Japan-China nuclear energy cooperation

Maximisation of Japan's nuclear energy production involves more than domestic development and national energy efforts; nuclear energy cooperation with China has the potential to ensure the materialisation of this aim. But under what circumstances would Japan and China engage in nuclear energy cooperation? Raquel Shaoul acknowledges the potential obstacles, but provides a new energy-economic approach which presents cooperation as a win-win energy equation worth consideration by policy-makers in the two countries.

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GIVEN THE CURRENT domestic and regional instability within major oil and natural gas producing countries, the fierce competition between consumers for access to these resources, the accumulated environmental damage due to the extensive use of coal and the uncertain remaining quantity of fossil fuels available to meet global energy demand, development of reliable alternative energy resources, such as nuclear power, is essential. Whether or not nuclear energy will contribute to filling the gap between world energy demand and supply, it is considered significant for the achievement of security of energy supply for big energy consumers, such as China and Japan.

Japan's nuclear policy and capabilities

Japan is dependent on imports for 81.9% of its energy supply, importing 99.8% of its oil consumption, 96.6% of its natural gas, 98.4% of its coal and 100% of its uranium. Of its total electric power generation, including private power generation, of 1,161 billion kWh in 2006, thermal power (coal, petroleum and gas) accounted for 65%, hydro power for 8.4% and nuclear power accounted for 26.1% (Statistical Handbook of Japan 2008). Nuclear power generation therefore enhances Japan's energy self-sufficiency from 6.1% to 17.3%, and as such it has taken on a central role in ensuring Japan's national energy security.

Subsequent to the oil crises of the 1970s, the Japanese government has followed a policy of developing and enhancing nuclear power generation. On 11 October 2005, the Japan Atomic Energy Commission (JAEC) adopted the Framework for Nuclear Energy Policy as the basic policy strategy to be followed by government and industries for ten years. The Framework for Nuclear Energy Policy determined that the share of nuclear power in electricity generation after the year 2030 should be at the level of 30 to 40% of total electricity production. It also confirmed that nuclear power production would be focused on light water reactors –LWRs (JAEC 2005).

The New National Energy Strategy Report of 2006 reaffirmed these policy directions for nuclear power. Numerical targets to be achieved by 2030 were set in order to accomplish objectives. The New National Energy Strategy called for raising the ration of nuclear power in the total power production to a level of 30% to 40% or more by 2030. Recently, Japanese nuclear energy policy has been emphasising not only its importance in terms of national energy security but also in terms of Japan's leading role in the international arena.

China's evolving nuclear policy and capabilities

China's primary energy use has increased more than fourfold from 413 Mtoe in 1980 to 1,863.4 Mtoe in 2007, with an average annual growth rate of 12% (British Petroleum 2008). Moreover, China's energy consumption is estimated to increase 30-fold by 2030 (from 1,560 million tons of oil equivalent in 2005 to three billion tons per year in 2030) (IEA 2007). China's electricity demand in 2007 was the second largest in the world, and is expected to continue to increase significantly for the next 20 years at an annual rate of as much as about 140TWh (Maeda 2007). Chinese electricity demand has been growing at more than 8% per year and electricity shortage occurred especially in the coastal provinces, such as Guangdong and Zhejiang, where industrialisation is booming. Though nuclear energy currently accounts for only 1.9% of the country's total electricity consumption, in coastal provinces it currently accounts for 13% (Xu 2008).

Whether or not China's increased nuclear power capacity will cover expected increases in energy demand in the near future, the Chinese government currently concedes that China has no alternative but to develop nuclear power.

According to the Three Stage-Strategy in the National Medium- and Long-term Plans for Science and Technology Development announced by the Chinese Government in February 2006, throughout the Second stage (2021-2035), China's goal is to increase the nuclear share to the current global average of 16% (Maeda 2007). Furthermore, in the 11th Five-Year Plan 2006-10 of March 2006, the Chinese government declared its support for nuclear power plant development and construction. China's National Plan for Coping with Climate Change, released by the government in June 2007, confirmed once more that the government's objectives to address climate change by 2010 include, among others, to boost nuclear power plant construction (State Council of the People's Republic of China 2008).

Several factors have encouraged China to pursue nuclear energy: the first factor is China's deteriorating energy situation, as manifest in electricity shortages. Second, some inherent problems exist within coal-fired energy production. In 2007, 'burning coal contributed to 90% of the national total sulphur dioxide (SO^2) emissions, about 70% of the national total dust, nitrogen oxide (NOx) emissions and carbon dioxide (CO^2) emissions'(Zhang 2007: 3547).

Is nuclear cooperation feasible?

Enhancement and materialisation of current and future nuclear energy cooperation will largely depend on how Japan and China manage to reconcile their different energy needs and domestic political limitations. China's expanding energy needs contrast sharply with the stagnant energy demands of Japan.

