

Renewables Japan Status Report 2014 Executíve Summary

Institute for Sustainable Energy Policies http://www.isep.or.jp/en

RENEWABLES JAPAN STATUS REPORT 2014 EXECUTIVE SUMMARY

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Chapter 1 : Introduction

Since the industrial revolution, human beings have depended mainly on fossil fuels such as oil, coal, and natural gas. However, fossil fuels are recognized as exhaustible energy sources, and some of them, especially oil, are said to have already reached peak production. As a result we can predict with certainty a long term rise of their prices. Moreover, the greenhouse gas that fossil fuel energy produces is one of the major causes of global warming, while climate change continues to become a global phenomenon. Nuclear energy, which has been pointed out as a remedy to energy problems, was once thought to be a serious alternative to the fossil fuels. Yet nuclear energy has

repeatedly been exposed as a serious threat to the human beings in the case of serious disasters that can occur like in Fukushima, and the further difficulties in handling the radioactive waste it produces.

In contrast to fossil fuels, renewable energy has attracted worldwide interest as the "sustainable energy for the future", and the utilization of these energy sources has vastly expanded in the ongoing process of "the fourth revolution" or green revolution; following the agricultural, industrial, IT

revolution. Since only a mere 5% of Japan's primary energy is domestically produced. However, renewable energy can be domestically produced in Japan, and can be used as an alternative to existing energy sources such as fossil fuel and nuclear energy. Furthermore, renewable energy produces almost no greenhouse gas emissions, and the implementation of renewable technology is expected to stabilize domestic and regional energy security, create jobs, and energize the regional economy. Renewable energy can also be used to produce electricity in various forms such as photovoltaic, wind, geothermal, hydro, biomass, geothermal, or as fuel in biomass fuel.

Although occasionally there have been calls for an expanded utilization of renewable energy, the amount introduced in Japan is still only about 10% of total

generated electricity, this even includes the large size hydro power facilities as shown in Fig.1. Furthermore, the climate of Japan's energy policy especially the nuclear industry has changed completely after the disaster on 11th March 2011 in Fukushima. The tragedy further clarified the necessity to alter the heavily nuclear dependent energy policy of Japan, especially considering the geological position Japan is located upon. Additionally, albeit the inevitability to rely on the fossil fuels in the short term, the highly probable rise in prices of the fossil fuels in the near future will force us to decide to alter the existing energy policy to one based on the renewable energy.





Renewable projects, particularly those of solar power generation, can be implemented within a relatively short time frame; therefore, introducing renewables can play an important role as a post-disaster recovery measure as well as contribute to energy security and global warming prevention. Moreover, the "the more popularization, the lower the price" characteristic, which is typical in small scale dispersed technology is present in the adoption of renewable energy. One of the positive characteristics of renewable technologies is that the performance improves and price declines as they become more popularized. In other words, the next decade in comparison to the last decade will witness much faster spread of renewable energy and thus a dramatic price decrease in the cost. This will make it possible to introduce more renewable technologies in ten years than the current speed at a lower cost simultaneously. From now on, the respective regions of Japan are expected to adopt an energy policy that focuses on small scale and dispersed renewables not only as to make it a mainstay of post-disaster economic recovery but also to realize a potential society of 100% renewable energy. This will be achieved through a drastic and strategic energy shift aimed at supplying stable and self-sufficient energy, while at the same time mitigating global warming as shown in Fig.2.



Fig.2 Image of Energy Shift to Sustainable Energy(ISEP)

etc.

Chapter 2 : Renewable Energy Market and Policy in Japan

2.1 New basic energy policy plan in Japan

The expanded proliferation renewable of technologies has been the utmost theme in revising the past pro-nuclear basic energy policy plan of Japan. The theme of moving towards more renewable energy was discussed in the "Energy and Environment meeting" held by the government in June of 2011, and the transition to become less dependent on the nuclear energy and move toward a more dispersed energy system was again addressed in the "Evolutionary Energy and Environment Strategy" in September 2012.

