



Japan's Energy Policy – Pre and Post Fukushima

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Japan has almost no domestic fossil resources. Even regarding nuclear as domestic energy, Japan's energy self sufficiency in 2008 was 14 per cent, which is significantly lower compared with other major economies such as China (94 per cent), UK (80 per cent), US (75 per cent), France (51 per cent) and Germany (40 per cent).

Since the two oil crises, energy security through reducing their dependency on Middle Eastern oil has been the centerpiece of Japanese energy policy. To this end, Japan has been vigorously promoting energy efficiency. Currently, Japan's energy intensity is the lowest among the major countries. Japan has been reducing dependency on oil in the power sector by promoting coal, natural gas and nuclear as its alternatives. The share of oil in power generation dropped from 73 per cent in 1973 to 13 per cent in 2007, while the share of nuclear, gas and coal increased to 26 per cent, 27 per cent, and 25 per cent respectively.

Since the 1990s, Japan's energy policy has been pursuing simultaneous achievement of 3Es, namely, energy security, environment (i.e., climate change mitigation) and economic efficiency (i.e., lowering energy cost). However, this is not at all easy. Promotion of coal is good for energy security and economic efficiency but will conflict with the climate change agenda. Promotion of renewable energy is good for energy security and climate change mitigation but tends to be more costly. It is for this reason that Japan has been promoting the nuclear option as a key for achieving 3Es.

In September 2009, Japan announced 25 per cent GHG emissions reduction target in the context of the UN climate negotiation. While this is a conditional target subject to the outcome of the negotiation, this has made the simultaneous achievement of 3Es further challenging. Since Japan's energy efficiency is already very high, marginal abatement cost for further mitigation is extremely expensive. If 25 per cent reduction is achieved solely by domestic action, its marginal cost is estimated to be over US\$450 per ton, 3-4 times higher than that of other countries.

Lack of international grid connection is another boundary condition. Unlike European countries which can import power from neighbours, Japan needs to domestically generate all the necessary power.

Pre-Fukushima - Strategic Plan of Energy 2010

Taking all of these boundary conditions into account, Japan set out the Strategic Plan of Energy in June 2010 with a series of ambitious goals.

On the demand side, it aimed at halving CO₂ emissions of the residential/commercial sector by 2030, a drastic reversal of 42 per cent increase from 1990 to 2007. On the supply side, it aimed at increasing the share of non-fossil fuel in the power sector from 34 per cent to 70 per cent (nuclear 52 per cent, RE 19 per cent), establishing 14 new and additional nuclear power plants by 2030 and raising the utilisation ratio of nuclear from 60 per cent to 90 per cent and 10 times expansion of the market volume for renewable through the FIT (feed-in tariff). If all of these goals are fulfilled, energy related CO₂ emissions in 2030 could be 30 per cent lower than 1990 level.

Post Fukushima – Into the Unknown

The Fukushima nuclear accident has completely changed the above picture. Japan's energy policies are facing unprecedented challenges from short, mid and long-term perspectives.

Currently, 39 out of 54 existing nuclear power plants are out of operation. The average capacity factor of Japanese power companies is -3.3 per cent. This is a rather worrisome figure given that 3 per cent capacity factor is normally regarded as the minimum requirement. The most imminent challenge is how to weather over Japan's hot summer this year. In the eastern part of Japan, the industrial consumers are legally obliged to save their power consumption by 15 per cent.

The more fundamental problem is what if nuclear power plants cannot come back to operation due to the lack of consent from the local communities even though they satisfy safety requirements, which are to be substantially strengthened after Fukushima? Furthermore, during the coming months, currently operating nuclear power plants will be stopped one after another for periodic inspections. If the current situation continues, all the nuclear power plants in Japan will have been stopped by next June and 30 per cent of total power generation will be lost. This will cause significant damage to Japan's economic recovery from the earthquake.

