RENEWABLES 2012 JAPAN STATUS REPORT
EXECUTIVE SUMMARY

Chapter 1 : Introduction

The severe nuclear disaster at Fukushima Daiichi nuclear power plant caused by the huge earthquake and the massive tsunami in March 11th, 2011 brought about controversies over the safety of nuclear plants. Uncertainty about the safety of nuclear power, as well as the energy security issue that arose from planned load-shedding, have caused widespread reconsideration of electrical liberalization that would separate transmission from power production. The Ministry of Economy, Trade and Industry has organized committees to discuss the current energy market system and the need for its reformation, especially when major electric utility companies are monopolizing the market. The decision is expected to be made around the summer of 2012, and if that's the case, then the measures will be implemented by the end of the year.

Nuclear power was introduced as an alternative energy resource with no CO_2 emission in the early 1960s and flourished until the Chernobyl accident in Ukraine (former Soviet Union), which created uncertainty regarding supposedly risk-free operation of nuclear power. The Chernobyl accident incited countries in Europe to raise concerns about the safety issues of nuclear power; even so the accident in Japan is considered a turning point from which global energy policies have been subjected to reassessments. The drastic growth of renewable energy is largely attributed to supportive policies, and setting targets for the long term is going to be important for further spread of renewable energy.

The renovation of the fundamental energy policy and current power distribution system has resulted in slow progress in initiating a governmental scheme to reduce the threat of climate change. The National Policy Unit declared at the 'Energy and Environment Council' held in December 2011 that they would come up with measures for global warming while backing energy mix options that would tackle global warming while attaining the energy security. They also plan to develop long term scenarios, along with an assessment of possible impacts of their decisions on the livelihood of citizens and the economy.

Chapter 2 : Renewable Policy Landscape

A nuclear dependent energy policy was dominant among decision makers and the public before the accident at Fukushima Daiichi nuclear plant on March 11th, 2011. Although the previous Japanese Prime Minister Kan declared that Japanese energy policy plan had to be reassessed from scratch, the process brought about disputes between the Kan Administration and government bureaucrats at the Ministry of Economy, Trade and Industry(METI).

The Minister of State for National Policy was appointed to set up the 'Energy and Environment Council' among the Ministers in June 2011. Nuclear fuel cycle, power generation costs and the separation of transmission from power generation were focused on in the council to achieve the twin core objectives of reducing the dependency on nuclear power and reassessment of nuclear policy and distributed energy system including renewables. However, the actual debate on the energy policy and the electrical infrastructure system was brought to "the Advisory Committee on Energy and Natural Resources" and "the Atomic Energy Commission". This meant that it was carried out under the influence of the governmental bureaucrats of the METI, and it was harder for the Kan Administration to inspect its progress. Kan proposed the Legislation for the Promotion of Renewable Energy and was approved in the end having improved the feasibility of the new energy policy. Fundamental policy on the energy system was adopted in December 2011, and the launch of the Innovative Strategy for Energy and Environment based on a series of dialogues in the 'Energy and Environment Council' is planned for summer of 2012.

Restoration of public infrastructure and facilities is not enough to rebuild the economy of the areas under the effect of nuclear radiation or hit by the earthquake and tsunami. New invention of local industry is needed along with the restoration work, and the national and the local governments look into the potential in the renewable energy industry. Their policies on the promotion of renewable energy focus on a self-sufficient energy supply system. However, the common issues in terms of renewable energy policy that the national and the local governments have include a lack of growth in the number of power producers and suppliers (PPSs) and abandoned local financing systems. It was suggested by the local

communities that the new renewable energy policy should adopt FIT. An example of such a policy plan is 'Energy Strategy for Reviving Tohoku-100% renewable energy by 2020-' proposed by ISEP.

Subsidies authorized by the Tokyo Metropolitan Government for solar heating have been given to housing developers to install solar water heating systems instead of other electric systems which are less efficient. All large buildings that are newly erected have to be equipped with at least one type of renewable energy under a policy implemented in Kyoto started in April 2012. The central government started their new projects in 2011 to promote local businesses in renewable energy power generation. After the events of the March 11th earthquake, Fukushima has reassessed its original renewable energy policy vision, and its new plan to install off-shore wind power is anticipated to increase the employment in the area. ICLEI Japan launched a local carbon registry where 124 local governments in Japan update their climate change countermeasure actions. It may be publicly viewed for the purpose of MRV.

