Progress in Implementing Energy-Saving Measures

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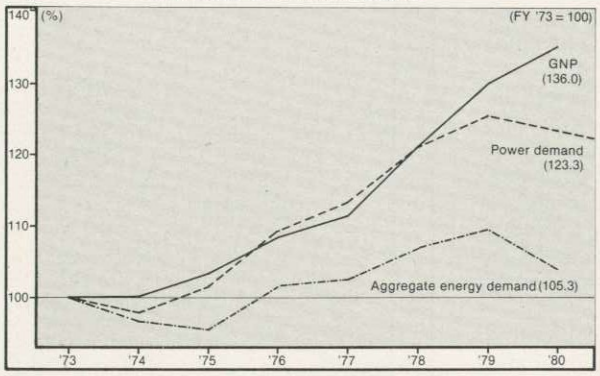
Japan's gross national product (GNP), which had been growing in the past at a rate close to 10%, dropped sharply after the first oil crisis in 1973. In 1974, there was zero growth, but in the following year it recovered to the 5% level. In fiscal 1980, Japan's GNP was 136% of the fiscal 1973 level (Fig. 1).

On the other hand, the increase in energy consumption was held down to a small margin, with aggregate energy consumption in fiscal 1980 being 105.3% of that in fiscal 1973. With respect to petroleum consumption in particular, Japan's crude oil imports in fiscal 1980 were below the import target figure set at the 1979 Tokyo Summit of industrially advanced countries and Japan was able to abide by the agreements reached at the IEA (International Energy Agency) ministerial conference and at the Venice Summit (Table 1).

Fig. 1. Trend of Energy Demand in Japan



(Notes)
1. Compiled on the basis of "Overall Energy Supply-Demand Balance" (in terms of calories) from *Overall Energy Statistics* (1981) published by the Agency of Natural Resources and Energy
2. Power demand includes privately generated electricity
3. GNP is real based on 1970 prices

Table 1. Petroleum Supply and Demand Targets and Actual Results

	1978	1979	1980	1981	1982	1983	1984	1985
Petroleum imports agreed upon at Tokyo Summit (10^4B/D)	(523)	540	540	—	—	—	—	630 / 690
Petroleum supply program (decided by the Japanese Government)(10^4B/D)	(523)	530	488	498	521	530	554	571
Demand for petroleum products (fuel oil) (10^6Kl)	240	238	210	210	219	226	231	236

Solar power generating plant in Shikoku, Japan

This achievement was due to the vigorous conservation efforts made by the industrial sector to cope with soaring oil prices and with the uncertainty over the oil supply. The private sector voluntarily switched to alternative energy sources wherever possible. In early 1980, the Diet (parliament) adopted legislation to promote the development and utilization of energy sources other than petroleum and the Government later established targets for development and utilization of substitute energy.

Fig. 2 shows the structural changes that occurred in the demand for petroleum in Japan. The volume of petroleum imports and energy consumption have been slowing down in contrast to the growth of GNP and IIP (Index of Industrial Production). Energy conservation and the switchover from petroleum to other energy sources have been progressing.

Fig. 3 shows the basic unit index of energy consumed by representative industries. A rise in the basic unit index of energy consumption was observed immediately after the first oil crisis of 1973 as a temporary phenomenon attributable to the lowering of the plant operation rate as well as to the restrictions on the use of oil and electric power. Subsequently, however, energy conservation was achieved to a great degree through the efforts of corporations. The impact on Japan of the second oil crisis of 1978, touched off by the Iran-Iraq War, was felt not so much in the volume of oil imports as in the price of oil. The impact, however, did not lead to serious consequences, because of greater efforts exerted by the private sector to deal with the problem.

Conservation Efforts of Manufacturing Industry

Fig. 4 shows the basic unit index of energy consumption and the production index in the manufacturing industry. Whereas the production index in fiscal 1980 rose to 122.8% of the fiscal 1973 figure, energy consumption diminished sharply to 72.3% of the fiscal 1973 figure. The basic unit index of petroleum consumption in fiscal 1980 was only 59.3% of the fiscal 1973 level.

These figures are evidence that progress is being made in switching from petroleum to substitute energy sources and in transforming energy-consuming industries into high value-added industries. It is expected that further progress will be made in Japan in the adoption of robots for industrial processes and in the development of so-called knowledge-intensive industries, such as electronics and mechatronics. The switchover from energy-consuming industries to knowledge-intensive industries is expected to continue for some time.

Table 2 shows the decrease in the basic unit index of energy and in the basic unit index of petroleum consumed by key industries. It shows that a move out of petroleum has been progressing in the steel industry while the use of coal to replace petroleum has advanced in the cement industry.