The necessity to introduce a concrete plan to meet the goal of introducing more renewable energy has often been pointed out. The overall review of the "Basic Energy Plan" was under consideration in the Fundamental Issues Sub-committee of the Advisory Committee for Natural Resources and Energy since October 2011, and targets for the introduction of renewable energy by 2030 were also discussed. Moreover, j in the sub-committee of discussing the policies and measures after 2013, in The Central Environmental Council, The Global Environmental Committee, have specifically discussed a roadmap to future energy supply in the medium to long term. As a result, the government provided plans for an energy strategy at the Energy and Environment Council in June 2012, and created the Innovative Strategy for Energy and the Environment in September 2012 after much discussion and even a spirited national public debate. In the proposed strategy, in order to realize a green energy revolution, full-scale introduction of renewable energy was proposed, and achieving 30% of the total power generation from renewable energy by 2030 was the first step to reaching that target.

However, this strategy will now again be reviewed from scratch due to the change of government which took place at the end of 2012. The reorganization of

the Coordination Subcommittee, the Advisory Committee for Natural Resources and Energy in July 2013 has resulted in the Basic Policy Subcommittee which submitted the "Opinion to the Basic Energy Plan", to formulate once again the Basic Energy Plan. The government's backward attitude has not been sufficient to meet the growing necessity for the expansion of the renewable energy in order to rejuvenate the Japanese economy. However, many citizens and NGOs have raised concerns over the opinion presented by the government which has both failed to revise nuclear policy thoroughly, and has yet to provided concrete figures on renewable energy policies or climate change policies. In response there have been about 19,000 opinions presented to the government as of January 2014. The policy presented by the government in February 2014 will be discussed among the majority parties, and the final decision will be left for the cabinet. Finally, "New Energy Basic Plan" is decided by the Cabinet in April 2014[1]. The government plan has in fact provided ardent support for expanding renewable energy, but has unfortunately not presented any concrete ideas as to how this will be achieved in the mid to long term.

On the other hand, the circumstances surrounding the renewable energy industry has changed dramatically since the earthquake in Tohoku region, and the environment for proliferation of renewable technology is beginning to become ever more favorable. 2012 was positioned as the first year for great renewable energy expansion, and 2013 already witnessed some improvements in adoption of green technology while some problems are still yet to be overcome.

2.2 Electricity system reform and reform of regulations and systems

Discussion has also been undertaken to reform government regulation and policy, such as opening of the electricity market and working towards a separation of power generation from transmission. This will be done to implement renewable energy based on the discussion in

"Expert Committee on Electricity System Reform" in" Coordination Subcommittee of the Advisory Committee for Natural Resources and Energy". The report includes a concrete plan, based on the direction presented in July 2012, and was revealed in February 2013. The content was decided by the cabinet, and was thus presented as a electricity system reform in the ordinary session of the Diet (Japan's Parliament) in 2013. The final bill was then approved in the extraordinary session of the Diet in Nov. 2013. Moreover, the parliament approved new bill for the electricity system reform on the 11th June 2014 to implement full liberalization of entry into the electricity retailing starting in 2016[2].

The necessity to continually revise the existing regulations and policies on renewable energy were noted as well. The action plans have been presented among many governmental institutions under the influence of Government revitalization Unit and energy environment meeting, while meeting to reform electricity system and accelerating the implementation of renewable energy is still being worked on. These regulation reforms have been passed on to the energy and Environment working group in the Regulation Reform meeting, and regulation reform action plan was decided by the cabinet.

Renewable energy law for the land use in agriculture, forestry and fishing villages, which relates to the regulations regarding the land use, was represented and activated in November 2013. The law was intended to support the healthy growth in the regional farming and fishing, by reorganizing land use in farming and fishing when the farm lands, forests or ponds are to be utilized for renewable energy

In terms of taxes, "the green investment tax reduction" is effective since 2011. The applicable facilities increased and periods were extended in 2013.

2.3 Feed-In Tariffs in Japan

The FIT (Feed-in Tariffs) policy which will enable the widespread use of renewable energy was enacted by the

National Diet in August 2011, and began as of July 2012. In order for this FIT system to function effectively, however, appropriate purchase price and purchase period needed to be set properly. In March 2012, the "Procurement Price Calculation Committee" was launched to discuss feasible purchase prices and purchase periods. The final purchase prices and periods were subsequently decided by the minister of METI. The price set for the newly implemented facilities in 2013 was reached through the same process in March 2013. The purchase price of photovoltaic energy was the only change in FIT prices, due to the lowering cost of the technology.

