New Direction towards Sustainable Society in Japan after the Nuclear Crisis

Yuka Hayakawa, Hidefumi Imura, and Masazumi Ao

Abstract*— *Nowadays, many cities in Japan are undertaking initiatives aiming to create cities with high environmental performance. Climate change countermeasures are considered as a top priority on the national environmental policy agenda, and the formation of low-carbon cities is a primary theme for environmental urban planning. However, the Great East Japan Earthquake, which caused the triple disasters of an earthquake, tsunami, and nuclear accident on 11 March, 2011, cast a large shadow on the initiatives aiming to create low-carbon cities. This paper makes a brief survey on the changing public awareness and attitude regarding nuclear safety and future energy sources in Japan, and discusses new direction of sustainable societies.

***Keywords*— Sustainable society, low-carbonisation, behaviour change, nuclear crisis.**

1. INTRODUCTION

The Great East Japan Earthquake brought light the importance of local energy management not only for the creation of low-carbon cities and a green economy, but also for post-disaster recovery, which will require a stable energy supply together with a new thought on the building of disaster-resilient cities. The consequence of the failure in the Fukushima nuclear power plant has caused a dilemma of energy needs and the concerns about nuclear power across the Japanese society.

For energy aspect, the accident provided people with greater concerns about the high risk of nuclear power plants. Faced with radiation contamination, people are more careful about safety prior to cost in energy generation. On the other hand, there are concerns about economic impacts due to a shortage of electricity supply as a result of the stoppage of nuclear power plants. In fact, from July to September 2011, the government issued restriction of electricity usage for commercial-scale utility customers, and many corporations and factories were forced to take actions that led to a reduction in productivity.

Japan agreed upon the GHG emission reduction target under Kyoto Protocol, Japanese government formulated the plan and promoted measures to achieve the target. However, the previous national reduction plan was based upon the premise that the use of nuclear power will be stable or even increase. Today, Japan must fundamentally reconsider the national economic, energy and environmental policies. Meanwhile, Japanese public opinion is dramatically split on the topic of nuclear safety.

Yet under these circumstances, the desire to create low-carbon cities remains unchanged. Japanese society is approaching a mature phase today. The Japanese economy is starting to lose the dynamism and vigour that it had during its period of rapid economic growth, but people are generally satisfied with the quality of life. Moreover, the ratio of elderly people in the total population is rising, and people seem to demand safety and security rather than conspicuous economic affluence. The public is aware that the choice is not between economy and environment, but that it is possible for both to have a favourable impact each other in a positive cycle, and the public gives broad support to initiatives for low-carbon cities.

2. THE HALT OF NUCLEAR POWER PLANTS AND THE NATIONAL ENERGY POLICY

The disaster that occurred in eastern Japan on 11 March, 2011, involved an earthquake, tsunami, and an accident at a nuclear power plant, causing tremendous damage in a wide area along the coast. In total, 15,866 persons lost their lives and 2,946 persons are still missing, and many homes, buildings and workplaces were also lost (National Police Agency, 2012). The economic and social impacts were profound. The Tokyo Electric Power Company (TEPCO) that caused the nuclear accident supplies electricity to the Kanto region, which is central to the Japanese economy, and covers the metropolitan area around Tokyo holding 42 million people. Immediately after the disaster, the entire Kanto region was plunged into a severe power shortage. Factories and offices had no choice but to restrict their business activities. Households also had to endure scheduled power outages in order to prevent unexpected blackout caused by electric shortage.

The Great East Japan Earthquake affected to Japanese national policy for low-carbon society vision. Before the disaster, Japanese government described the vision with 3 primary pillars for national strategy; economic growth, stable energy supply and decarbonisation. It was based on energy mix of fossil fuels, nuclear power, and renewable energy. However, people have huge concerns about security of nuclear power plant was occurred by

Yuka HAYAKAWA is with Tokyo Institute of Technology, 2-12-1 NE-30, Okayama, Meguro-ku, Tokyo 152-8552 JAPAN. Phone: +81-3-5734-2906, E-mail: haya@valdes.titech.ac.jp.

