

Sustainable Energy Policy in Japan, Post Fukushima

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Background

Japan has limited fossil fuel reserves. It imported 83% of its total energy supply (coal 20%, oil 41% and gas 19%) in 2009. In terms of electricity, in 2009 Japan generated 1113 TWh of which 25% came from nuclear, 67% from combined oil, gas and coal, and the rest, 8%, from hydropower

This energy structure of Japan has to be understood within the context of the U.S./Japan relationship, which determined the level and the pattern of Japanese economic development. The current industrial energy structure, especially electricity company formation, was the brainchild of U.S. strategy: the privatized electricity companies originally functioned to reduce the Japanese central government's power over the energy industry, as well as to open the Japanese market to the international oil companies. In exchange, the U.S. supplied Japan with the technical assistance and a market for its final products. The oil crisis of 1973 marked the turning point for Japan, making it consider the issue of national energy security. An energy source diversification policy was adopted, including various energy efficiency measures. Subsequently, Japan's oil imports have decreased, while coal and natural gas imports have increased. Within the diversification context, nuclear energy also gained a position, replacing imported oil. Despite the fact that energy security policy was much discussed in reference to national energy independence, U.S./Japan co-operation continued for nuclear development. Many argue that nuclear development was only to increase Japan's reliance on U.S. companies, as they control nuclear fuels (Kihara, 1980). Japan's current proven fossil fuel reserves are regarded as immaterial, and the development of its indigenous energy sources is limited. However, the possibility of their future development should not be denied. For example, 821 million tonnes of coal are available for mining in Japan, while some natural gas reserves are also obtainable. With technical development, those reserves might be utilized. Technologies to develop renewable energies are comparatively well advanced in Japan. However, their practical application is unsatisfactory, with a rather modest target for their further utilization.

The government-industry relationship, whose foundation dates back to post WWII U.S. policy, has been kept under tight control until recently, and the relationship between the government and the electricity companies contributed to allowing the current nuclear accidents and government reactions to it. The energy industries were enjoying a virtual monopoly over their supply areas for decades, with competition among and within the supply area being restricted. Market liberalization was brought into the policy contexts, as a means to bring economic efficiency. So far, however, the effect of market liberalization has been marginal, and the movement was halted after 1990s.

Economics

The cost of energy production shows that nuclear energy provided the lowest cost (at 0.20 US\$) per kWh in 2008. In comparison, the production cost with coal, gas and oil are 0.40, 0.80 and 1.80 US\$ per kWh, respectively (World Nuclear Association, 2011). The production costs using renewable energy sources, such as biofuel, solar photovoltaic and others, are even higher per kWh. The availability of coal is huge in East-Asia (China, Australia, Indonesia), but using coal is less desirable as greenhouse gas (GHG) emissions from coal are higher than for gas and oil with the same energy content. Thus coal must be utilized with clean coal technology, making it still more expensive. Renewable energy sources such as solar, wind and biomass can play a role in reducing oil dependency in the future, but economic production and technology development will be the major determinants in their development. To promote renewable energy as a main energy source, requires introduction of a carbon tax and allocation of the proceeds to renewable energy R&D. National legislation on a feed-in tariff for renewables is close to submission to the Parliament. Through these, it is expected that renewable energy costs could be more competitive and the gap in production costs with nuclear energy diminished.

Environment

Whilst coal, oil and gas emit 484, 350 and 270 kg CO₂/MWh, renewable energy sources as biofuel are also not entirely CO₂ free during combustion, and could be even higher than with fossil fuel with the same energy content, in some situations (Jupesta, 2011). From this point of view, nuclear was considered by the Japanese government as a climate mitigation technology. However, safety issues became the major hurdles for further implementation of this technology,

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as is obvious from the huge environmental and economic impact of the Fukushima disaster (The Economist, 2011a). It is estimated that the cost for the Fukushima nuclear leakage may grow to US\$600 billion. Radiation from explosions on the site was deposited on land, and highly contaminated water has been pumped from the nuclear reactor into the Pacific Ocean. These will directly and indirectly affect humans and the ecosystems at various geographical scales. Even before the earthquake, there was recognition that the nuclear energy expansion would not save Japan from oil dependency since some of the energy demand sector, such as transportation, still needs a huge amount of gasoline.(Barret, 2011).