The Japan Energy Economics Research Institute classified the reduction in the basic unit index of energy consumption into that achieved through energy conservation and that achieved by a switchover from oil to substitute energy and attempted the ratiocination shown in Table 3.

This shows that energy consumption for industrial activities climbed slowly until the first half of fiscal 1980 in all except the metal and machinery industries, but registered negative growth thereafter. This reflects the economic recession in recent years.

The switchover from petroleum to substitute energy began to produce results in the latter half of fiscal 1979 even before the promulgation of legislation to promote the development and utilization of alternative energy sources. Fifty percent of the reduction in petroleum consumption in the second half of fiscal 1980 was due to the move out of oil. Conservation of energy, which reached a peak in fiscal 1979, has continued to produce appreciable results. The reduction in energy consumption achieved in fiscal 1980, which was greater than anticipated, was attributable to the combined effects of the switchover from petroleum and the reduction in energy consumption.

The principal energy-saving measures taken by the key manufacturing industries are listed in Table 2. It takes a long time to recoup investment in some of these measures. At present, either the specially recognized depreciation system or the investment tax credit is applicable to energy-saving equipment. While loan and credit systems are being expanded, they are not necessarily being employed efficiently because of the difficulty in predicting the future of the Japanese economy. However, compared with the period immediately after the first oil crisis when energy-saving measures were aimed primarily at raising plant operation rate and rationalizing plant management, the current measures are developing into full-fledged steps towards reducing energy consumption. It is expected that further progress will be made parallel with the change in industrial structure from energy-consuming to knowledge-intensive mentioned earlier.

The manufacturing industry's investment in energy-saving equipment in fiscal

Fig. 2. Structural Changes in Demand for Petroleum

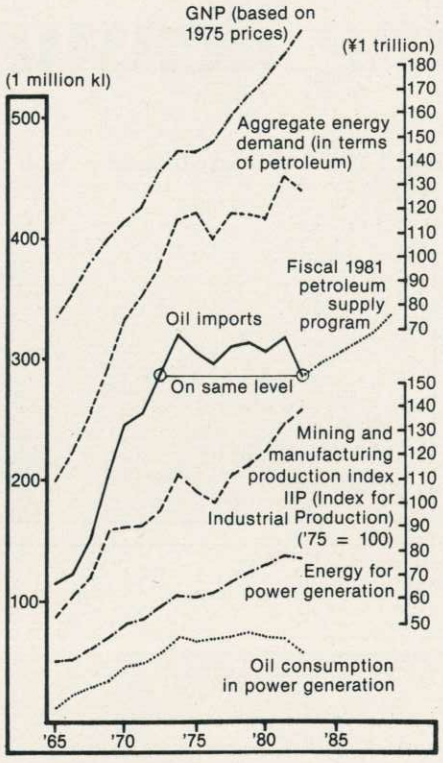
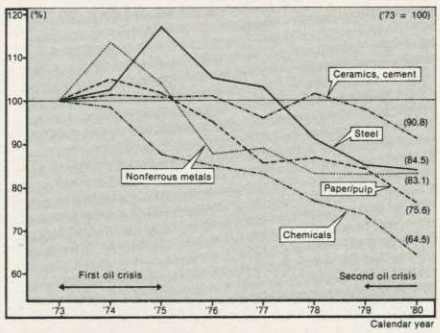
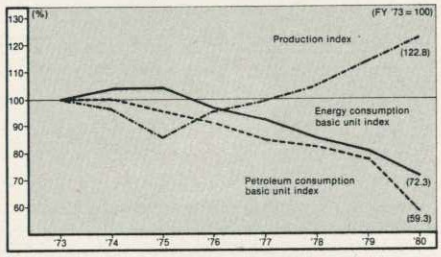


Fig. 3. Trend of Basic Unit Index of Energy Consumption in Key Industries



(Notes)
1. Energy consumption basic unit index = Each industry's energy consumption index/each industry's production index
2. Based on Japan Energy Economics Research Institute's 1980 Energy Balance Table

Fig. 4. Trend of Basic Unit Index of Energy Consumption in Manufacturing Industry



(Notes)
1. Energy consumption basic unit index = Energy consumption index of manufacturing industry/production index of manufacturing industry
2. Petroleum consumption basic unit index = Petroleum consumption index of manufacturing industry/production index of manufacturing industry
3. All based on 1974 values
4. Based on Japan Energy Economics Research Institute's 1980 Energy Balance Table

Table 2. Reduction in Energy Consumption Basic Unit and Petroleum Consumption Basic Unit in Key Industries