The price for 2014 was then again discussed in January 2014. There were many problems raised in the debate, including the revision of purchase price of photovoltaic based on new cost evaluations, and the cost evaluation of off shore wind turbines which were for the first time discussed in the METI. Another issue considered was the question of whether cost evaluation should be applied to small scale energy generating facilities according to their size, such as photovoltaic and biomass. Renewable projects the size in which in local citizens or businesses can participate in also attracted demand. However, the decision was made not to consider the size into cost evaluation. The purchase price of photovoltaic for the year 2014 on renewable power sites of more than 10kW was agreed to be reduced by 10%, and an additional FIT was created for the offshore wind turbines.

These FIT policy rules were set except for rules concerning "Priority Access", but the current situation revealed that for electricity companies it is difficult for them to connect with a non-functioning system. To fully expand the use of renewable energy such as photovoltaic and wind turbines, a "priority access" must be given to renewable energy sources of electricity. Further, especially in the distribution of electricity system reforming regulations is a key. The regulations that must be reformed include the separation of electricity generation and transmission, along with the maintenance of the energy supply network.

The overall introduction of the current FIT system started in July 2012, and reached certified capacity of 30GW by the end of 2013, and 70GW by March 2014 as shown in Fig.3 [3]. This figure is 5 times the size of original capacity of renewable energy power generation used more than 20 years ago in 1990, which was around 13GW. However, 96% of the certified capacity of facilities were photovoltaic and 55% of them were photovoltaic larger than or equal to 1MW. Capacity of operating facilities is about 9GW which is 13% of certified capacity.



2014(Data Source: METI[3], Graph: ISEP)

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On the other hand, the certified facilities of wind turbines have not reached capacity of 1.0GW yet, and operating facilities are only about 8% of the certified facilities of wind turbines. Wind projects need prolonged period for preparation such as environmental assessment which is not necessary for photovoltaic project.

The growing interest in geothermal or small scale hydro energy has resulted in the discussion and consideration of further FIT price implementation of those technologies. However, the time consuming nature of the survey and the complex procedures have prevented the certification and installation of new facilities. The survey on geothermal resources has begun in many regions, although a few projects have been certified in FIT scheme yet. The amount of certified facilities of small hydro power has reached 298 MW but only the 2%, of which amounts to 6MW, has commenced power generation.

In terms of biomass energy production many concerns have been raised. These concerns include the stable supply of the raw materials such as unused timber, which can at times be bought at a higher purchase prices, availability of wood fuels, and the establishment of supply chain. Also, there is apprehension toward the amount of fuel required for the large-scale coal co-combustion, and the evaluation of the purchase price should be according to power and the heat used in the process. There are also many other problems to overcome including the preservation and effective usage of forestry. By end of March 2014, certified capacity of woody biomass reaches over 1.5GW which is 77% of total capacity of certified facilities of biomass.

As described above, there has been a tremendous prevalence of photovoltaic, but at the same time this technology has shown problems surrounding the FIT policy itself, and other renewable energy policies. ISEP has responded to the situation by making proposals aimed at changing the current FIT policy and energy policy as a whole, and to update the FIT policy to current circumstances. ISEP is working to promote these policies to realize more renewable energy growth across the country and in many of Japan's regions.

A significant amount of knowledge and experience can be gained from European nations, such as Germany, who have thus far led the way in FIT policy implementation. On the other hand Japan must look at the existing challenges that the domestic renewable energy market is facing in facilitating FIT policy. Many recommendations put forth by ISEP pertaining to the purchase price and length have been included in current domestic FIT policy. However, many problems including the partition of purchase prices, disclosure of information, the priority access system, and prioritization of energy distribution have yet to be accomplished despite the opportunity to reorganize FIT policy.

Drastic reformation of the energy system, setup of the

concrete targets for renewable energy adoption, disclosure of information, reformation of existing regulations and systems, along with solving problems related to FIT policy are necessary steps toward making a more sustainable society. Utilizing and implementing renewable energy is thus an essential element in accomplishing this task.

