



Japan



The future of Japan's energy policy was exposed in a recent electricity review published by the Federation of Electric Power Companies of Japan (FEPC). In the years to come, Japan's 'grand design' is to reduce its reliance on oil resources to mitigate the economic, political and environmental problems associated with them. The review forecasts an increase in energy production from renewables and a reduction in its reliance on traditional energy sources by 2 GW. The substitutes that Japan has been developing are nuclear, solar, biofuels, wind and hydro power.

However, questions remain whether such energy sources will offer adequate supply without disruptions to the power industry. The historical context Japan's energy market took its current form in 1952 when the top ten energy companies collaborated to form the FEPC to address the serious issue of power supply. Japan's energy suppliers were struggling to meet energy demand amidst a period of high industrial growth and power shortages. Significant investment was ploughed into the energy sector, which gradually led to an improvement in Japan's infrastructural capacity and allowed the country to power up its booming economy. However, Japan's bright new energy sector, which was heavily reliant on oil, was hit during the oil crises of the 1970s. The obvious solution to over-reliance on oil was to vary its energy sources, and nuclear was presented as one alternative.

Natural gas and coal, as well as promoting



Photo: Bloomberg

energy efficiency and conservation were also measures that eventually came into discussion after the oil hikes. The benefits of privatisation Varying its energy supply has been challenging for Japan which imports 96% of its primary energy sources and remains vulnerable to power shortages. Despite reliance on nuclear energy, dependency on non-domestic supply of fuel resources is at 82%. Privatisation has changed

PROFILE

Capital Area	Tokyo 377,835 km ²	Installed Capacity	266,129MW
Population	127.5 million	Population Electrified	100%
GDP	US\$3.963 trillion	Main Voltages (kV)	500, 275, 220, 187
Currency	Yen	Natural Resources	negligible mineral resources



Photo: Bloomberg

the face of the industry.

In March 2000, the retail market was partially liberalized to allow power producers and suppliers (PPS) to sell electricity to extra-high voltage users with demand over 2MW. From April 2005, the scope of liberalization was expanded to all high-voltage users consuming more than 50kW. Raising market involvement comes with a price. Ryuchi Kaga, Director General, Project Finance Department of the Japan Bank for International Cooperation recently pointed out that “integrated power companies were suspected of interfering in the affairs of the new entrants.” Nor has privatisation been extended to the entire market. Customers in the regulated market continue to receive electricity supplied from regional suppliers. Full liberalization, including residential customers, is only scheduled for discussion later this year.

National Energy Strategy 2006

The New National Energy Strategy 2006 In response to recent changes in market structure

and diversifying risks in the international energy market, the Ministry of Economy, Trade and Industry (METI) drafted the New National Energy Strategy in May 2006. The objectives were to establish effective energy security measures, to buttress sustainable growth through a comprehensive approach for energy, and environmental issues and assist other nations in addressing energy problems.

One year later, the plans of the New Energy Strategy are under way and recent developments in the Japanese Power Industry indicate success. The first part of the plan consists of energy conservation policies. According to an estimate by METI, Japan improved its energy conservation by 37% since the 1970s and plans a further 30% improvement by 2030. These results were the product of carefully devised energy conservation technologies and extensive social reforms. Tokyo’s sensitisation program to release cutting-edge energy conserving technologies was implemented on time.

By 2007, the Japanese were among the most

efficient energy users worldwide. Looking ahead to 2030, METI is working on processes that will develop technical progress in future power semi conductors. It is also planning to boost energy utilization devices such as thermal energy storage devices, refrigerators and advanced transport systems. The second part of the scheme consists of diversifying resources used in the power industry to reduce CO2 emissions.