Politics

Japanese politics are known to be less potent than its administrative bureaucracy, which practically determines government policy in most fields. This is largely a result of the single party dominance by the Liberal Democratic Party (LDP) which lasted nearly 40 years beginning in 1955. Under the LDP regime, bureaucrats could predict and produce necessary policy proposals, including those related energy issues. The LDP had a deep connection with U.S. nuclear interests, and it formed schemes to introduce and maintain nuclear technology in Japan. After the LDP regime lost power in 1993, Japanese politics became highly fluid. The Democrat Party took power in 2009. The current Prime Minister Kan has a personal record of backing renewable energy, and in May 2011, he announced that renewables would be the main pillar of Japan's energy policy. His plan, the Sun Rise Project, is to install photovoltaic (PV) devices on all available roof tops in Japan by 2030, and to promote large scale off-shore wind turbines, biomass and geothermal energy by 2020.

There are thus some signs that the politicians will take public demand on environmental and safety issues into account. The "ancient regime", however, remains and resists change. For example, many LDP Members of Parliament are representing the vested interests of particular industrial sectors, notably the power generating industry, and act to protect the industry's business interests. The Japanese Democrats, on the other hand, seem not yet able to co-ordinate sufficient policy integration to counter these interests. Further political leadership is seen necessary if there were to be a firm political commitment for the energy and environmental security in Japan.

The Economic Impact of Fukushima

Soon after the earthquake, 11 reactors in Miyagi, Fukushima and Ibaraki prefectures were automatically shut down. The other 3 reactors in Fukushima prefecture are still under inspection at this writing. Altogether 12 GW of power supply was disrupted which accounts for 25% of Japan's electricity supply (Japan's Ministry of Economy Trading and Industry, 2011). Japan is expected to have a large amount of property loss and (relative to the size of the earthquake and tsunamis) small human casualties. It is reported that this earthquake will cost Japan between 5-7% of its GDP or US\$300-600 billion (Kashyap and Hoshi, 2011). In comparison, the Kobe Earthquake in 1995 cost Japan 2% of its GDP. The Great Kanto Earthquake in 1923, which devastated the Tokyo area, cost 30% of GDP for its property damage. The cost of the world's recent natural disaster is shown in Figure 1.

Electricity supply in the Metropolitan Tokyo area was thrown into chaos after the Fukushima Dai-ichi nuclear plant and other generators were shut down by the quake and tsunami. Through compulsory power cuts executed by TEPCO and energy saving measures, mainly in the Kanto region, in addition to power generation from local utilities and industries, electric-

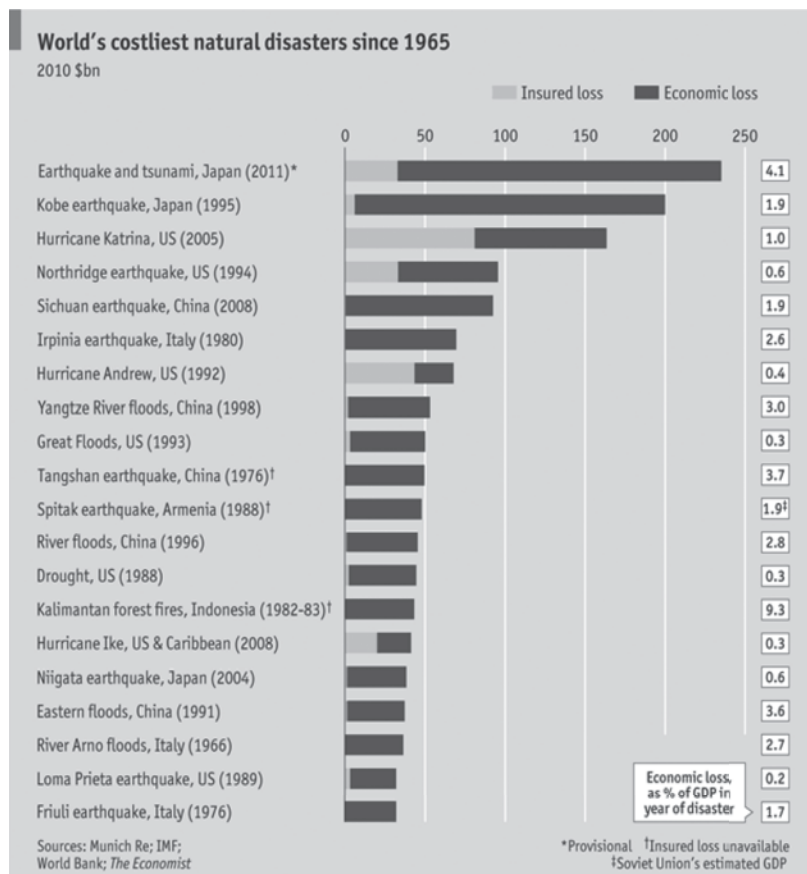


Figure 1: The Cost of Natural Disasters
Source: The Economist

ity supply became marginally sufficient to meet demand. The study from the Institute of Energy Economics shows several measures to save energy: lighting reduction can save 1.72-2.95 GW; increasing 1-2 degrees Celsius in air conditioning settings can save 0.45- 0.94 GW; office automation machines using energy saving modes can save 0.36 GW and reducing elevators and escalators can save 0.17-0.28 GW (The Institute of Energy Economics, 2011c). To cope with the anticipated electricity shortage, companies and households have shown a willingness to curb demand during peak hours, which the government hopes will ward off blackouts.