Energy and Environment Council

On 29 July 2011, the Energy and Environment Council, which was established under the Prime Minister with the participation of all relevant Ministers, spelled out measures to cope with the short-term power supply/demand balance in the next 3 years. They enumerate 1) energy efficiency (e.g., dissemination of high efficiency product, promotion of energy efficiency investment, smart metering and tariff menu for encouraging peak cut), 2) renewable energy (e.g.,

introduction of the FIT), 3) high-efficiency thermal power, 4) distributed power generation and smart community and 5) electricity market reform (e.g., neutrality of transmission/distribution, vertical separation of generation and transmission). They have also included the resumption of nuclear power plants of which safety has been confirmed.

The Council also laid out an interim wrap up towards a mid/long-term Innovative Energy & Environment Strategy to be published sometime next year. The 2010 Plan putting strong emphasis on nuclear will be overhauled from scratch. While avoiding energy shortage and energy price hike, the Council intends to make a comprehensive review of nuclear policy and to draw a scenario towards reducing dependency on nuclear. In doing so, the general public will be informed of objective data (e.g., cost comparison among different power sources) and engaged in broad dialogue. Six pillars, namely, energy efficiency, renewable, fossil fuel, nuclear, power supply system and energy/environment industries will be addressed in a comprehensive manner.

No Silver Bullet

At present, it is not clear which energy/power mix Japan is aiming at in 2030-50. The 2010 Plan tried to achieve the 3Es by setting ambitious goals on nuclear, renewable and energy efficiency. Given nuclear centric equilibrium looks difficult, a new equilibrium must be sought. While there seems to be a broad support among general public to reducing dependency on nuclear, it is subject to intensive debate how far, how quickly and at what cost it will be implemented.

Replacing nuclear with other sources is not so easy. While gas-fired power plants could be constructed relatively quickly, an estimate suggests that replacing all the nuclear power with thermal power will additionally incur US \$38 billion per year for fuel import. This will raise monthly electricity bills for households and industry by 18 per cent and 36 per cent respectively. Such price hike could result in industry hollowing and significantly damage the Japanese economy. In addition, Japan's CO₂ emissions in 2020 will be 18 per cent above 1990 level.

Replacing nuclear with renewables is challenging as well. Currently, generation costs of PV, geothermal and wind power are 49 JPY/kwh, 8-22 JPY/kwh and 10-14 JPY/kwh respectively, far more expensive than thermal and nuclear power sources. Of course, the current cost comparison should not be taken for granted. Nuclear could become more expensive taking into account more stringent safety measures

and payments to local communities where nuclear plants are sited. Massive penetration of renewable energy through FIT and RD&D efforts could certainly reduce its generation cost over time. In the long-term horizon, more penetration of renewable energy will raise energy self-sufficiency and save the cost of imported fossil fuel. However, in the short to mid-term perspective, the Japanese economy will have to bear considerably higher electricity price. Careful assessment of job creation in renewable industries and job losses in energy intensive industries is warranted. Low energy density of PV and wind power due to their intermittency is another bottleneck. An estimate indicates that replacement of all the nuclear with PV requires 200 GW PVs with US\$1 trillion investment and 5260 km² space. Replacement with wind power also needs 152 GW wind mills with US\$375 billion investment and 5000 km² space. This huge investment cost does not include back-up power facilities or battery facilities to cope with intermittency.

Each power source has advantages and disadvantages in terms of economic cost, supply stability, spatial constraint, climate change and social acceptance. In short, there is no silver bullet.

Vigilant Journey

A comprehensive review of Japan's energy policy has just started. Its final conclusion remains to be seen. The new energy policy will continuously seek to strike a balance between 3Es, but S (safety) will be put as the prerequisite. Since there is no silver bullet, all the options, including nuclear, should be kept open in finding a new pragmatic energy mix.

All the stakeholders (industry, consumer, academia, local communities) must be engaged in the review and informed of all the relevant data including cost comparison of various power sources, implication to Japanese economy and GHG emissions. Widespread "nuclearphobia" after Fukushima is not surprising. Japanese people could choose "nuclear-free" if they so wish, but its economic consequences in the coming 5-10-20 years needs to be fully analysed beforehand. Investors of energy-related facilities need predictability. Rash decisions now without sober cost-benefit analysis could easily be reversed afterwards when encountering adversities. This will in the end erode policy predictability, hamper new investment and risk national security. We are still on a journey, but we must be a vigilant traveller. □

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