Renewables

The list of renewables is long, reflecting the need to ensure that Japan effectively reaches its overall target emission levels. Given that electricity demand is expected to rise by 0.8% on average annually till 2015, it is going to be a tall order for the scheme to achieve its overall long term objectives. Nuclear Energy In Japan's energy plan, nuclear power will maintain its share of total energy generated above the current level of 30%. Nuclear makes a significant contribution to energy security for resourcepoor Japan, by reducing its reliance by the energyequivalent of approximately 410 million barrels per year. This represents roughly 20% percent of total annual crude imports. By 2015, electric power companies will have developed power generation facilities with a total capacity of 29.01GW, 42% (12.26GW) of which will be accounted for by nuclear power. As with other nations, Japan is increasing its use of the fuel both as a means of greater self-reliance and as a way to reduce CO2 emissions.

However, history continues to play a part



Photo: Bloomberg



Photo: Bloomberg

in the acceptance of nuclear in Japan, and political sensitivity remains a key area for the power companies. Hydropower Japan has invested heavily in hydro electric power in recent years. The largest operating hydro power system is provided by Kazunogawa, a 1600MW underground pumped storage plant, constructed by the Tokyo Electric & Power Company (TEPCO) in Japan's Yamashi Prefecture. The project includes four reversible turbines which generate a total of 160MW (400,000kW each). The first unit was commissioned in December 1999.

The second began in June 2000, and the fourth in July 2000. At the time of construction these represented the largest such units in the world. Following completion of this facility, TEPCO announced a massive 2,700MW project in Kannagawa. The latest Japanese electricity report states that hydroelectric power is expected to account for more than 47 GW by 2010 and will represent one of the most important sources of renewable energy. Solar Power, according to estimates, Japan leads the world in solar technology. Within Japan, the industry is dominated by heavy engineering and electronics conglomerates, which have honed their research and development skills over the years. This was promoted by government incentives for solar use. Photovoltaic (PV) research and PV usage have all seen increased activity in recent years, though the high raw silicon prices have had a detrimental short term impact on global demand. As raw material prices

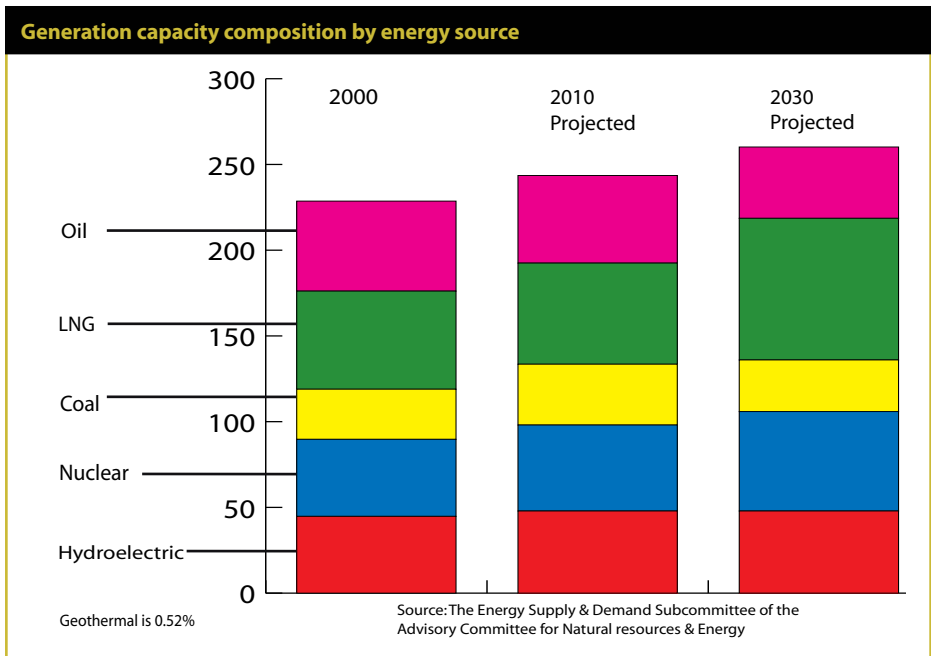
and solar technologies costs are expected to fall in the next 2-3 years, demand is anticipated to grow and the Japanese industry looks well placed to benefit from it.