Hidefumi IMURA and Masazumi Ao are with Yokohama City University.

the accident of Fukushima nuclear power plant, and have a question whether nuclear power generation should be the primary energy resource in Japan or not. It can be said that it is the dilemma of energy needs and the fear of nuclear power generation.

The question of how to secure a stable supply of electricity, and what should be the future mix of electricity sources are critical for the national energy, economy and environment policy. They have an enormous bearing on environmental policy. Japan has studiously prepared and implemented measures to achieve the national emission reduction targets for GHG, as agreed under the Kyoto Protocol. It was developing a plan to achieve the medium-term national target of a 25 % reduction in total GHG emissions by the year 2020, and was preparing a road map to that end. That scenario, however, was premised upon greater dependency on nuclear power as indicated by the National Energy Supply and Demand Forecast (see Table 1). Today, the assumptions underpinning that scenario have collapsed, making it extremely difficult to make future forecasts of GHG emissions.

Table 1 shows Japan's long term energy demand and supply prospect, announced August 2009. It consists of new energy, geothermal, hydroelectric, nuclear, natural gas, coal, liquefied petroleum gas (LPG) and oil as possible energy source. As seen in Table 1, Japanese energy plan was highly depended on nuclear power generation. It can be seen that nuclear power was planned to be increased gradually, and expected to be one of the primary energy resource in 2030. Along with this national strategy, government estimated CO_2 emission reduction and meet target of Kyoto Protocol. However, after the disaster and nuclear power plant accident in Fukushima, there have been numbers of discussions across Japan about use of nuclear power as national primary energy resource. This caused of issues on stable energy supply and low-carbonisation.

Table 1. Forecast of Primary Energy Supply in Japan Up Until 2030

		1990	2005	2020			2030		
				BAU*	Case A**	Case B***	BAU*	Case A**	Case B***
Total Amount (Million tons of Crude Oil Equivalent)		508	588	627	596	553	637	590	515
Breakdown by Source (%)	Oil	52	43	36	36	34	35	35	33
	LPG	4	3	3	5	3	3	3	3
	Coal	17	21	20	20	19	21	20	18
	Natural Gas	11	15	18	17	16	18	16	14
	Nuclear	10	12	16	17	18	17	18	21
	Hydropower	4	3	3	3	3	3	3	4
	Geothermal	0	0	0	0	0	0	0	0
	Other New Energy	3	3	3	4	5	5	5	7

* BAU: Business as Usual Case

** Case A assumes that the current level of energy saving effort will be continued.

*** Case B assumes that the maximum level of energy saving effort will be implemented.

Source: The Energy Data and Modelling Center, "EDMC Handbook of Energy & Economic Statistics in Japan 2012", 2012

Until now, initiatives about low-carbon cities were based upon the major premise of a comprehensive national energy strategy decided by the central government, supported by industry, and an electrical supply system premised upon nuclear dependence. Japan's electricity supply system is operated by nine power utilities that enjoy regional monopolies for a long time. Problems with the conventional electricity supply system designed with the highest priority on stability of supply were often pointed out in the past, but in the face of the enormous influence of the government and power utilities, questions and criticisms were drowned out. The power utilities have been unenthusiastic about the Renewable Portfolio Standard (RPS) system, by which power utilities are required to purchase renewable energy such as solar, wind, and geothermal power. Although the system has been in effect since 2003, the purchase prices have been kept low based on the power utilities' assertion that the supply capacity is variable and unstable. The recent disaster, however, has created the opportunity to re-examine these longstanding issues. A shift is being considered from this RPS system, to a 'feed-in tariff' system, under which power utilities are expected to purchase electricity at a price fixed by the government. Higher prices of purchase will give a larger incentive to develop renewable energy power. Japanese government launched a 'feed-in tariff' system since July 2012 to encourage new enterprises to get into the new market of renewable energy, and to provide consumers alternative choices of energy supply.

