



Political and Social Discourses on Nuclear Energy in Japan: The Evolution of the Idea of ‘Dream Energy’

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ABSTRACT

The paper provides a historical overview of the political and social discourses on nuclear energy in Japan. It briefly traces the evolution of the idea of nuclear energy as ‘dream energy’ since post war era. Furthermore, based on the contemporary discourses and the growing social and political pressures of the anti-nuclear movements, the paper indicates a trend towards an anti-nuclear crusade and envisages Japan’s future nuclear power plan. It has been argued that political and economic factors may not make it favorable for Japan to take a strong stand against the use of nuclear energy. This is due to the massive dependence of Japanese industries as well as usage by domestic units of nuclear power. Most likely the immediate future would hold Japan in a position where it tries to balance its growing need for energy on one hand and its strong public stance against the use of nuclear reactors.

Keywords: discourse, dream energy, Japan, nuclear energy, renewable sources

INTRODUCTION

Post war Japan began rapid reconstruction in almost all spheres – political, economic and social. Modernization has been the prominent underlying idea for Japan since the Meiji Restoration of 1868. Electric power generation was one of the areas that underwent immense modernization in a relatively short span of time. With its poor wealth of natural resources, Japan found in nuclear power and alternative from its dependence on imported oil, which could be utilized in its long-term energy plans. Japan is also the only country to have experienced the devastation by nuclear weapons during the Second World War. Thus, while, on one hand, Japan seems to possess what is termed by many as ‘Nuclear Allergy’, indicating its clear and strong stand against the possession of nuclear weapons; on the other hand, it was the third largest consumer of nuclear power in the world before the Fukushima Disaster of 2011.¹

¹ U.S. Energy Information Administration – Japan, p.2, Full Report last updated 31 July 2014, accessed September 7, 2014.

Taking cue from the western countries, such as the USA and France, the post war Japan began to consider nuclear power as the ‘dream energy,’² which would eventually lead Japan to meet its power requirements without being dependent upon external sources. The scientific community engaged in the development of Japanese nuclear power technology in the early stage was of the view that nuclear power was a prerequisite for Japan’s reconstruction from the devastation wrought by the war.³ This self sufficient mode of power generation became the dream of post war Japan, and it relentlessly worked towards it. However increasing problems with public acceptance and nuclear related accidents are believed to have impeded Japan's goals of rapid advancement and expansion.⁴

In this paper, the first section briefly traces the evolution of political ideology regarding the development and expansion of nuclear energy in Japan and tries to explore if there has been a change in this ideology in. The second section points towards the social reaction of the political ideology on nuclear energy and the development of anti nuclear sentiment among the citizens of Japan over the years. The last section recognizes Japan’s efforts towards renewable energy and questions the use of alternate energy sources; paper concludes with a view on whether or not nuclear energy remains the ‘dream energy’.

METHODOLOGY

This paper has been written using information and discussion from a number of articles from various journals as well as academic internet sources, which have been mentioned in the References section as well as in the footnotes. The information adhering to the contemporary situation and discourse within Japan has been gauged through recent newspaper publications. Moreover a visit to Tokyo in September 2014, by the author was utilized to gather some firsthand views and information, which have been reflected in the conclusion of this paper.

RESULTS

As the political as well as social discourse on Japan’s nuclear energy continue till date and no one clear stance is being portrayed, it is difficult to have a conclusive result. However considering the direction of the discourse it has been predicted that it would be increasingly difficult for the Japanese government to convince the public to continue its support for increasing dependence on nuclear power; as anti nuclear sentiment has begun to surface even within the political realm. Therefore a middle path where alternate energy sources as well as nuclear energy constitutes the energy mix viably for Japan is what policy makers should be aiming for.

² The term ‘dream energy’ as referring to nuclear energy can be found in Oguma Eiji, “Japan’s Nuclear Power and Anti-Nuclear Movement from a Socio-Historical Perspective,” Working Paper, Keio University 2012; and also in “The Dream that failed: Japan’s Nuclear Energy,” *The Economist* (March 10, 2012).

³ Rajaram Panda, “The Nuclear Debate in Japan, Are there alternatives?” in *IPCS Issue Brief*, No 170 (August 2011).