China's current central energy problem is the result of a lack of effective governmental mechanisms to promote and materialise energy efficiency and conservation. Despite this, the Chinese energy market is 90% self-sufficient. The Japanese energy market, in contrast, shifted its high energy consumption and environmentally-unfriendly heavy industries and adopted major energy efficiency measures. However, due to its almost total lack of domestic energy sources, Japan's primary energy self-sufficiency accounts for merely 17.3% of its energy consumption. Consequently, the two countries have adopted different 'Energy Mix' approaches to assure energy security. While development of nuclear energy is vital to enhance Japan's energy security, China's energy market, in the short term, can continue without significant nuclear energy development.

While development and utilisation of nuclear energy provides many advantages for China's energy market, especially in the mid and long-term, the Chinese government may choose to develop alternative energy solutions, such as clean coal technology and renewable energy technology instead of or in addition to nuclear energy development.

Mutual distrust derived from historical rivalry; ongoing geo-political and territorial disputes; hostile domestic public opinion and political nationalist sentiments in both countries also have the potential to obstruct energy cooperation.

An additional factor potentially obstructing nuclear energy cooperation has to do with the Chinese government's demand for full transfer of nuclear technology to local partners as a pre-condition to concluding nuclear agreements. As a result, Japanese companies may be reluctant to invest in the Chinese market. Companies are concerned about potential technology being lost to low-cost Chinese competitors, due to the deficient imposition and protection of intellectual property rights in China.

Despite the above mentioned impediments to nuclear energy cooperation, there are also shared interests which could incline Japan and China to engage in, develop and deepen their nuclear energy cooperation. The first of these interests is already leading to nuclear cooperation and the second offers potential for future nuclear cooperation:

Capital investment and business opportunity:

Actual nuclear energy cooperation between China and Japan is taking place as a result of the Chinese government's needs for capital to develop and expand its nuclear industry and Japanese companies looking after energy business opportunities – especially at a time when the Japanese economy is facing difficulties. In order to attract foreign direct investment, China has been improving laws and policies related to the opening up of its market. And in the face of the massive potential of the Chinese energy market, the three big Japanese businesses dealing in power systems – Toshiba, Hitachi and Mitsubishi – have begun to run nuclear energy business in China.

In July 2007, Toshiba's subsidiary Westinghouse Electric Company signed an agreement with consortium partner Shaw and several Chinese companies to construct four AP1000 nuclear power reactors in China (CNNC 2006). Two plants are to be constructed at Sanmen and another two at Haiyang, with each plant estimated to cost up to $US4 billion. Construction of these third generation plants is to start in 2009 and completion of the first plant is expected by 2013. In other words, more than 50% of the current Chinese nuclear power plant construction (four out of seven plants) is being managed by a Japanese company.

Reliable energy supply and maximisation of nuclear energy utility:

The concept of electric power grid interconnection in North East Asia is not new. There are electricity grid interconnections between Japan and Korea, made possible by recently developed High Voltage Direct Current (HVDC) undersea cable technology (Kanagawa and Nakata 2006). The idea behind transnational electricity supply grids as a means to promote nuclear energy cooperation between Japan and China relies on these same HVDC technology breakthroughs. One breakthrough relates to the world's longest transmission link from the Xiangjiaba hydro power plant, located in the south-west of China, to Shanghai, located 2,071 km away (ABB Corporate 2007). Another technological HVDC improvement is to do with undersea electricity transmission.

Electricity cannot be stored; therefore, supply and demand must be kept in balance in real-time. Moreover, supply of nuclear electricity is inflexible to momentary fluctuations in energy demand due to its lack of substitutability –for this reason, electricity generation in Japan is powered by mixed energy sources (including oil and natural gas together with nuclear power) which compensate for nuclear energy inflexibility. Taking this into account, nuclear energy's share of the total power plant's electricity generation can only rise to a maximum of about 40%. Electricity sales to China might permit Japan to take full advantage of nuclear energy production and promote nuclear energy cooperation.

China is currently facing intensified urbanisation and a sharp increase in electricity demand. Development of nuclear energy, in concert with other energy measures, might permit China to continue to carry on economic development and avoid negative side-effects from accelerated industrialisation. Moreover, nuclear energy purchase from Japan might be an economic solution to sustaining China's energy security supply.

To achieve the potential benefits from power grid interconnection and trade there are many issues that need to be resolved. There could be technological problems due to differences in standards and quality of power by country. There is also great concern about the reliability of interconnected power grids, because their malfunctioning may lead to costly and hazardous blackouts (Yun and Zhang 2006). Nevertheless, in principle, it offers a win-win energy option for the two countries.

Prospects for nuclear energy cooperation

The governments of Japan and China recognise the significant advantages of nuclear power cooperation. Japanese companies have succeeded in entering China's promising nuclear energy market. However, broad nuclear energy cooperation can only possibly be achieved as a result of governmental support in a capital-intensive field.

Nuclear energy cooperation can significantly improve the two countries' energy security when this initiative is also materialised at governmental level. Nuclear energy cooperation occurring at the bilateral and domestic mentioned levels can be a significant positive influence on regime stability and the countries' broad-spectrum political relations - e.g. with regards to the long-standing territorial and energy dispute over the Diaoyutai/Senkaku islands in the East China Sea.

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