Energy and the Environment

By Kazuya Fujime

Japan will face a welter of challenging energy and environmental issues in the decade ahead, and the 1990s are likely to be years of trial. Holding sluggish in the wake of the first and second oil crises, energy demand changed course in the latter half of the 1980s to increase at the same rate as real economic growth. Assuming no oil-crisis-size jump in prices, energy demand is expected to increase at an annual rate of 2 to 3% in the 1990s, somewhat slower than in the past few years but faster than what had been expected.

Yet there are a number of factors that will make it difficult for supply to keep up with demand–including the way safety concerns are delaying nuclear power plant construction, the limitations that greater awareness of such global environmental issues as acid rain and global warming are putting on greater use of coal and other fossil fuels, and the fact that projects to develop and commercialize alternative energy sources were scrapped when the oil price bubble collapsed.

These features characterizing the energy market surfaced in the late 1980s and will become increasingly prominent in the 1990s. Little wonder that an increasing number of energy analysts are warning that, given the wrong conditions, we could be in for a third oil crisis.

In May 1989, the Ministry of International Trade and Industry asked its Advisory Committee for Energy to bring the October 1987 "Long-Term Energy Supply-Demand Outlook" up to date and to conduct a comprehensive reassessment of energy policy in line with the changing picture. The actual updating was done under the auspices of the Overall Coordination Committee and its subcommittee, the Long-Term Outlook Subcommittee, the Supply and Demand Committee, the Energy Conservation Committee, the Alternative Energy Committee, the Coal Committee and the Nuclear Power Committee–all of which include private-sector specialists, energy industry representatives, consumer representatives and labor leaders, as well as academics and bureaucrats, working from information supplied by the Agency of Natural Resources and Energy.

Because electricity is such an important form of energy, the Council of Electric Utility Industry dealt with electricity issues in parallel deliberations and was in close contact throughout with the Advisory Committee for Energy. The Advisory Committee published an interim report in October 1989, and the new Long-Term Energy Supply-Demand Outlook and policy recommendations were released in early June (Table 1).

One major difference distinguishing this year's Long-Term Energy Supply-Demand Outlook is that it is the first time demand forecasts have been revised upward since 1973. The outlook is revised approximately every other year, and each of the six previous ones since the oil crisis had been more and more pessimistic about demand growth.

Also significantly, the outlook for nuclear power plant construction is down despite the higher demand forecasts. In the past, the nuclear power outlook had moved in parallel to the demand outlook, both of them falling. This time, however, nuclear power is down despite an upturn in demand, mainly because the strong opposition to nuclear power is making it increasingly difficult to site new facilities.

Juggling the mix

At the same time, the outlook has had to juggle its energy mix in light of the worldwide concern over the global environment, a concern that finds particularly strong expression in Japan over the need for an agreement to reduce carbon dioxide emissions. As a result, the outlook has assigned energy conservation and the more efficient use of energy resources a top priority. As the report states, the main issues for the 1990s are those of achieving sustainable growth, ensuring stable energy supplies, and protecting the environment.

Disregarding minor ups and downs, Japanese energy consumption showed almost zero growth from 1973 through 1986. While part of this was due to the

Table 1 **Japan's Long-Term Energy Outlook (June 1990)**

(million liters of oil equivalence)

	FY 1988	FY 2000 (forecast)	FY 2010 (forecast)
Energy demand	482	597	666
Percentage supplied by each energy source			(%)
Oil	57.3	51.6	46.0
Coal	18.1	17.4	15.5
Natural gas	9.6	10.9	12.0
Nuclear	9.0	13.2	16.7
Hydroelectric	4.6	3.7	3.7
Geothermal	0.1	0.3	0.9
New energies	1.3	2.9	5.2

economic sluggishness, especially in steel, chemicals and other energy-intensive industries, energy-conservation efforts were an even more important reason. Demand for energy started up again, however, in fiscal 1987, mirroring real economic growth of about 5% per annum. This turnaround is attributed to the 1985 collapse in crude oil prices, the yen's appreciation (which made oil imports even cheaper for Japanese companies), and the start of economic growth in 1987 led by domestic demand and sparking a revival of the energy-intensive industries. Also, growing prosperity meant individuals were less interested in energy conservation and more interested in luxury goods and an affluent–which is to say an energy-wasteful–lifestyle.