⁴ Nadine van Zyl, “Nuclear Power: Government Policy and public opinion in the United States and Japan” in *Sustainable Energy* (May 1, 2001).

DISCUSSION

Post war political discourse on nuclear energy in Japan

Nuclear power plants have been considered as a symbol of an industrialized society. Nuclear energy had already gained grounds in developed countries like the USA. Thus the years, from 1965 to 1994, when Japan became a society dependent on manufacturing, also was the period where Japan's nuclear power plant construction reached its peak, aiming to meet the increasing power requirements of an industrializing society.

In Japan, the government is deeply involved in its economy and the same holds true for nuclear power. Japan's central government has always firmly supported and promoted nuclear power, primarily because domestic resources are scarce and this energy source provides hope for self sufficiency.⁵ Japan thus has a powerful nuclear industry notoriously dominated by the “nuclear village”, a term commonly used to refer to institutional and individual pro-nuclear advocates, including nuclear vendors, the bureaucracy, the Diet, the utilities, the financial sector, the media, and academia.⁶ Construction of electric power plants, including nuclear plants, is determined by the government's long-term energy supply and demand forecast and the Long Term Plan⁷ for the utilization of atomic energy. This is submitted by the advisory panel of the Minister of Economics, Trade and Industry, for cabinet decision without going through parliamentary deliberations in the Diet. Based on this plan, the government provides various subsidies and social economic infrastructure construction, and the electric utilities pursue their business.⁸

The first nuclear power plant started operating in 1957. Thereafter, for over a decade, there were high hopes for nuclear energy as “dream energy.” The Japan Atomic Energy Research Institute's power demonstration reactor first generated electricity in 1963, which marked the beginning of nuclear power generation.

Nuclear power came to be envisioned as being symbolic of an industrialized society. Nonetheless the intensive economic growth came along with severe environmental pollution and was thus accompanied by the anti pollution movement of 1960s. Since its inception nuclear power was seen dubiously with its long term as well as short term effects being questioned.

The Act on Compensation for Nuclear Damage was passed in 1961 keeping in mind the possibility of a disaster. It indicates that in the case of a nuclear plant accident, compensation is to be made from insurance contributions of the electric power company. The Act states that if the accident surpasses the limit of the liability, the government “may” provide necessary assistance. This reflects the fact that though the electric power company expects governmental assistance, the government gives no direct indication of bearing the responsibility.⁹

⁵ Ibid.p.1.

⁶ Ogawa Akihiro, “Demanding a Safer Tomorrow: Japan's Anti-nuclear rallies in the Summer of 2012” in *Anthropology Today*, Vol. 29, No. 1(February 2013), p.21.

⁷ Revised in 2005 to the Framework for Nuclear Energy Policy.

⁸ Oguma,p.3.

⁹ Ibid.3.

Some opposition groups arose in the 1960s, but mostly these grew out of disputes over compensations paid to citizens who had been adversely affected.¹⁰ Nonetheless by 1969, a greater part of the respondents to a survey by the Prime Minister's Office indicated their opposition to construction of nuclear plants in areas they lived. However, nuclear plant construction continued in areas already designated; and in 1970 Japan had its first commercial nuclear power plant.

Throughout most of the 1960s, 1970s, and early-1980s, there was a general consensus within the media, the general public, and local governments in Japan on the necessity of nuclear power. Opposition was limited to a few people residing near nuclear plants.¹¹ Throughout the 1970s-1980s, Japan continued promoting nuclear energy, strongly backed by the central government and a fair level of public acceptance.¹²

But as Japan became a post industrialized society and its economy faced recession, the issues which had been undercover came in view during 1980s leading to the beginning of a 'chain reaction'.¹³ The Asian Financial Crisis of 1997 further aggravated the problems, due to declining income levels the demand for various commodities including electric power and as a result power plant construction went down. Moreover Japan had been internationally criticized for its excessive stockpiling of plutonium, and thus during the 1993 Japan-U.S. negotiations it made a commitment against keeping surplus plutonium. Furthermore 1995 witnessed an accident at the fast breeder reactor, Monju which used plutonium as fuel.¹⁴ The severity of this accident was kept hidden until on-the-spot investigation by local government staff revealed the facts. These factors combined to eventually put an end to the increasing construction of nuclear power plants by 1997.

