mid-2000s, the majority of RD&D funding went toward developing wind resource databases and grid stabilization technology, such as Japan Wind Atlas Development (FY1993), field testing and data gathering projects (FY1995-FY2006), Local Area Wind Energy Prediction System (LAWEPS) development (FY1999-FY2002), wind database based on LAWEPS (FY2003-), and energy storage based on LAWEPS (FY2003-) (FY2005-FY2007).In the late 2000s, things began to shift[6]. In 2007, 2008, and 2009, the Ministry of Economy, Trade, and Industry (METI, the successor of the MITI) released three energy technology roadmaps. Wind energy was identified as a priority for technological advancement in the roadmaps. Turbine upscaling, composite materials development, cost reduction, power quality improvement, power system management, wind power production forecasting, grid connection control, grid stability, and high-quality low-wind turbine development were all priorities for onshore wind. Exploration of both bottom fixed foundation and floating foundation ideas, wind power production forecasting, grid connection control, grid stability, energy conversion and storage system development were all mentioned as RD&D priorities in the roadmaps for offshore wind. The METI's increasing interest in wind energy is due to an increase in wind energy installations across the globe.In 2008, the METI includes wind energy research and development in its Energy Innovation Program. The overall budget for the three multiyear projects increased dramatically from 2009[7].There are three components to the Energy Innovation Program for Wind. From FY 2008 to FY 2012, the first focused on creating technological solutions for

Japanese-specific meteorological and climatic circumstances such strong lightning and typhoons. The second program (FY2008–FY2014) is completely dedicated to offshore wind energy technology and includes three kinds of projects: large-scale offshore wind system development, offshore wind demonstration for both fixed and floating foundations, and offshore wind resource monitoring studies. The program has been extended through the end of fiscal year 2017[8].

- Wind energy market development policy up to 2011: The main energy policy in Japan is technological development, and market policy has been extremely weak, with wind being no exception. Capital subsidies and Renewable Portfolio Standards (RPS), based on the "Special Measures Law Concerning the Use of New Energy by Electric Utilities," were the two major market policies for wind. Capital subsidies began in fiscal year 1998 and continued until fiscal year 2010[9].One was for private-sector development, with up to a third of the capital cost covered. The other provided funding for wind projects in the non-profit sector and municipalities, paying up to half of the capital costs. Although the latter initiative was not formally discontinued in FY 2011, there were no open wind project recruiting opportunities that year [10].The RPS program, which began on April 1, 2003 and ended on June 30, 2012, was the other major initiative. Solar power production, wind power generation, biomass, small and medium-sized hydro power generation (up to 1 MW capacity), and binary geothermal power generation were all included under the RPS system. An electrical retailer may produce power, buy new energy electricity from another party, or buy a "New Energy Certificate" from another party to fulfill its obligations.

1.2 Wind Energy Current Issues And Future Agenda:

- Assessments of renewable energy potential: Prior to March 11, 2011, both the METI and the Ministry of the Environment (MOE) have looked into the renewable energy installation possibilities. They released the findings shortly after the Great East Japan Earthquake and Fukushima Nuclear Power Plant Disaster in 2011. In comparison to other renewable energy sources, these two ministries said that onshore and offshore wind energy had much higher potential.

- FITs and the wind energy market: Renewable energy installation has increased significantly since the FIT was introduced in July 2012. However, as shown in Table 5, PV made up more than 95 percent of the facilities that went live; there are significant differences between renewable resources built under the FIT program. In the case of wind, 66 MW wind energy facilities went online during the first year of the FIT program, although their capacity is less than 1.9 percent of PV capacity. In addition, the METI had approved 805 MW of wind energy facilities as Specified Suppliers and were awaiting commissioning, while just 3.8 percent of PV had been certified as of the end of June 2013. At the end of June 2013, about 84 percent of FIT-certified renewable power plants were yet to be operational. This is uncommon when compared to renewable energy installations in other nations, since wind is typically a more cost-effective option. The main explanation for this disparity and the significant rise in PV is the gap in lead-time, not the tariff levels or resource potentials. Due to numerous obstacles, including a layer of rules for development licenses, wind and geothermal have considerably longer lead times than PV; PV is much simpler to install with just a few regulatory permissions in Japan. The sections that follow delve into the obstacles that stymie wind energy development.