Industry	Degree of reduction in energy consumption basic unit (FY '80/FY '73)	Degree of reduction in petroleum consumption basic unit (FY '80/FY '73)	Outline of energy-saving measures
Paper/pulp	91.4%	77.9%	1. Recovery of used heat 2. Improvement of operation control 3. Adoption of continuous production processes 4. Greater use of used paper
Dyeing	81.0%	76.0%	1. Raising energy conservation awareness and thorough enforcement of maintenance and control 2. Recovery and recycling of used warm water and waste heat 3. Installation of energy-saving equipment 4. Improvement of processing conditions, etc.
Cement	79.1%	31.8%	1. NSP conversion 2. Improvement of raw material mill and finishing mill, etc. 3. Use of waste heat 4. Proper control of combustion
Steel	88.0%	43.0%	1. Improvement of operation technology 2. Recovery of used energy 3. Improvement of production processes 4. Raising energy utilization efficiency
Sheet glass	70.6%	67.1%	1. Improvement of holding heat 2. Use of thermal insulation material 3. Renovation of the ceiling of kiln 4. Improvement of heat accumulation efficiency 5. Installation of used heat boiler 6. Adjustment of excess air ratio 7. Improvement of blowoff mechanism 8. Improved heat insulation by sophistication of kiln material 9. Thorough control of lighting in plants
Aluminum smelting	90.0%	68.7%	1. Recovery of liquid waste 2. Improvement of heat insulation 3. Intensified control of combustion 4. Revision of electrodes
Petrochemical (ethylene division)	81.4%	84.2%	1. Recovery of used heat 2. Improvement of compressor 3. Reduction in reflux ratio of distiller process

Table 3. Factors Responsible for Fluctuations in Petroleum Consumption by Type of Industry

	'79 First half/'78 First half			'79 Second half/'78 Second half			'80 First half/'79 First half			'80 Second half/'79 Second half		
	By energy conservation	By Switchover to substitute energy	For industrial activities	By energy conservation	By Switchover to substitute energy	For industrial activities	By energy conservation	By Switchover to substitute energy	For industrial activities	By energy conservation	By Switchover to substitute energy	For industrial activities
Chemicals	−738	160	1495	−923	366	1131	−888	−62	835	−1305	−327	−2219
Steel	−273	195	530	−147	−263	326	−34	−1511	227	199	−1592	−223
Ceramics	−21	−166	303	−81	−426	244	−414	−868	242	−291	−2108	−81
Textiles	20	−9	53	−393	−138	−11	−558	−177	−4	−192	−47	−52
Paper/pulp	−13	31	120	−88	−44	149	−208	−198	152	−161	−248	−111
Metal, machinery	−203	−128	181	−148	−37	207	−231	−77	326	−321	−208	217
Others	−34	182	324	−531	−303	383	−721	−607	449	207	150	17
Total	−1262	265	3006	−2311	−845	2429	−3054	−3500	2227	−1864	−4380	−2452

(Source)
Energy Economics, June 1981 issue, Vol. 7, No. 3

(Unit: 10^{10} Kcal)

1980 was 200% of that of the year before and in fiscal 1981 more than 120% of the 1980 level.

Energy-saving measures are producing results in the manufacturing industry as is evident from the above, but much of the achievement was made by big businesses. Medium and small enterprises, which account for 35% of total energy consumed by the manufacturing industry, are lagging seriously behind and are still in the first stage of energy conservation due to insufficient knowledge of energy-saving technology and lack of investment funds. However, with the industrial structure changing, small and medium enterprises are also expected to make rapid progress as soon as they can see some prospects of business improvement.