The Tōkaimura nuclear plant accident of 1999¹⁵ led to the criticism of Japan Nuclear Fuel Conversion Co. (JCO) and there was an increase in construction costs due to the international concern regarding the safety of nuclear plants. The cause of the accident was reported as "human error and serious breaches of safety principles" by the International Atomic Energy Agency (IAEA).¹⁶ Henceforth after the passing of Information Disclosure Law in the same year, the nuclear power administration was coerced into disclosing its meeting minutes and invite comments from the opponents of nuclear power.

In the spring of 2001 Japanese nuclear energy suffered another setback, when a company discarded plans for a nuclear plant after the prefectural governor of the host site made a request against the construction. This marked the first time a high-ranking elected official publicly opposed nuclear energy construction, and consequently industry feared that a precedent could be set.¹⁷

Even in the middle of changing public opinion and increased accident/incident frequency, the Japanese government continued to remain committed to its long-term

¹⁰ Nadine van Zyl, p.5.

¹¹ Peter Dauvergne, "Nuclear Power Development in Japan: 'Outside Forces' and the Politics of reciprocal consent" in *Asian Survey*, Vol 33, No 6 (June 1993), p.578.

¹² Nadine van Zyl, p.8.

¹³ Oguma, p.9.

¹⁴ A fire was caused due to leakage of molten sodium (a cooling agent) from piping for a cooling system at a fast breeder reactor; no casualties were reported.

¹⁵ A total of 119 people received a radiation dose, two of the doses proved fatal.

¹⁶ *World Nuclear Association* < <http://www.world-nuclear.org/info/Safety-and-Security/Safety-of-Plants/Tokaimura-Criticality-Accident/>>.

¹⁷ Nadine van Zyl, p.10.

nuclear strategy. In November 2000, the Japan Atomic Energy Commission (JAEC) officially released its 9th long-term plan. Furthermore, even Japan Democratic Party (JDP) coming to power in 2009 resulted in limited impact on nuclear power policies. In their attempt to overcome their stagnant economic condition, and as domestic nuclear plant construction had reached an impasse, a policy of exporting nuclear power plants was adopted with government support; negotiations began with countries like Vietnam, Thailand, and India.

On July 13, 2011, Prime Minister Kan Naoto declared at a news conference that Japan would gradually decrease reliance on nuclear power, with the ultimate goal of achieving a nuclear power plant-free society.¹⁸ The announcement ushered a historic shift in Japan's energy policy, which has long been promoting nuclear power as a key energy source. However, such a radical policy shift requires clear plans and effective strategies based on solid scientific, technological and economic grounds. Kan gave no such details and the next day of his announcement he claimed denuclearization to be his personal opinion and not the government's decision.¹⁹

It can therefore be seen that the central government has never really moved away from the pro-nuclear stance of the 1950s, despite shifts in public opinion, nuclear accidents and the threat of nuclear radiation contamination. Even though a section of the political class does support anti-nuclear stand, a majority still tends to back up the nuclear energy industry largely due to economic reasons. However a changing trend can be seen from 2012, post-Fukushima disaster, with the emergence of Green Party in Japan known as the 'Greens Japan,' which aims to abolish nuclear power in Japan.²⁰ But, whether or not they will be able to bring about a shift in the Japanese political ideology regarding nuclear energy is yet to be seen. Moreover there are no signs by the central cabinet showing a strong stand against nuclear energy rather the opposite can be seen wherein from 2014 political lobbies have been trying to sway the public opinion in their favor.

Social discourse on nuclear energy in Japan (Anti-nuclear movements)

The anti-nuclear power movement of Japan was initiated in the late-1960s. The movement was led broadly by two sections of the society. Firstly, there were those in the farming and fishery industries from the regions where nuclear power plants are located. Japan's nuclear plants are constructed on the seacoast in order to use water for cooling purposes and the issues of land and fishing rights became a bone of contention. The second section was of labor unions and the Japan Socialist Party, as well as intellectuals. In particular, "the labor unions, Socialist Party members, lawyers, educators, students, and scientists from the neighboring regional cities supported the movement of the farmers and fishermen."²¹

Till the mid 1980s these classes were the main force of the movement, later agriculture and fishing industries declined, as the tendency to rely on nuclear plants

¹⁸ Speech by the Prime Minister < http://japan.kantei.go.jp/kan/statement/201107/13kaiken_e.html>.