Also, the Ministry of Economy, Trade and Industry of Japan (METI) announced the policy to consolidate separation system of electrical power production from power distribution and transmission from 2014 for 'electric liberalization' by promoting various companies generating electric power by renewable energy resource. This trend leads the drastic change of Japanese energy policy and understanding of sustainable development.

3. CHANGING AWARENESS AND ATTITUDE OF CITIZEN

Since the disaster in March 2011, citizens' aspects and behaviour towards sustainable societies have been drastically changed. Especially, local concerns and opposition are very strong regarding any plans to restart nuclear power plants that were halted for regular inspections. As of 5 May, 2012, all nuclear power plants nationwide were unable to restart operations, even those where regular inspections have been completed.

In regards to restart of nuclear power plant, there has been numbers of discussions. Asahi Shimbun's public opinion survey by telephone held on 14 and 15 April showed that only 28% of answerers supported the central government had indicated that it was appropriate to restart Ooi nuclear power plant supplying electricity for Kansai region (Western part of Japan) which stopped as inspection, but 55% opposed government's statement. However, the public opinion survey by Sankei Shimbun and Fuji News Network on 19 and 20 May 2012 indicates 51.5 % of answerers considered that it is appropriate to restart only power plants inspected and

secured safety in case of electric shortage and 43.6 % opposed.

National energy strategy and policy also needs to be re-examined fundamentally. There was another survey, which asks respondents participating in discussion about energy mix in 2030 and to analyse their consciousness changes before and after the discussion. Figure 1 shows that almost half of citizens require 0% of nuclear to usage scenario. In addition, a national-wide public opinion survey by Kyodo News Service-affiliated group on 11 and 12 June, 2012 showed the result that 82 % of respondents insist to abandon all existing nuclear power plants in Japan immediately, to deactivate gradually from the one embarking regular inspections or to consider decommissioning as the situation of electricity demand and supply, and only 14 % approved to keep all existing plants. As above, it is split on the opinion of nuclear energy power plants among citizens and even experts.

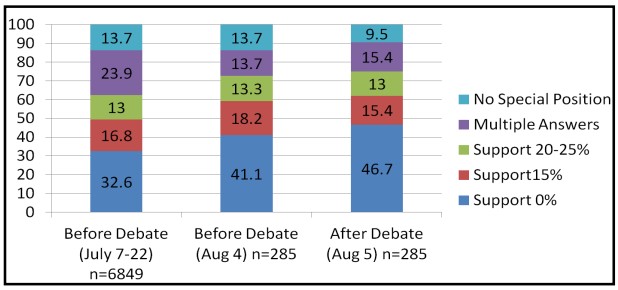


Figure 1. Result of Public Opinion Survey about Nuclear Energy of 2012
(Source: Asahi Shimbun Public Opinion Survey, 23 Auguest 2012)

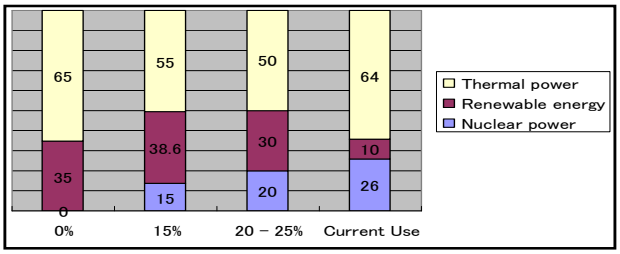
Survey procedure

Firstly, telephone survey to people above 20 years old was conducted and 6849 people answered in July 2012. Then, 285 persons out of all respondents participated in the discussion on 4 and 5 August 2012.

In this survey, government provided three options of energy mix with thermal, renewal and nuclear, and these three options* are based on how much depends on nuclear power generation in 2030 (0%, 15%, 20-25%).