It was declared that power utilities will install mega solar power with the installed capacity of 140 MW by 2020 due to the implementation of a piece of legislation that encourages power utilities to generate renewable energy power. Similarly, gas companies have begun to adopt fuel cells and biogas to generate electricity, while oil companies are shifting towards solar power, wind power and bio-fuels. Businesses generating and supplying electricity to meet the demand of 50 kW or above per consumer are growing, although there remain issues such as how to transmit the power.

The new global investment for renewable energy grew from 7 billion dollars in 2002 to 260 billion dollars in 2011, although Japan's investment only accounts for 3% of it. However, Japan still owns the world's highest quality solar technology, and although the world share of Japanese photovoltaic cells has been declining since 2006, it is expected to grow up to 22% by 2020 as the cumulative capacity of solar power rises up to 100 GW by 2030.

Implementation of schemes to promote renewable energy such as feed-in tariffs (FIT) has led to an increase in the number of renewable energy power projects funded by direct investment from the citizens (Community Funds) in countries like Denmark and Germany. The implementation of a stricter FIT policy will be starting in July 2012 in Japan. There are a few examples of community-funded projects, such as wind power and solar panels on the roofs of all the public buildings in one city in Japan.

Although there are no obligations for businesses to adopt emissions trading schemes in Japan, there are different types of carbon credit systems adopted voluntarily. A trial introduction of a domestic emissions trading scheme by The Ministry of Economy, Industry and Trade has registered 857 businesses by the end of 2011, and it is expected that 1.4 Mt-CO_2 worth of carbon emissions are to be reduced through technological innovation such as the installation of biomass boilers. Green Power Certificate trading, originally adopted by private companies, reached 270 GWh worth of electricity generated from different types of renewable energy sources in FY 2010. Businesses that fall under the 'GHG reduction and emissions trading scheme' introduced by Tokyo Metropolitan Government in 2010 can also use Green Power Certificates as a proof of their compliance.

Chapter 3 : Trends of Renewable Energy

(1) *Electric Power*

The cumulative capacity of renewable energy power was estimated to have reached above 13 GW at the end of fiscal year 2010 (Fig.3-1), and half of it was attributed to biomass and to small hydropower (under 10MW). The growth of solar power, which had cumulative capacity of 3.88 GW by the end of FY 2010, had slowed down between 2004 and 2009 due to less supportive policies such as including cuts in subsidies. The introduction of a partial FIT system in the Japanese solar power market in 2009 has had an effect, and the annual installed capacity of solar power reached over 1 GW in FY 2010. The annual installed capacity of wind power, which had been growing at the rate of above 30% until FY 2006, continues to decline. The cumulative capacity was about 2.4 GW at the end of FY 2010, while the added power capacity in 2011 was estimated to be around 0.08 GW (estimated by JWPA). The cumulative capacity of geothermal power, with no new installations since 2000, was maintained at 0.54 GW at the end of FY 2010. The added power capacity of small hydropower (under 10 MW) has remained low, with a total increase of 0.18 GW between FY 1990 and FY 2010. The growing use of woody biomass, as well as biomass from municipal and industrial waste, led to an overall increase in biomass power capacity.

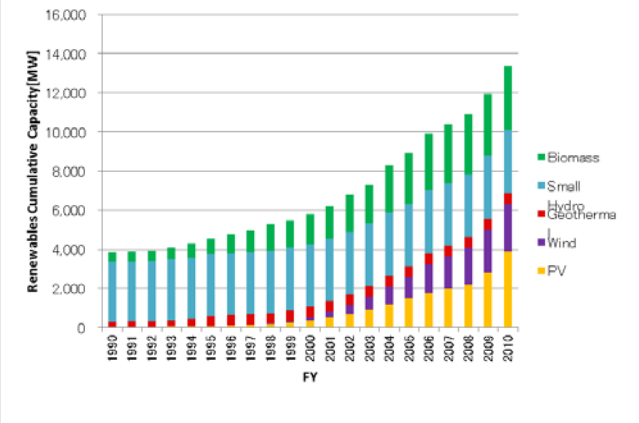


Fig.3-1: Renewables Cumulative Capacity in Japan

Power generation of solar and wind energy, with relatively high growth rates of 38% and 12% respectively, accounted for only 0.4 % of total power generation in FY 2010. With relatively low growth rates of 3 % or lower, the total power generation of geothermal, small hydropower and biomass accounts for nearly 80 % of all renewable power sources in Japan (Fig.3-2, Table3-1). However, renewable energy accounts for 3.5% of total power generation which is only a 1% increase in the decade between 2000 and 2010. It should be noted that the total domestic power generation includes the power generated by both power utilities and non-utility generators.