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2.4 Community Power in Japan

Building strategies and organizations with the goal of introducing renewable energy has commenced in many regions across Japan. These organizations have added to the recognition and importance of renewable energy. The drive toward more renewable energy is especially high in the Tohoku region, which aims to utilize renewable energy to revitalize the economy. Various projects are already underway including the concept of community power which utilizes the participation of local resources including firms, people, and energy sources.

The unique characteristics of renewable energy are evident in contrast to large energy producing firms and company projects which generally develop power generation on a massive scale. Renewable energy on the other hand develops and progresses within a much smaller area. The contentious point with smaller scale power is how to grant the ownership of renewable projects to the local stake holders. The World Wind Energy Committee has consulted with both practitioners and experts of small scale power generation in order to gain a better understanding of the renewable energy, especially as it is increasingly spreading across the globe. The World Wind Committee in 2011 introduced three principles of community power as follows;

The three major principles of community power;

- 1. Most or all of the projects should be governed by the local stake holders.
- 2. The decisions regarding projects should be made by the organizations based in the community.
- Most or all of the social, economic benefits should be distributed in the region. (Source: WWEA)

At least two of these principles have to be met in order to be guaranteed as a community power project.

To promote more involvement in the renewable energy projects, The Ministry of Environment has started "Region-led Renewable Energy Business Initiative" which intends to support setting up conferences consisting of local stake holders who help in the creation of plans to implement more renewable energy projects in the community.

7 communities were been selected from the 68 who volunteered in FY2011. An additional 8 communities were selected from 52 in FY2012, and 10 of 37 in

FY2013 were selected. Selected communities over 25 locations have started renewable energy projects.

ISEP itself has been conducting a community power laboratory since June 2013. The aim of the project is to help start community power based electricity companies involving both the suppliers and consumers of energy. The knowledge gained in the process is meant to be used to accelerate change within each respective region. The participants in the laboratory are local energy practitioners, researchers, and local government staff. The aim is to create business models or systems that could involve many stakeholders, while at the same time contributing to a concrete plan to implement more renewable energy.

Chapter 3 : Renewable energy trends in Japan

The accumulated amount of renewable energy generating facilities in Japan reached 17 GW by the end of FY2012. 60% of renewable energy facilities consist of photovoltaic and wind turbines, and the two forms have surpassed the amount of geothermal, small scale hydro, and biomass (including waste power generation) combined as shown in Fig.4.



Fig.4 Cumulative Capacity of Renewable Energy in Japan(Source: ISEP)

By the end of FY2012 the total amount of photovoltaic(PV) introduced reached 7GW. The cutting of some subsidies has resulted in sluggish increase since 2004, but has recovered due to the new policy of purchase policy of excess electricity which began in 2009, and was further helped by the current FIT system which was implemented in 2012. The total installation capacity of PV in FY2012 reached almost 2 GW. The total amount of wind power capacity was also 2.64 GW, but the annual installation was less than 90MW.

Although the capacity of installed wind power had rapidly increased by a growth rate of 30 percent until 2006, since 2007 the rate of wind power annual ISEP conducts a community power international conference every year, and has introduced the results and best practices both inside and outside of Japan in order to promote the introduction of more renewable energy. The first conference was held in Tokyo in March 2012, while the second conference was held in Ube city in Yamaguchi Prefecture. In February 2013 the third conference was conducted in various locations inside Fukushima prefecture from January 31- 2nd of February 2014 [4].

The main topic of the discussion was the possibility of achieving 100% renewable energy dependent economy led by local companies and actors.

installation capacity has slowed down due to various constraints, including the problems of conditions of site, priority of grid connection and the enhancement of environmental assessment by law even after strong FIT policy start.

Unfortunately, Geothermal power has seen no installation of new facilities since 2000, although

renovation has been carried out to some existing power stations. Geothermal installed total capacity remained at only 540 MW by the end of FY2012. The start of FIT policy has induced more resource survey and development plans across the country. Further, problems regarding national park regulations have been addressed, and the continuous relationship between geothermal power and hot spring persons concerned is also beginning to improve.

For small hydroelectric power (less than or equal to 10MW output), the number of newly installed equipment has been low, and its growth has only increased by about 190 MW in

22 years. In recent years installation of less than 1MW power has developed. The FIT policy has encouraged survey and start-up of the projects across the country, due to the new appointment of hydro power facilities of less than 30MW for new FIT participation.