The operator of the Fukushima power plant, TEPCO, has lost four-fifths of its value because of the disaster. TEPCO posted the largest loss in Japanese corporate history outside of the financial sector on 20th May which amounted to ¥1.2 trillion (The Economist, 2011b). That does not include compensation payments (which are estimated over ¥2 trillion), which will be too much of a financial burden for a single utility like TEPCO. Therefore, the government is currently developing a scheme to support TEPCO to complete compensations. TEPCO, in the middle of public anger, has been trying to ease the situation by selling assets unrelated to supplying energy (such as property and cross-shareholdings) and halting its business expansion. This company has cut 40% and 25% of executives and workers' salaries, respectively, and its president, Masataka Shimizu, has stepped down.

After the Fukushima nuclear leakage, Chubu Electric agreed to the request from Prime Minister Kan to stop all its nuclear reactors at the Hamaoka Nuclear power plant in Shizuoka prefecture. Many other governors have been seriously concerned that they may face a similar situation as Fukushima, in case of earthquake and tsunamis. Currently only 19 of the country's 54 nuclear reactors are in service. The tsunami impact worsened the situation in three prefectures (Miyagi, Fukushima and Iwate). Toyota, the automobile giant, delayed its production as one of its suppliers located in Fukushima was severely affected. The microcontroller chip supplier is expecting to be back to normal production by the autumn. Many other small and medium enterprises (SME) were also devastated. The Government has tried to support the economic recovery by several financial schemes which totaled 10 trillion yen for SMEs (Japan's Ministry of Economy Trading and Industry, 2011). These funds also support early restoration of infrastructures for oil and gas terminals, facilitating projects to save electricity, and subsidizing radiation level inspection of export product.

The question of how much of these government reactions could be substantiated for the Fukushima reconstruction is a matter of argument. Japan is thus facing a cross roads where long term sustainability challenges energy security and economic viability. At the moment of writing, Prime Minister Kan is in the midst of criticism for handling the crisis. However, looking back at the history of energy interests which formed the background to the current nuclear disaster, there is no guarantee that any politician of the opposition party, as well as those in the ruling party, could handle the situation better. After the disaster, politicians, regardless of party, generally feel it would be difficult to return to nuclear development in Japan, but they consider that it would be an economic loss to abandon all the nuclear related technologies. Therefore, they may choose to maintain nuclear as a "technology", though further increases of nuclear as "power" may not materialize. Development of alternative energy, on the other hand, requires further political commitment in order to be firmly rooted in the Japanese energy systems.

A recent survey conducted by Asahi Shimbun shows that 74% of voters support abolishing nuclear power after a phase out period, compared with 14% opposed. Sixty five percent said that renewable energy for electricity production should be increased and electricity fees raised (Asahi Shimbun, 2011). Despite the concern for nuclear safety, shown by the nuclear phase out in Germany, Italy and Switzerland, some other countries did not change their nuclear development policies due to tight energy supply-demand balance and underdeveloped social infrastructure which is crucial for their high economic and industrial growth. China, India, Pakistan, Russia and Bulgaria are moving forward to increase nuclear power with French support. Even concern about the safety issues of nuclear power, cannot stop their use of nuclear power because phase out would lead to an economic recession (The Institute of Energy Economics, 2011b).

Summary

There are several conclusions which could be drawn from this study:

- * From an energy security perspective, and international nuclear market development, Japan may still maintain nuclear technology as one of the energy sources for the time being, but its future capacity increase, as previously planned, became highly uncertain after the Fukushima accidents.
- * From the economic point of view, the cost of production of nuclear energy in Japan is the lowest compared to all other sources, but most of the existing cost calculations have not taken account of

- all the externalities and government subsidies.
- * To promote renewable energy, policy options such as a carbon tax and feed in tariffs could be introduced to produce lower production costs of renewable energy and diminish the wide cost gap with nuclear energy.
 - * From an environmental point of view, nuclear energy was considered as a climate mitigation technology. Considering the huge risk of nuclear leakage, the safety issue became the top issue in considering any further nuclear development.

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