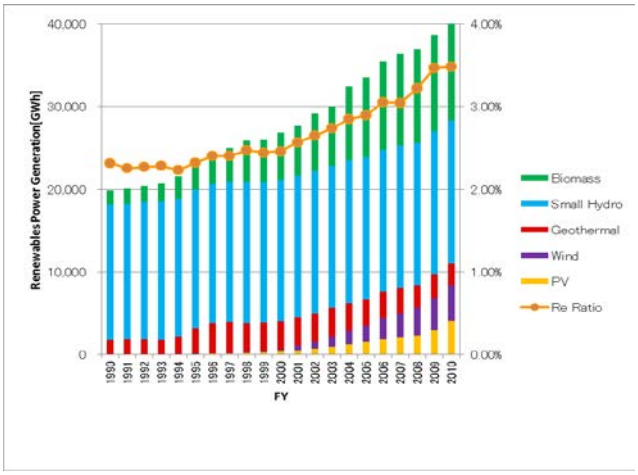


Fig.3-2: Power Generation by Renewables in Japan

Table3-1: Renewables Capacity and Power Generation in FY2010, Japan

Japan (FY2010)	Installed Capacity [MW]	Cumulative Capacity [MW]	Power Gen. [GWh]	Ratio of Power Generation [%]
Solar	1,063	3,884	4,083	0.35%
Wind	256	2,440	4,275	0.37%
Geothermal	2	540	2,652	0.23%
Small Hydro	5	3,239	17,305	1.49%
Biomass	96	3,256	11,978	1.03%
Total	1,422	13,358	40,293	3.47%

(a) Solar Photovoltaic (PV) Power Generation

Total shipments of Japanese PV modules in FY2010 reached 2.54 GW (52% growth relative to that in 2009) of which domestic shipments (1.06 GW) exhibited a 71% increase while overseas shipments (1.48 GW) exhibited a 41% increase. Total imports of solar modules in FY2010 were 0.26 GW, double of the previous year, and the imported modules account for 20 % of domestic shipments.

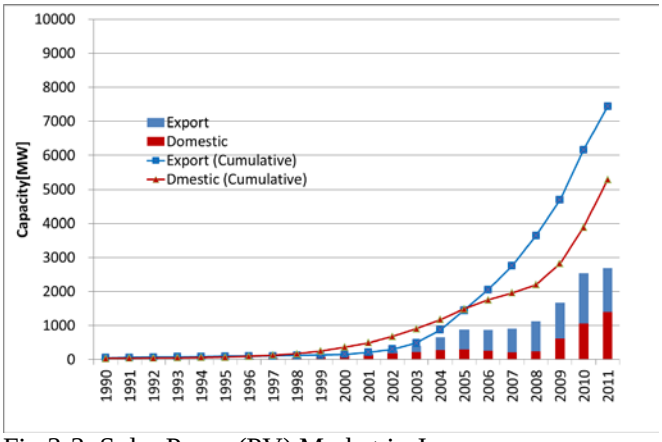
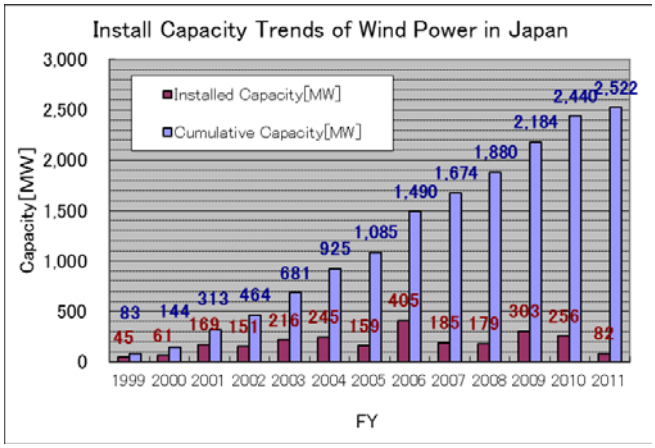


Fig.3-3: Solar Power(PV) Market in Japan

(b) Wind Power Generation

The total number of wind turbines was 1,807, with an installed capacity of 2.4 GW at the end of 2010. This implies that Japan failed to reach the previous target of installing 3 GW of wind power by 2010. Installed capacity at the end of year 2011 was 2.5 GW and was estimated to increase by 22 MW by the end of FY 2011 (estimated by JWPA). Installed capacity is relatively high in areas such as Hokkaido, Tohoku, and Kyushu, where the wind condition is suitable. However, recruitment for new installation is restrained due to limited grid connection capacity. In addition, restrictions on building sites, the amendment to the building code in 2008, and an increase in global demand on wind power have had negative effects on the domestic wind power industry. Furthermore, such diminutive increase in the new installation is also derived from reconsideration of the subsidy scheme.