Biomass power generation has been growing with the spread of power generation making use of general waste and industrial waste under RPS law. And in recent years installation of wood biomass power generation has seen a fairly large increase. Relatively larger biomass projects have also commenced in accordance with the increase in biomass supply. This increase was due to the newly partitioned purchase plan for unused wood, which was not suitable for biomass beforehand because of the high cost. The efficiency of energy production of biomass and small scale hydro are over 60% on average, although it has increased sluggishly. As the Figure 1 shows, the amount of energy generated from biomass and small scale hydro sources amounts to over 70% of total produced renewable energy electricity. On the other hand, photovoltaic and wind turbines have a share of about 28% within renewably produced power, and consists overall of 1% of total generated electricity in FY2012. The figures regarding the electricity generated by geothermal are disclosed annually, but the amount produced is recently in decline. The figure has surpassed the amount in the previous year, but was well below the amount that photovoltaic and wind turbines accounted for in FY2011.

The amount of total renewable energy generated climbed to over 4% for the first time, but the growth rate is still only 5.6% annually (the total generated electricity in 2012 was 1101 TWh). Photovoltaic has grown at a significant pace of 37% annually, but the sluggishness of wind turbines (5%) compared to the installation figures in other countries demonstrates the lack of progress made in wind power expansion.



Fig.5 Renewables Power Generation in Japan (Source: ISEP)

Table1: Data of Renewables Resource in Japan as of end of FY2012(Source: ISEP)

Source	Installed	Cumulati	Power	Ratio	Ratio
	Capacity	ve	Generation	in	to
	in	Capacity	In	RE	total
	FY2012	by end of	FY2012	[%]	gener
	[MW]	FY2012	[GWh]		ation
		[MW]			[%]
PV	1,975	7,263	7,635	17.1%	0.69%
Wind	860	2,642	4,838	10.8%	0.44%
Geo	0	540	2,609	5.8%	0.24%
thermal					
Small	5	3,256	17,401	39.0%	1.58%
Hydro					
Biomass	35	3,312	12,186	27.3%	1.11%
Total	2,101	17,014	44,670	100%	4.06%

Chapter 4 : Toward Renewables 100% - Medium and long-term Scenarios

Our society and economy which consumes a massive amount of energy is heavily dependent on unsustainable fossil fuels such as coal, oil, and natural gas. Nuclear energy, which has been seen as the alternative to fossil fuel while increasing energy security is under the serious debate regarding safety and the waste it produces. Therefore, the world has recognized it must cut down energy consumption, while simultaneously depending less on the unsustainable energy sources such as fossil fuel and nuclear energy. Using sustainable renewable energy under intelligent energy policy is one way to promote these goals.

Projections and long term scenarios to introduce a 100% fully renewable energy supplied society is seen as the ideal future, and an achievable mission.

On January 16th, 2013, ISEP and REN21(Renewable Energy Network for 21st century, based in Paris) announced the commencement of a Global Future Report in the International Energy Conference of 2013 which was held in Abu Dhabi (ADIREC2013).The report contains interviews with more than 170 leaders in renewable energy sector, and was written with newly formed concepts based on gathered information from more than 50 futuristic scenarios carried out on an unprecedented scale.

Domestically, mid-long term scenarios using no nuclear power and realizing a 100% renewable energy have been presented by numerous NGOs including; ISEP, Kiko Network, WWF Japan, Green Peace Japan and many others, which were spurred to action after the 3.11 nuclear incidents.

ISEP first proposed strategy paper after 3.11 for Japan's mid-long term reorganization of domestic energy strategy was titled "unplanned electricity stoppage to strategically shift of energy" and was released in March 2011. The strategy proposes an alteration towards a diversified energy policy that enables not only the revitalization of Japanese economy after the earth quake in the short term, but also uses energy policy to stable energy supply, work towards energy self-sufficiency, and acts against global warming. The report sets a goal of reaching 30% renewable power generation by 2020, and 100% by 2050.