*Three Options for Energy Mix in 2030

(1) 0% Nuclear (2) 15% Nuclear (3) 20-25% Nuclear



Since people experienced electric shortage crisis, awareness raising and behaviour change of saving electricity has been enhanced throughout Japan. In summer 2011 and 2012, people were required to limit electric usage and local government called for actions and practiced the campaigns for saving electricity. It can be regarded as opportunity to raise people's awareness and change behaviour for saving energy not transiently but continuously.

In response to people's opinion, the government finally announced the policy to phase out all nuclear power plants by 2030.

4. NEW DIRECTION OF SUSTAINABLE SOCIETY: "FUTURE CITY" INITIATIVE

In addition to above mentioned huge impact of the disaster, it needs to be considered trend of super-aging which numbers of cities face to for new direction of sustainable societies.

Japanese Government announced "FutureCity" Initiative which is one of the 21 National Strategic Projects of "New Growth Strategy" on 18 July 2010. It aims to tackle with issues regarding environment and super-aging societies. As seen in Figure 2, while all ages tend to decrease, only people over 65 years old will increase until 2040.

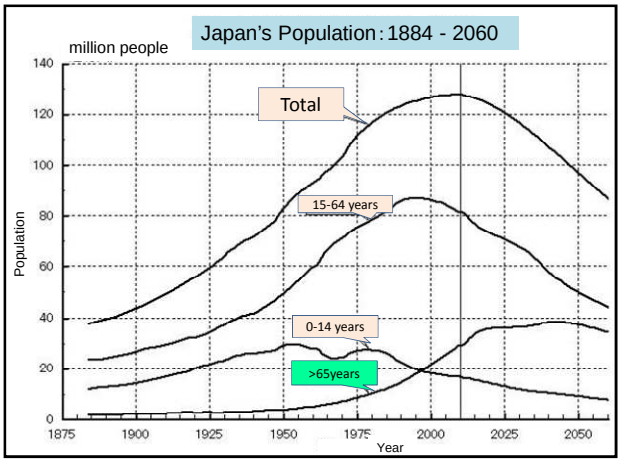


Figure 2. Japan's Population: 1884 – 2060
(Source: The National Institute of Population and Social Security Research, 30 March 2012)

Furthermore, one thing that people notice when watching the local news coverage of disaster-affected areas in eastern Japan is the large proportion of elderly persons. Many of the young move to the city, leaving the elderly behind. Because the population is declining, there are fewer local physicians, making it necessary for people to travel long distances to the city for medical services.

Those situations implicate what the future may be like for Japanese society as a whole. In this respect, large cities like Yokohama are no exception, with a rising ratio of elderly persons in the suburban residential population. In the Tokyo metropolitan area, only elderly persons now live in suburban apartment complexes like Tama New Town, which was constructed during the nation's time of rapid economic growth in the 1960s. What is needed to create low-carbon cities is not only the spread of what are called smart houses and eco-houses with low energy consumption, but many new things combined together for urban development, such as improvements in transportation systems, like buses designed with the

convenience of elderly passengers in mind, and an enhancement of nursing care and health services that capitalize on information and communication technologies to protect solitary elderly persons live alone.

Based on compelling observations such as these, the Cabinet Secretariat of Japan launched the '"FutureCity" Initiative' project. Later, in response to the 2011 disaster, this initiative came to be seen as an essential concept for the recovery of the disaster-affected areas. In 2011, planning projects under the Cabinet Secretariat's budget were started in 11 cities and towns, of which six had been damaged by the disaster. In those places, while preparing for earthquakes and tsunamis that may recur someday and at the same time effectively utilising untapped local renewable energy, discussions have begun for city planning that can also contribute to measures to address climate change. It is expected that they will incorporate fresh concepts that are different from conventional initiatives in disaster-affected areas, but discussions have only just begun.

From the cases of this project, various models can be recognised as sustainable low-carbon cities. There are some common aspects between each project as following:

(1) response to the new economic, social and technological trends such as recovery and reconstruction after the great disaster, and economic revitalisation by green growth or green innovation.
(2) community-based collaboration for establishment of CO_2 reduction system by including local stakeholders.
(3) developing and utilising local resources such as renewable energy resource and human resource including elder people.
(4) strong local initiative for energy generation and management within the region.