(c) Small Hydropower Generation

Most of the hydropower plants in Japan were built before 1990, and the cumulative capacity of those with a capacity of below 10 MW at the end of FY 2010 was 3.24 GW, which accounts for 6.7 % of the total capacity of all sized hydropower. 157 small hydropower plants with a capacity below 10 MW were erected after 1990, and the cumulative capacity of those plants is 179 MW. Renewable Portfolio Standard (RPS) applies to majority of those with a capacity of below 1 MW that were constructed after FY 2004.

(d) Geothermal Power Generation

Cumulative capacity of geothermal power grew to 530 MW between when the first power plant was built in 1966 and 1990. The oil crisis in 1970's empowered movement in the private sector to develop geothermal energy power. However, added capacity was only 1 MW between 1990 and 1999 when the latest geothermal plant was built, and the 10 year period of no added power capacity was called 'the lost decade'. Annual generation has been declining since its peak in 2003 and exhibited 8.8 % reduction in FY 2010. Issues involving locating appropriate sites and the costs relating to development, construction and maintenance have led to an exemption from RPS.

(e) Biomass Power Generation

Sources for fuel in biomass power generation vary, from wood fuel, food, and livestock, to waste such as industrial and municipal waste. Biomass power is generated through direct combustion, gasification or methane fermentation of these fuel resources. Cumulative capacity at the end of FY 2010 was 3.26 GW, which was 6.7 times larger than that in 1990. General and industrial waste accounts for 90 % (54.9 % and 35.6 %, respectively) of the total capacity under the incentive of RPS regulatory policy. On the other hand, power generation from wood fuel accounts for only 8%, so the wood biomass is expected to be encouraged while promoting forestry and the usage of domestic timber. It is difficult to assess sustainability and the effect of reducing CO2 for each different type of biomass fuel, even though the credibility of reviewing such data is important in emission trading schemes and feed-in-tariffs.

(2) *Heat*

(a) Solar Heating

Solar heating market grew after the oil crisis and peaked in 1980s when the cumulative capacity reached 1.7 GWth. Total capacity of solar heating, while incorporating depreciation in stock into the estimation, has been declining since FY 1994 due to a fossil fuel supply at low prices. This has impeded technological development and innovation of the systems. Deterioration in product reliability stemming from quality issues of these solar heating systems caused a decline in sales down to the current sales of 40 to 60 thousand per year.

(b) Geothermal

The tradition of the Japanese hot spa is regarded as exploiting geothermal heat. Although there is little data available to assess trends in the use of hot springs for bathing purposes, it is estimated that available heat energy has increased since the amount of flow has doubled in the last 40 years. It was estimated by the government in 2006 that utilizing hot springs for bath can save 36.5 PJ of heat energy. Growth in geothermal heat pumps was marginal when it was first introduced at the beginning of 1980's and it slowly became more noticeable around 2004. At the year 2010, it was estimated that the annual installation had been around

100 for the last 4 years.

(c) Biomass

In contrast to a tradition to include firewood as a biomass resource when estimating the trend in the biomass heating, this report focuses on combusting appliances that use wood pellets and wood chips. The number of boilers and stoves between 2008 and 2009, and both appliances exhibited 14 % increase. It is difficult to estimate the total amount of domestic biomass energy supply, especially the amount generated via large boilers and 'combined heat and power (CHP)' in paper manufacturing, since most of it is consumed for the manufacturing process.

(3) Bio Fuels

Bio-ethanol (almost as ETBE) and biodiesel (BDF) account for 98% and 2% respectively in the total production of biofuels, which has reached only 379 mega-liter in FY 2010. This is less than 1% of the passenger vehicle fuel in demand (estimated to be around 56 giga-liter) and is around 75% of the target aiming to adopt 500 mega-liter as transportation fuel by FY 2010.