¹⁹ Rajaram Panda, p.1.

²⁰ Sonoda Koji, "Japanese Green Party forms with an eye on National Politics" in *Asahi Shimbun* (July 30, 2012).

²¹ Oguma, p.13.

grew due to rapid industrialization and manufacturing. Also the subsidies and donations to farmers and fishermen turned them away from the movement.²²

The urban housewives and young people became the central figures of the anti-nuclear movement of 1988.²³ Chernobyl Nuclear Plant Accident in 1986 provided the impetus to this group to participate in the movement. These housewives were women who, despite being well educated, were unable to find good employment because of gender discrimination or were forced to resign from their jobs for childbearing and child-rearing. Furthermore, as most of them belonged to rich families they had the economic means for involvement in the movement. But as the shock of Chernobyl disaster faded this group became less active. After the 1990s concerns of these women shifted to issues related to their own aging problems, and caring for elderly family members.²⁴

During 1990s Japan's nuclear industry began facing increasing uncertainty. Prior to the Chernobyl's accident, media generally avoided discussing nuclear power's dangers, this changed after 1985. Media coverage became more critical, and for the first time opinion polls indicated that more Japanese opposed nuclear energy than those who supported it. Questions of nuclear energy's effects on health and welfare started arising. This new awareness was reflected in the media, with "changing editorial tones and an increased anxiety regarding nuclear power."²⁵ MITI and power companies responded to these concerns through large-scale public relations campaigns such as; "Nuclear Power Day" which was held in October 1989, and Japan government spent 4 billion ¥ in 1990 in order to encourage public acceptance.²⁶

The turning point however was the Fukushima Disaster of 2011. Almost 60,000 protestors participated in an anti nuclear rally in Tokyo's Meiji Park held on 19 September 2011. Other groups that surfaced after the 2011 Fukushima Daiichi Nuclear Power Plant accident were the "free" workers who came about during post-industrialized society and foreigners who lived in Japan. Due to the hazardous work conditions in which nuclear power plant workers worked they demanded use of renewable energy instead, also they wanted a liberalized electric power market.²⁷

The movement upholds that rather than depending upon nuclear energy, Japan should look for an alternative, environment friendly, and sustainable energy sources, such as the sun, wind, water, and natural gas.²⁸ Indeed, Japanese industries have already begun to market such energy sources as new business ventures, and local citizens' movements are focused on liberating Japan from its dependence on nuclear power through the domestic adoption of solar power. Though initially there were only these disparate actions, soon the groups began coordinating with each other, which lead to the coming together of different social classes. The anti-nuclear power demonstrations held in 2012, were an example to this trend where in while still tending to divide by groups, are beginning to co-exist.²⁹ Nevertheless competing with the business

²² Ibid., p.14.

²³ Nadine van Zyl, p.8; and Oguma,p.14.

²⁴ Oguma,p.15.

²⁵ Nadine van Zyl, p.6.

²⁶ Ibid.,p.7.

²⁷ Oguma,p.16.

²⁸ Ogawa,p.24.

²⁹ Oguma,p.18.

interests of the ‘nuclear village’ which enjoys an upper hand, will be an unnerving task.³⁰

A complex assortment of factors makes up the new opposition to nuclear power in Japan. Opponents include not only traditional adversaries, such as opposition parties and residents living near reactor sites but also the new antagonists, such as local governments, the media, and broad-based citizen groups. These forces do not function as a unit, but apply pressure collectively on the government.³¹ However, it has been opined that just as the *stop nuclear power plants wave* disappeared without substantial results, the present movement will also follow the same course. The scale of the environmental movement in Japan is comparatively small and it is indicated that the resources for the antinuclear movement of Japan are even smaller.³²

But Japan saw the public opinion seeking the phasing out of nuclear power plants reaching around 70 percent in 2012.³³ The Japanese nuclear industry's management of the public has in itself become an issue, as has lack of trust in officials. Crisis management has an important public policy dimension and from this perspective it is felt by many that the Japanese government has been too hasty in developing and expanding nuclear plants, without adequately considering “the determinants and disadvantages.”³⁴

We find that Japan's present nuclear development plans are witnessing a trend towards decrease in public support and dissent of local governments. Further, public has essentially lost their trust in the officials who represent the nuclear industry of Japan. This has been largely due to the past incidents and accidents that were covered up thereby creating suspicion regarding any statement or action from the nuclear power administration or the government.