- Japan's wind resource locations and grid connectivity problems: The geographical distribution of wind resources in Japan is very unequal. The MOE (2011) examined wind energy potentials and existing power generation capacity for each EPCO area, illustrating that wind energy resources are concentrated in the Hokkaido, tohoku, and Kyushu EPCO regions, while existing power generation capacity indicates demand centers in the Tokyo, Kansai, and Chubu EPCO areas. As a result, areas with abundant wind resources do not face high demand. Furthermore, excellent wind resources are often found in distant regions with no or low-capacity transmission lines, making it difficult to link large-scale wind energy projects without bolstering transmission line capacity within each region. This geographical disparity in market demand and wind energy production necessitates the construction of a robust transmission system to transport wind-generated power from Hokkaido, Tohoku, and Kyushu to demand centers like as Tokyo, Kansai, and Chubu. However, the poor transmission line capacity between regional EPCOs restricted grid connection of wind power plants in Japan. In addition to the grid's fundamental characteristics, Japan's power production mix is inflexible, with a high penetration of base load power plants including nuclear, run-of-river hydro, and must-run thermals, resulting in less flexible electricity throughout the night. Due to these conditions, the grid connection of distributed energy production has typically been capped at ten EPCOs. Table 6 displays the grid connection ceilings imposed by each regional EPCO, but the Tokyo, Kansai, and Chubu EPCOs do not establish the limitations since they refuse to give distributed power producers with accurate technical information about their system. EPCOs often defend grid connection limits by citing the risk of voltage fluctuations, the difficulties of maintaining appropriate frequency, and the management of excess energy generated by intermittent wind and PV power production. Due to regional market segregation and a lack of significant regional connectivity, each EPCO must carefully balance supply and demand within each area; wind intermittency may make supply–demand balancing problematic. The specific issues with wind energy grid integration differ per by EPCO. The EPCOs in Tohoku, Chugoku, Shikoku, and Kyushu lack flexibly controlled power production capacity and a lack of downward reserve in the event of low demand with abundant wind. The grid's frequency may be increased as a result of this. Okinawa EPCO lacks the necessary control capability for short-term frequency variation and balancing (a few minutes to 20 minutes). During periods of fast demand shift, all EPCOs suffer from a lack of control capability for long-term (from 20 minutes to six hours) variation and steep ramp induced by wind power. With these reasons, EPCOs abruptly curtailed wind power production anytime they believed wind power generation endangered grid stability. EPCOs were required to pay power generation income to wind power producers for curtailment hours if they exceeded 8% of annual power production hours when curtailment was implemented for certain grid-related reasons. Wind power producers have been able to apply (bid) for grid access within the Hokkaido, Tohoku, and Kyushu EPCOs' ceilings since 2002. The recipients of grid access have been chosen by lottery, although the bidding and lottery procedure has lasted anything from six months to a year.

2. DISCUSSION

This paper examines the history and present problems of wind energy development in Japan and considers the role of policy and future direction of wind energy. Past policy with its poor market emphasis did not increase wind energy share in Japan. The circumstances around wind and other renewable energy changed significantly following the Great East Earthquake and Tsunami and the subsequent Fukushima Nuclear Plant Accident in early 2011. The new Feed-in Tariff system was implemented and the Electricity Sector Reform is steadily proceeding. Although wind energy has considerably greater potential than other renewable in Japan Wind power is one of the fastest-growing renewable energy sources. Usage is on the increase globally, in part because prices are decreasing. Global installed wind-generation capacity onshore and offshore has grown by a factor of nearly 75 in the last two decades, rising from 7.5 gigawatts (GW) in 1997 to approximately 564 GW by 2018, according to IRENA's latest statistics. Production of wind power quadrupled between 2009 and 2013, and in 2016 wind energy accounted for 16 percent of the electricity produced by renewable. Many areas of the globe have high wind speeds, yet the greatest sites for producing wind power are often isolated ones. Offshore wind power provides enormous promise. Wind turbines originally appeared more than a century ago. Following the development of the electric generator in the 1830s, engineers began trying to harness wind energy to generate electricity. Wind power generation did occurred in the United Kingdom and the United States in 1887 and 1888, but modern wind power is believed to have been first created in Denmark, where horizontal-axis wind turbines were constructed in 1891 and a 22.8-metre wind turbine started operating in 1897.Wind is utilized to generate electricity utilizing the kinetic energy produced by air in motion. This is converted into electrical energy utilizing wind turbines or wind energy conversion devices. Wind initially strikes a turbine’s blades, forcing them to spin and turn the turbine attached to them. That converts the kinetic energy to rotational energy, by rotating a shaft which is linked to a generator, and thus generating electrical energy via electromagnetic. This essay examines the history and present problems of wind energy development in Japan and considers the role of policy and future direction of wind energy. Past policy with its poor market emphasis did not increase wind energy share in Japan.

3. CONCLUSION

the risks and blockages that impede large-scale deployment of onshore wind energy in Japan by depicting a typical wind power generating project flow/value chain on the horizontal axis, as well as the location of risks and blockages in terms of safety and reliability. features of resources, policies and laws, data/technologies infrastructures, business methods, cost, market, and stakeholder relations are all factors to consider. Relationships on the vertical axis, as well as interrelationships. Numerous blockages occur in every value chain activity, causing uncertainty and high risks, extending project lead times, and raising risk premiums and prices across the board. The majority of blockages are man-made, despite the fact that changing natural wind resource characteristics is difficult. By complicating the project process and raising uncertainty, a layer of regulation constitutes one of the biggest obstacles.

Even though many laws and regulatory processes are being deregulated, it will take time to resolve problems with the newly adopted EIA process and create a streamlined but solid development process that meets the needs of all regulatory agencies, local people, and the wind sector. Another significant obstacle is the absence of grid capacity, defined regulations, and operational processes for integrating wind energy projects into the current system. They contribute to a high level of development and grid connection uncertainty, as well as a high level of development expenses. Although integrating a large amount of wind and solar energy into the grid is a top priority for countries looking to increase intermittent renewable in their energy mix, the scale of the Japanese problem differs significantly from that of countries such asGermany and Spain, which have already established strong wind energy deployment documents. The latest integrated, regionally separated, and small electricity market constructions, as well as the lack of transparent grid connection rules, necessitate significant institutional changes, which are dependent on the existence and exercise of strong and consistent political will, as such changes necessitate long-term commitment and effort. Physical grid capacity augmentation is also required to allow broader area grid operations to more readily absorb wind intermittency. This must be accompanied by structural and market change in the power industry. The EPCO's political and economic authority has been undermined by the shutdown of nuclear power plants and significant public opposition to their previous commercial practices, especially in connection to nuclear power, thus there may be a short window of time.

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