There are 265 biofuel factories in Japan, and those that produce BDF derived from food account for 236, while the rest utilises wood and agricultural material for their fuel production. Only 23 factories have provided sufficient production data, and the total production capacity for these factories (operation began between 2003 and 2009) was 37,774 kL/year. The average capacity per single factory is larger for bio-ethanol than that of BDF, and especially the average capacity of three factories producing bio-ethanol from food can be deduced as around 10 mega-liter/year.

Chapter 4 : Long-term Scenario

After the Fukushima disaster on March 11, 2011, Japan's long-term energy policy had to be restarted from scratch. The Energy and Environmental Council of government will provide choices for a new basic policy plan until spring 2012, and the hope is that a national discourse will provide the decision by the end of the summer 2012. Citizen and Many NGOs have been pushing for a complete abandonment of nuclear power and a transition to sustainable energy. For example, WWF Japan (World Wide Fund for Nature Japan) released "100% Sustainable Energy" in November 2011 with the goal of achieving 50% sustainable energy and 50% reduction in energy use in Japan by 2050.

The Institute for Sustainable Energy Policies (ISEP) released "Energy Policy Paper after 3.11" to encourage a similar goal. In their view, locally implemented sustainable energy policies will grant stability in electricity supplies, encourage independence in different communities, and help to abate global warming. ISEP advocates 100% sustainable energy use by 2050, dismissing nuclear power by 2020 and fossil fuels by 2050.

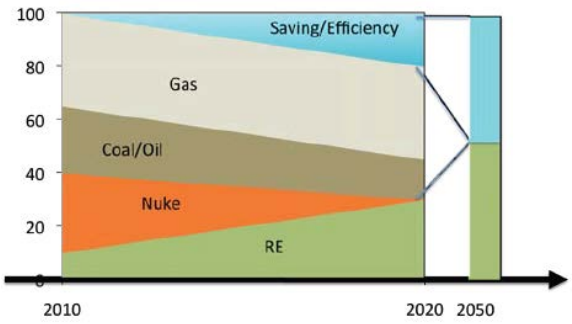


Fig.4-1: Images of energy shift of power generation for mid and long terms in Japan

Chapter 5 : Regional Potential & Implementation

The real potential for renewable energy lies not in the large cities, but in the rural parts of Japan, such as agricultural or beachfront areas. In the "Energy Sustainable Zone" report (2011), research found that although Japan gets only 4% of its energy from renewable sources, 12 prefectures now receive more than 10% of their electricity from renewable energy (with 9 of these prefectures also receiving over 10% of their heat from renewable sources). Tokyo and Osaka, as large cities, receive a mere 1% from renewable energy and will need to be connected to resource-rich areas to increase their energy supply ratio. The report also states that 52 municipalities receive 100% of their energy (power and heat) from renewable sources, with 82 municipalities receiving 100% of power, but not heat, from renewable sources.

Various research has been conducted both in Japan and around the world evaluating the potential for renewable energy supply in different regions. Japan's Ministry of Environment (MoE) conducted a study with various renewable energy organizations to make quantitative estimations of potential distribution and scale of renewable energy use. One such estimation was carried out for PV, on-shore and off-shore wind power (273 GW and 141 GW, respectively) and small hydropower (14 GW).

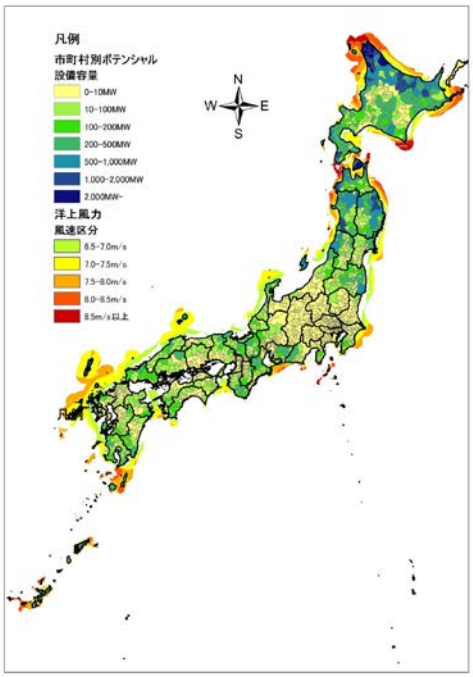


Fig5.1: Potential map of wind power in each area of Japan

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