Towards a Renewable Future?

Strong support exists for alternative domestic energy sources, and if real choices did exist, the Japanese people would most likely choose to abandon nuclear power and go for alternatives like solar or wind power. The Fukushima Disaster of 2011 provided this impetus towards a future that is more dependent on renewable energy. Since then the Japanese government has become more cautious in trying to promote nuclear energy and instead has been putting in efforts to build its renewable energy sources. The Japanese government has set up its renewable targets of total power generation, between 25-35% by 2030, by which time they intend to invest about \$700 billion in new renewable energy³⁵.

³⁰ Ogawa, p.24.

³¹ Dauvergne, p.579.

³² Sato Nagako, *Antinuclear energy movements in Germany and Japan: A Comparative Analysis of Protest against disposal of nuclear waste*, Osaka University Knowledge Archive, 2009.

³³ Oguma, p.18.

³⁴ Namakura Akira and Kikuchi Masao, “What we know, and What we have not yet learned: Triple Disasters and the Fukushima Nuclear Fiasco in Japan” in *Public Administration Review* (Nov-Dec 2011).

³⁵ Renewable energy for Japan: A post Fukushima quest – Wharton, University of Pennsylvania; see <<http://knowledge.wharton.upenn.edu/article/renewable-energy-japan-post-fukushima-quest/>>

Japanese government has also been financially supporting renewable energy. The ‘feed in tariff’ (FIT) that began in July 2012, employed few months after the meltdown assures that the government will purchase any power generated through a renewable source at a fixed price. The renewable forms included are solar, wind, biomass, geothermal and hydropower. Solar producers, for instance, will receive, over 20 years, ¥37.8, or 38 cents, per kilowatt hour generated³⁶. 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 turbines³⁷.

However the requirement of battery banks to store wind and solar energy is proving to be an obstacle as it not only increases the cost of energy production but Japan also faces space limitations. Nonetheless Japanese private companies are joining the initiative towards renewable energy and energy efficiency. Companies like Honda, Mitsui and Mitsubishi have been investing in building solar installations. 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. 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 13GW³⁸.

The theme of moving towards more renewable energy has been discussed at various levels such as “Energy and Environment Meeting” in June, 2011 and “Evolutionary Energy and Environment Strategy” of September 2012. On June 3, 2014 Tokyo Metropolitan Government (TMG) established an exploratory committee to expand the use of renewable energy both in and out of Tokyo. Though such efforts seem promising but many feel that these may not be enough. During the April 2014 Cabinet Meeting wherein the government adopted the Basic Energy Plan which indicates the governments energy policy; left many anti nuclear supporters disheartened even though the government indicated towards its aim to exceed the past targets of renewable energy power generation³⁹. But agencies such as Japan Renewable Energy Foundation believe that by April 2014 renewable energy already accounted for about 12.7% of total energy produced thus the goal of achieving more than 13.5% by 2020 only seems as “too modest” a target⁴⁰. The Institute for Sustainable Energy Policies, Tokyo (ISEP) Executive Summary of Report 2014 indicates that there is a need for reform in the separation of electricity generation and transmission, along with the maintenance of energy supply networks.

On one hand where countries like Germany have decided to completely stop its usage of nuclear power by 2020 and on the other hand where countries like India are looking forward to building its nuclear power generation strength, it seems like Japan is presently following the middle path. Even though some seem optimistic about the achievable goal of complete dependence on renewable forms of energy and the impact of community in the process of achieving this goal (ISEP Executive Summary Report; 2014) many still question the feasibility of such a transition in Japan.

³⁶ Ibid.

³⁷ Renewables Japan Status Report 2014, *Executive Summary* – Institute for Sustainable Energy Policies (ISEP), Tokyo, p.3.

³⁸ Ibid.

³⁹ *Strategic Energy Plan, 2014* – Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry, p.22.