It is instructive to briefly review the historic relationship between energy demand and economic growth in Japan. In the 1950s, GNP grew 8.8% and energy consumption 12.4% per annum. Thus the energy elasticity coefficient (the ratio of the two growth rates) was 1.41. In the 1960s, the elasticity coefficient was 1.14 with GNP growth of 11.0% and energy demand growth of 12.5%. In the crisis-ridden 1970s, the elasticity coefficient was down to 0.5 as GNP growth was 4.6% and energy consumption growth 2.3%. For roughly the first half of the 1980s (1980–1986), the elasticity coefficient was a mere 0.03 as GNP grew 3.9% and energy demand grew only 0.1% per annum. However, this elasticity coefficient was back up sharply to 1.0 in the years 1986–1990 as both GNP and energy consumption grew an average 5% a year.

What lies ahead for the 1990s? After one of the longest periods of sustained growth in recent history, the economy should slow down in 1991–1992 and production in the energy-intensive industries should slacken. As a result, the energy-GNP elasticity coefficient should once again slip below 1.0. Three economic cycles are forecast for the 1990s, but the overall per-annum GNP growth rate is expected to average 3.75% or so. By contrast, the average anticipated per-annum growth in energy consumption is 2.2%, resulting in an elasticity of 0.6.

Of course, all bets are off if crude oil prices jump the way they did during the oil crises, if there are wild gyrations in the exchange rate, or if something else happens that would lead to sharply higher prices and interest rates. At the same time, achieving the sustained growth implicit in these forecasts will require that the economy finds some way to cope with crippling labor shortages within the context of economic globalization, and the energy outlook will have to be revised substantially if these efforts fail.

What energy sources?

Although energy consumption is not expected to grow as fast in the 1990s as it has in recent years, it will increase steadily compared with the flat growth of the 1970s and early 1980s. The issue for the 1990s is thus one of whether or not Japan can secure the energy supplies it needs. Even assuming that the necessary gross energy resources can be found, there are other important considerations: qualitative concerns, supply stability, and whether or not the supplies are consistent with the demand.

Electric power, for example, faces ever-longer lead times–the time it takes to go from the drawing board to the actual start of operations–mainly because of the need to reach agreements with local residents before a power plant can be built. Nuclear power plants now have decade-long or longer lead times, but people are not only worried about nuclear facilities. Safety, environmental and other concerns are also delaying the construction of coal-, LNG- and oil-fired plants, and lead times are getting longer for all types of power plants.

While the 1979 Three Mile Island accident in the U.S. was, of course, a major blow to the nuclear power industry, Japanese plans for nuclear facilities were set back even further by the way electricity demand plunged during the second oil crisis that same year. This was compounded by the 1986 Chernobyl accident in the Soviet Union, which demonstrated the gravity of a nuclear accident in graphic terms that both expert and layman could readily understand. However, it was not until early 1988 that the antinuclear power movement started to have a real impact on the government's plans to develop nuclear power. Antinuclear interest in Japan was scarce until the publication of the heavily documented *Kiken na Hanashi* (A Dangerous Story: Chernobyl and the Future of Japan). This book by Takashi Hirose sold hundreds of thousands of copies and sparked a nationwide firestorm of antinuclear activism enlisting urban young people and housewives.

Like France, Japan had been a darling of the nuclear power industry, but the spate of media publicity about nuclear power's safety problems in early 1988–publicity that the industry was unable to effectively counter–has buttressed public resistance and made it extremely difficult to find new sites for nuclear power facilities.

At present, Japan has 37 nuclear power plants generating 30 million kilowatts (30 GW) of electricity yearly (Table 2). This accounts for 25% of Japan's total electrical power generation. There are also 13 new facilities under construction with an expected output of about 13 million kilowatts, and additional facilities with an estimated output of 3.5 million kilowatts have been approved by the Electric Power Development Coordination Council. When all of these facilities come on stream, they will provide a total of over 46 million kilowatts. However, local opposition is likely to delay some of the additional facilities in the planning stage, and 45 million kilowatts is a more plausible estimate of output by the year 2000.

Using an electricity demand outlook slightly higher than past figures, it seems most unlikely that the industry will achieve its goal of having nuclear facilities generate 40% of total electricity output by the year 2000, and 33% is a much more reasonable estimate (Fig. 1).