Wind Power

Wind power remains the hottest new energy option. So far, however, it has accounted for only a fraction of energy supply mostly due to an engineering issue. Most turbines are manufactured in Europe, which have different climatic conditions from Asia, and results in sub-optimal performance. Nonetheless, hope looms eternal. The New Energy and Industrial Technology Development Organisation (NEDO) has been modifying the European wind turbines. In association with Kyushu University and Torishima Pump Manufacturing, NEDO is exploring a promising source of wind power called wind lens microturbines. These are able to pivot to face the wind - a significant advantage in the kind of wind patterns commonly seen in Asia.

Unfortunately, the capacity is currently limited to one Kilowatt of energy. Biofuels Until recently, Japanese biomass energy projects have been limited to only 0.8% of Japan's total energy production. Compare this with an annual production of waste and unused biomass in Japan that is estimated at the energy equivalent of 29.9 million kilolitres of crude oil. To capitalise on this valuable source, Tokyo introduced a national biomass strategy in 2002 that set power generation from biofuels to 330 MW by 2010. So far, the availability and stability of supply is the major problem facing the development of the biofuel market in Japan. And so in May 2005, Japan signed a \$578 million loan agreement with Brazil to finance infrastructure, which will increase biofuels exports to Japan.

Overseas Investment the Japanese government has taken a regional view on sourcing energy resources and generating bi-lateral partnerships. China has been the most recent recipient of Japanese expertise. Japan AE Power Systems Corporation announced a US\$5



Million investment in Suzhou. The President of AE Power Systems, Masakazu Mori said that “thanks to economic growth in China, large-scale investments are expected in the field of electric power”. A recent agreement in Indonesia has paved the way to develop a plant which will convert low grade coal into liquid fuels such as diesel. Indonesia is the world’s largest exporter of coal and with oil prices at current highs, the development in South Sumatra will produce a return on investment of around 20%. The project will be undertaken by two large Indonesian companies backed by the Japan Bank for International Cooperation. The thrust is to ‘create’ Japan’s own natural resources overseas.

Interestingly, though, the project will only be viable with oil crude prices at over \$40 per barrel. Whilst barrel prices dipping below \$40 seems unlikely, it is not unprecedented.

Will Japan’s heavy emphasis on renewable and nuclear power prove inspired or foolhardy? Only time will tell. However, in a resource poor nation, over-reliance on imported fossil fuels is an expensive option, and with the political wind turning against oil, gas and coal, the choices are limited. The Japanese are famed for incremental innovation and the government has a strong commitment to invest in alternative energy sources. Coupled with overseas investments, the odds may be staked in Japan’s.

Type of new energy	Condition of Introduction
Wind power generation	More than 260 wind turbines with a total capacity of 144MW were in operation in 2001. Large-scale facilities with unit generating capacity of 1.5MW or above are coming into use. Wind power is considered a key renewable energy source and the goal by 2010: 3,000MW installed generating capacity.
Waste power generation	Waste power had a generating capacity of about 900MW in 1999. Local governments have taken the lead in constructing waste-fired power plants. Issues include the need to increase plant capacities, achieve more efficient power generation and reduce impact on environment. Goal by 2010: 4,170MW.
Biomass power generation	Wood chips, bagasse (sugar cane husks), methane gas and sludge are principal fuels. Generating capacity in 1999 was 80MW. Goal by 2010: 330MW.
Solar Power	Total installed solar cell power generating capacity was 317MW in 2000, the largest in the world. The need for further cost reductions must be addressed. Goal by 2010: 4,820MW.
Clean-energy motor vehicles	Hybrid automobiles and natural gas automobiles are steadily increasing. Experimental operation of fuel-cell buses began late 2003. Goal by 2010: 3.5 million clean-energy cars on the road.
Other Fuel cells	Phosphoric acid fuel cells (PAFCs) are in the most advanced stage of development among fuel cells, and cogeneration systems that utilise waste heat have reached the commercialisation stage. Polymer electrolyte fuel cells (PEFCs) are also under development by automakers, with R&D directed towards developing commercialised fuel-cell cars. Goal by 2010: 2,200MW of fuel-cell generating capacity installed.