⁴⁰ *A Statement on the Basic Energy Plan of Japan* – Japan Renewable energy Foundation

CONCLUSION

It has been said that nuclear power development in Japan is best understood as a continual process of conflict, negotiation, and compromise between the state and private industry over the area in which authority may be applied and the practical exercise of authority.⁴¹ In conclusion we can say that though both political and social discourse tends to be moving towards an anti nuclear ideology, questions are raised about whether Japan can overcome its dependence from its ‘dream energy’. Politically and economically this might not be an easy step to take, keeping in consideration the vested interests of the ‘nuclear village’ as well as the heavy dependence of Japanese industries and domestic units on nuclear power.

Considering the exponentially high rates at which global energy needs are increasing some believe that the anti nuclear lobby will eventually lose ground as nuclear energy would prove to be the only long-term viable solution. This seems to hold true at present as there is no alternative source of energy that can match the nuclear power generator output. Moreover PM Shinzo Abe has been pushing for restarting the nuclear reactors that have been stopped due to the growing safety concerns and as Japanese public turned against nuclear power post the Fukushima Disaster in 2011. As on 10 September 2014, the Satsuma-Sendai plant received formal safety sign off by Nuclear Regulation Authority to restart two reactors⁴². Updates of this nature seem to indicate the regained confidence of the political discourse on nuclear power or it could be attributed to a lack of feasible alternatives.

Japan had previously expected its use of nuclear energy to increase but many analysts feel that now the share of nuclear power in Japan's energy mix is more likely to shrink. It is difficult to ignore the growing social outcry against the nuclear energy which is being supported by different sections of the society. Intellectuals such as public activists, environmentalists and lawyers are joining hands in order to make the Japanese citizens aware of the long term repercussions of nuclear energy. Moreover the increasing nuclear mishaps, cover up of accidents, lacking conformity on issues of nuclear waste management, etc add to the public opinion of discarding the idea of nuclear energy as ‘dream energy’.

The government has been focusing on making the use of nuclear power safer, including proper guidelines on issues like nuclear waste disposal and compensation for nuclear damage and plutonium storage safety measures. New guidelines have been issued and made public to restore the public confidence in the ‘dream energy’. JAEA has also been publishing latest frequent updates on the ongoing developments in Fukushima. Despite its suspicion and anxiety the Japanese government's steadfast approach may be one of the reason why the public continues to feel that nuclear power is a necessity.

As Japan is very poor in natural resources, it must depend on imported energy sources. Japan is the world's largest liquefied natural gas importer, second largest coal importer and third largest net oil importer⁴³. Such dependence on imports certainly

⁴¹ Dauvergne, p.576.

⁴² *BBC World News Report* (10/9/2014) < <http://www.bbc.com/news/world-asia-29137757> > accessed September 11, 2014; and Takeuchi Toshitaka, “Japan’s nuclear energy and waste storage policy quandary” in *Japan Today* (August 12, 2014).

⁴³ *U.S. Energy Information Administration – Japan*, Full Report last updated 31 July 2014.

has economic implications on Japanese economy that has been trying to overcome its stagnation. This might be one of the reasons why the government seems hesitant to completely do away with the self-sufficient source of nuclear power. Instead talks of civil nuclear cooperation continue with countries like India where Japan is willing to share its nuclear technology for domestic purposes and thereby spread the use nuclear energy across the world.

However a turn towards renewable energy would not be an easy path, but as more research is being done into improving the productivity of these alternatives it may prove to be the best option for countries like Japan which face increasing social pressure against nuclear power. Nonetheless will these renewable alternate modes of energy be able to meet the ever-increasing needs of power anytime soon is a question unanswered at present. Countries like Japan should become the foremost ones to invest more on Research and Development of renewable modes of power generation. Unless a comparable alternative energy source is developed it seems highly unlikely that Japan would be willing to completely disband the nuclear energy option. Japan might continue to use civil nuclear power while simultaneously trying to reduce its risks and look for alternate safer methods of energy production. Nonetheless as noted by the ISEP Executive Summary of Report 2014, “Projections and long term scenarios to introduce a 100% fully renewable energy supplied society is seen as the ideal future, and an achievable mission.”⁴⁴

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⁴⁴ Renewables Japan Status Report 2014, *Executive Summary* – Institute for Sustainable Energy Policies (ISEP), Tokyo, p.6.

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