With the spread of the antinuclear movement and the deep-rooted fear that nuclear power is inherently unsafe, the government and the industry will have a very difficult time indeed gaining public acceptance for more nuclear power in the years ahead. Yet given the need for even greater energy output beginning in 2010 or so, it is essential that determined efforts be made to salve public anxiety

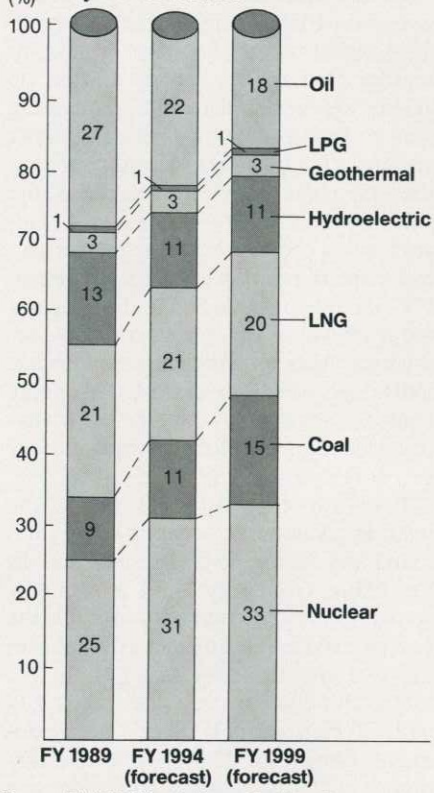
Table 2 Usage by Power Source

(million kw)

	End of FY 1989		End of FY 1994		End of FY 1999	
		(%)	(forecast)	(%)	(forecast)	(%)
Hydroelectric	36.32	21.6	39.88	20.4	43.96	19.6
Ordinary	19.32	11.5	19.82	10.1	20.98	9.4
Pumped storage	17.00	10.1	20.06	10.3	22.98	10.3
Thermal	102.37	60.9	115.07	58.9	131.95	58.9
Coal	11.69	7.0	17.31	8.9	27.03	12.1
LNG	34.76	20.7	42.27	21.6	49.62	22.1
Geothermal	0.18	0.1	0.34	0.2	0.77	0.3
LPG	1.00	0.6	1.00	0.5	1.50	0.7
Oil, etc.	54.74	32.6	54.14	27.7	53.03	23.7
Nuclear	29.28	17.4	40.37	20.7	48.14	21.5
Total	167.97	100	195.32	100	224.05	100

Notes: 1. These figures do not include in-house power generation.
2. The figures for coal, LNG and LPG include that mixed with oil.
3. LNG includes natural gas usage.
4. Due to rounding, total figures are not necessarily equal to the sum of the source-specific amounts.
Source: FY 1990 Electric Power Facilities Construction Plan

Fig. 1 Outlook for Electric Power Output by Power Source



Source: FY 1990 Electric Power Facilities Construction Plan

over nuclear safety and to win the public's trust.

Coal-fired electric power facilities are presently generating about 11.7 million kilowatts, but new facilities under construction will add another 5 million kilowatts and there are plans for an additional 11.8 million kilowatts of capacity. By the year 2000, coal-fired plants should have a total output of 27 million kilowatts and should produce 15% (up from 9% at present) of Japan's total output. Coal-fired power, however, also faces environmental roadblocks as concerns about global warming seem likely to lead to restrictions on carbon dioxide emissions and thus slower growth for coal-fired facilities.

The present output from LNG-fired plants is 35 million kilowatts, while plants capable of producing an additional 6.8 million kilowatts are under construction, and others able to produce about 700,000 kilowatts are in the planning stage. The estimated LNG output capacity for the year 2000 is about 50 million kilowatts, which will make this a more important power source than nuclear power. However, there is resistance to this type of power production as well.

While LNG has not been implicated as a polluter, local residents are nonetheless anxious about the possibility of a disastrous accident. Economically as well, LNG is not necessarily the most attractive alternative. The high capital outlays required for LNG terminals and its special distribution network and the fact that LNG prices are linked on a caloric basis to the import price of crude oil make LNG somewhat pricey. In addition, companies have fought for take-or-pay clauses in their contracts as one way of spreading the investment risks, and this limits energy policy flexibility. Because LNG facilities are used for middle and peak loads, LNG's present 20% share of total electricity output is unlikely to change substantially over the next decade.

There is some concern, however, that restrictions on carbon dioxide emissions will shift demand to natural gas (since burning natural gas gives off only 60% as much carbon dioxide as coal and only 70% as much as oil) and that this will push natural gas prices up. However, the environmental attractions should be more than enough to offset this higher price. Thus the real long-term concern is that the entire world will turn to natural gas in the 1990s and that, despite the abundance of natural gas reserves, Japan will find it difficult to buy as much as it wants.