WWF Japan has proposed "Renewable Energy 100%

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energy scenario toward a low carbon society" in November 2011 which followed the release of the plan for "renewable energy 100% by 2050 internationally" by WWF International in February 2011. The WWF International plan is based on halving the amount of energy demand by 2050, and was proposed in the

Chapter 5 : Regional renewable energy results and potential

In order to achieve renewable energy proliferation it is important to evaluate the existing regions and areas that use renewable energy. By evaluating each prefecture or city we can thus discover the areas with a higher supply of renewable energy than the national average of only 4%.Japan's renewable energy supply's situation from 2007 was revealed by a joint study between the Kurasaka Lab. in Chiba University and ISEP. The share of renewable energy in each region was thought to be useful in forecasting the possibility of sustainability in other areas. It also enables a grasp of sustainability that

30%

25%

20%

15%

10%

5%

0%

existing economic statistics have failed to achieve by evaluating the accomplishme nts of each renewable source as is suitable for each region's unique characteristics



different renewable energy forms as a share of electricity from renewable energy in each prefecture (the energy demand from the private or business and agriculture, forestry and fishery sector) and shows that there are more than 10 prefectures that supply 10% of existing power through renewables, and about 50 cities and villages provide power through more than 100% renewables.

The implementation possibility of renewable energy is in fact extremely large throughout Japan. The potential for installation is shown in the "renewable energy potential research" conducted by the Ministry of Environment,

which covers PV(other than residential usage), wind turbines, geothermal, and small scale hydro energy[6].

energy saving scenario by WWF Japan in July 2011. Each scenario considers meeting the remaining energy demand by using domestically produced renewable energy.

The research was conducted in the following two years through careful evaluation of information and recalculation of potential renewable energy installation.

Fig.7 shows the potential in each region, and also demonstrates the renewable energy potential in Hokkaido, Tohoku, and Kyushu region, which is especially high considering the amount of existing wind sources. The energy potential is high even when comparing it to current electricity demand.

Fig.6 Ranking of the different renewable energy forms as a share of electricity from renewable energy in each prefecture (Source: Sustainable Zone Study Group)





^{otential} 10 MW

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Biomass

Small Hydro

Geo Therma

Wind

PV

Chapter 6 : Proposals for renewable energy policy in Japan

renewable Achieving 100% energy will be accomplished only through a radical transition from the existing energy system, and the new plan will be based on a re-vision of achieving a nuclear free society in light of the Fukushima nuclear disaster. Planning the necessary renewable energy policy toward achieving a sustainable energy society, structuring a concrete climate change policy, and creating an energy security policy will have to take place in the long term .There are several government policies that have already begun, such as FIT system, which have shown promise encouraging more introduction of renewable energy sources.

Political commitment towards a long term strategy, including reduction of subsidies for fossil fuels, and internalization of the negative external cost of fossil fuels, is necessary to achieve the vast introduction of renewable energy. Moreover, it is not only necessary to reduce existing obstacles and regulations in the energy market, but it is also imperative to develop a transparent renewable energy market that reduces the financial risk of implementing renewable energy businesses. This can be achieved by introducing FIT policy. It is also important to continue and grow the practice of renewable energy projects led by local stakeholders, which enables the benefits of renewable energy to be spread across all regions of Japan. The Renewables Japan Status Report 2011 which was formulated the day before the tragedy on 10th of March has since been revised completely in light of the seriousness of the accident at Fukushima. The rejuvenation plan which used a vast amount of natural resources was re-considered after the exposure of huge risk associated with nuclear power plants, and the weakness of the existing concentrated energy system.

After the revision of the pre 3.11 energy policies, the domestic energy policy has completely transformed since the implementation of FIT policy starting in July 2012. The year 2012 thus became the first year in developing a more renewable energy society. Many renewable energy projects have also grown across the country. Renewable energy report of 2012 reviewed the process of domestic renewable energy, and has shown the path forward towards a "4th Revolution" or green revolution in expanding renewable energy production. Renewable energy report of 2013 has envisioned a sustainable society not dependent on nuclear power or fossil fuel, instead focusing on the implementation of a "acceleration of the 4th revolution" and restructuring of domestic energy policy to achieve this goal.

This report has demonstrated the realistic possibility of using community power to achieve 100% renewable energy in many regions throughout both Japan and even around the world.



Fig.8 The International Community Power Conference 2014 in Fukushima (31th Jan.-2nd Feb. 2014)

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Fig.9 Map of initiatives for Community Power in Japan

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