Civil and Other Sectors

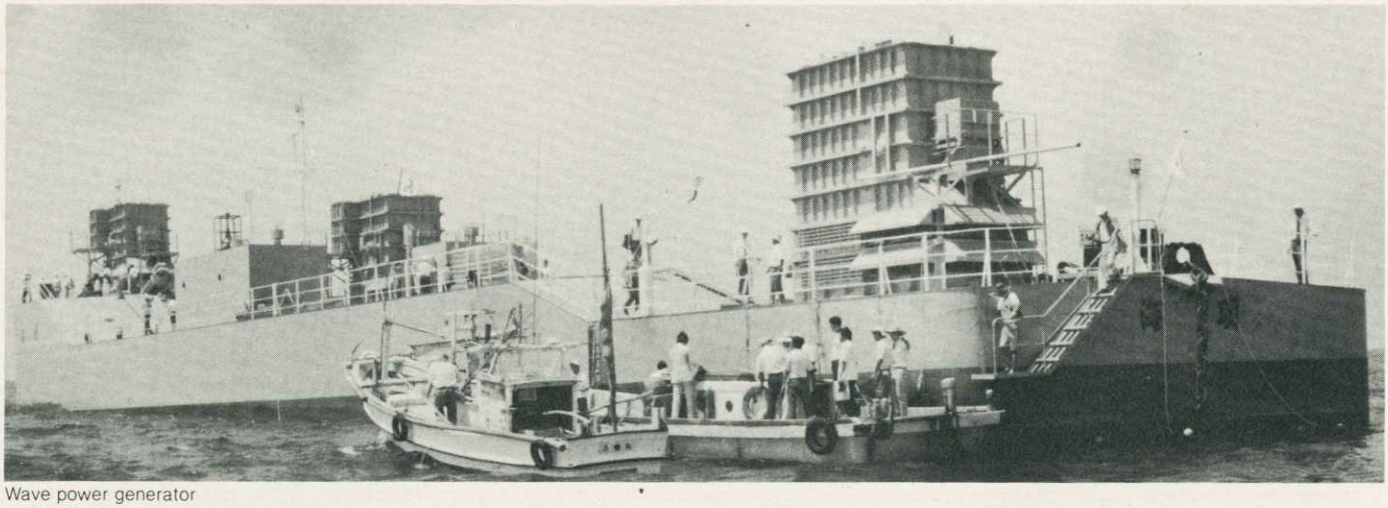
Energy consumption in the civil sector (transportation, office buildings, etc.) in fiscal 1979 was 129% of the fiscal 1973 figure while that in the household sector was 115%. These increases may appear at first sight as signs that little progress is being made in energy conservation in these sectors. However, buildings have installed energy-saving fittings, and cooling and heating systems have been improved to consume less energy. Big buildings are now designed to economize energy consumption by 20 to 30%. Considering these and the high per-household diffusion rate of home electric appliances, plus the widespread appearance of energy-saving appliances on the market, we can say that people are making efforts to conserve energy while at the same time improving their living standard. Substantial civil sector energy conservation was achieved in Japan for the following reasons:

First, Japanese homes are small and consume a relatively small amount of energy compared with homes in the U.S. and European countries. Secondly, the climate in Japan is mild, equivalent to that in Oklahoma City in the U.S., Marseilles in France and Venice in Italy. Thirdly, there is a trend away from central heating toward individual room heating. Fourthly, heat pumps and other air-conditioning systems with high energy efficiency have been developed and popularized. These are major features of the energy-saving efforts being made in the civil sector.

Furthermore, Japanese houses are built to require a relatively small amount of energy, while the Japanese life style is geared to energy conservation. Generally speaking, the Japanese have customs which do not consume so much energy. Therefore, it is not so much that they are concentrating on economizing energy, but that they are leading a well-regulated life while pursuing greater well-being.

Most newly built homes use heat insulation materials. (Houses which use heat insulation materials qualify for larger loans.)

The ratio of aggregate energy consumption in the transportation sector in 1979, with Japan as one, was 4.5 for the U.S. and 1.3 to 1.4 for Britain, West Germany and France. Of all the means of transportation, automobiles were the most energy-consuming, accounting for 66.7% of total



Wave power generator

energy consumed in the transportation sector (in 1979). Comparison of energy consumption of private and commercial vehicles shows the former account for as much as 60% of total car energy consumption. The fuel-mileage ratio of passenger cars in 1980 rose 26% (10 modes) from that in 1973. Motor expressways are being constructed and improved rapidly throughout Japan. Further improvements with a view to improving fuel-mileage efficiency are to be hoped for. For example, attention is being focused on the development of fuel-saving ceramic engines, which are now being tested for practical use.

I have explained the progress Japan is making in energy-saving. I myself have been grappling with the problem of energy conservation in the electric power industry for six years. Judging from the flood of inquiries and requests for advice on ways to conserve energy in all fields from the industrial sector to the home sector, I believe that enthusiasm for energy conservation is very strong in Japan.

Energy-saving buildings have been constructed and exhibited. Highly efficient refrigerators and heat pump air-conditioners have been developed, and an electric power demand control device has been developed and marketed. All of these have proved very popular with the public.

Energy conservation results achieved by Japan are highly appraised by other countries, and future developments in energy conservation in this country are being watched by the world with keen interest. To finance energy imports, Japan uses as much as 50% of its foreign exchange earnings. Also, as one of the industrially advanced nations, Japan has major responsibilities to fulfil in conserving energy. For these reasons, energy conservation efforts will continue, along with stepped up technical cooperation and exchanges with other countries to achieve technical innovations and to ensure energy security. ●

Solar house designed for drastic reduction of energy consumption