These trends can be considered as post-disaster and new direction of sustainable societies. If every local governments design their own regional plan by defining locally prior targets such as low birth rate and longevity, waste management and so on, and using local resource, whole Japan would shift to sustainable society. For transition to sustainable societies, decentralisation and dynamic social reforms are required.

5. CONCLUSION

Since the Great East Japan Earthquake, Japanese energy and environmental policy has been in disarray. Even before the damage caused by the disaster, urban planning concepts in Japan have been in the midst of dramatic change, in response to declining population, fewer children, aging of society and deceleration in economic growth. There, it is essential to promote integrated policies for the local economy, employment, welfare, and energy management. The "FutureCity" Initiative is one of response to this situation in Japan, and a few decades from now, other cities in Asia may be confronting the same issues. The initiative implies some factors for transition to sustainable societies; technological development, institutional reform and financial mechanism. From an aspect of technology, development of green technology and operation system should be introduced. For actual operation, institutional reform of electric power industry by adopting such as feed-in tariffs is necessary. Also, sustainable business models need to be invented for continuous growth and improvement of people's quality of life.

Last but not least, the most essential aspect is making people's mind and behaviour more sustainable. This is a key for success of sustainable cities with appropriate social and economic system including business models and financial mechanisms. If people as responsible consumers do not accept new business model, it means that new social or business system is not sustainable. It all depends on citizens whether they accept or not. Therefore, awareness raising of new concepts of sustainable development needs to be done through some ways such as education for sustainable consumption, environmental education or education for sustainable development at schools or communities.

REFERENCES

[1] Hidefumi Imura and Miranda Schreurs (eds.)(2005): "Environmental Policy in Japan", pp.1-424, Edward Elgar.
[2] Hidefumi Imura (2010): 'Eco-Cities: Re-Examining Concepts and Approaches' in "Toward Liveable and Sustainable Urban Environment, Eco-Cities in East" (eds. Lye Liang Fook and Chen Gang), pp.19-46, World Scientific Publishing., Co.
[3] Hidefumi Imura (2012): 'The Evolution of Environmental Policy' in "Economic and Policy Lessons from Japan to Developing Countries" (eds. Toshihisa Toyoda, Jun Nishikawa and Hiroshi Kan Sato), pp.217-235, Palgrave
[4] Asahi Shimbun Public Opinion Survey on 14-15 April, 2012 (16 April, 2012), http://www.asahi.com/national/update/0415/TKY201204150369.html?ref=reca (Accessed on 11 July, 2012)
[5] Asahi Shimbun, Public Opinion Survey in July and August (23 August, 2012), http://www.asahi.com/politics/intro/TKY201208220872.html?id1=2&id2=cabcaicd (Accessed on 22 September, 2012)
[6] Asahi Shimbun, National Public Opinion Survey on July, 4 and 5 August, 2012 (23 August, 2012), http://www.asahi.com/politics/intro/TKY201208220872.html?id1=2&id2=cabcaicd (Accessed on 19 September, 2012)
[7] Sankei Shimbun and Fuji News Network, Public Opinion Survey on 19 and 20 May 2012 (21 May, 2012), http://sankei.jp.msn.com/politics/news/120521/stt12052111540002-n1.htm (Accessed on 11 July, 2012)
[8] Kyodo News Service-affiliated group on 11-12 June, 2012 (19 June, 2012), http://www.asyura2.com/11/genpatu13/msg/120.html (Accessed on 11 July, 2012)
[9] National Police Agency (4 July, 2012)

http://www.npa.go.jp/archive/keibi/biki/higaijokyo.pdf

(Accessed on 12 July, 2012)

[10] The National Institute of Population and Social Security Research (30 March, 2012), "Estimation of Future Population in Japan" as of January 2012, http://www.ipss.go.jp/syoushika/tohkei/newest04/hh2401.asp (Accessed on 22 September, 2012)