The International Energy Agency (IEA) has banned the construction of new oil-fired electric power facilities. Thus the goal in oil-fired policy is one of maintaining the present 55 million kilowatts a year capacity as long as possible. Since electric power demand varies sub-

stantially depending on the time of year and even the time of day, the most efficient mix is to use capital-intensive nuclear plants and coal-fired plants to cover the constant base load and to use LNG-fired plants for the middle and peak loads. Oil-fired plants are designated for peak-load times because of their operational efficiency. When nuclear, coal and other energy sources prove inadequate, however, oil-fired facilities will have to come to the rescue. It is thus imperative that capacity be raised to about 70% of base load, even though there is concern as to whether or not it will be possible to acquire enough C-grade fuel oil when such situations arise.

Oil demand has been growing in all areas: transportation, home heating, industrial use and for electric power plants. Because it is so easy to use, it seems certain to remain the most relied on energy source, and this means it is essential to ensure stable access to guaranteed supplies. At the time of the first oil crisis in 1973, oil supplied 78% of Japan's energy. By 1985, this was down to about 55%, mainly because of higher crude oil prices and efforts to shift to alternative energies. However, oil demand has been increasing faster than demand for alternative energies since 1986, and the oil dependence has inched upward until it was 57% in 1988.

If this trend continues, including sluggish growth in demand for alternative energies, oil dependence may top 60% in the 1990s. This would in turn push the dependence on overseas energy sources from 83% at present to over 85% and would drive the dependence on Middle East sources from 68% of all crude oil imports at present to over 70%, making Japan's energy situation less secure. It is thus imperative that steps be taken now to diversify energy sources, to expand stockpiles, and to otherwise ensure that Japan has stable energy supplies.

In the late 1960s and 1970s, Japan applied itself to the endemic pollution problems spawned by its rapid economic growth. Among the energy-related pollution issues are air pollution from sulfur oxides, and the response was to switch to low-sulfur energy (natural gas, low-sulfur crude and heavy oil, and low-sulfur coal) and to install desulfurization devices. Nitrogen oxides are more difficult to control, but a solution is in sight for stationary sources (such as electric power plants) and attention is now shifting to moving sources (such as diesel-powered trucks and automobiles). Japanese controls on sulfur oxides and nitrogen oxides are among the most advanced in the world.

Between neighbors

Acid rain, an environmental problem that is global in nature, is said to be caused by sulfur oxides and nitrogen oxides. For geographical reasons, however, there is little chance that Japanese sources will pollute neighboring countries, and Japan's comprehensive air pollution policies have virtually eliminated fears that Japan might be a source of acid rain on its own. Yet acid rain is no respecter of borders, and surveys have found that Japan is affected by acid rain originating in China and other mainland countries that use large amounts of coal.

While this will eventually become an international issue in Asia just as it has in Europe and North America, the underlying North-South problem will make it even more difficult to find a solution. There is little hope of eliminating the acid rain that falls on Japan unless Japan takes the initiative in providing both technical cooperation and financial assistance to help the polluting countries.

The global warming caused by the large amounts of carbon dioxide released into the air from fossil fuel combustion is even more complex and even more of a global problem than acid rain is. Even though there is no clear-cut scientific proof of a causal link between carbon dioxide emissions and global warming, the leading industrial countries are already moving to restrict and reduce carbon dioxide emissions.

Judging from reports, Europe seems to be very supportive of strict regulations while the United States and Japan are hanging back and taking a go-slow approach. However, in a bid to retain the international initiative, the U.S. seems to be making a clear distinction between what it says for public consumption and what it does behind the scenes. Japan, on the other hand, is still struggling to find a proper response to this very political, somewhat ambiguous, and complex international problem. Japan's position is complicated by the fact that failure to respond appropriately could shut Japan out of the international decision-making loop and make it a pariah in the international community.

Approximately 60% of global warming is blamed on the combustion of fossil fuels, and the various countries' shares of total world carbon dioxide emissions are currently 24% for the United States, 16% for the Soviet Union, 10% for China, 4% for Japan, 3% each for West Germany and Britain, and 2% each for France, Italy and India. Since 53% of carbon dioxide emissions are spewed out by the socialist and developing countries, no international agreement restricting carbon dioxide emissions will mean anything unless these countries are signatories.

Although Japan ranks fourth on the CO_2 list, it is responsible for only 4% of all emissions worldwide. However, that does not let Japan off the hook. Asia, including China and India, emits more than a quarter of the world total, and Japan should make a vigorous effort to support Asian emission reductions, both technologically and financially. Handled right, Japanese environmental assistance for the rest of Asia can contribute importantly both to coordination among the industrial countries and to the solution of the North-South problem.

The dual energy and environmental imperatives are bound to make the 1990s a very trying decade for Japan. Known as an economic giant but a political dwarf, Japan needs to take the initiative and put its technological prowess to work in helping solve the many energy and environmental problems confronting today's world.

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