

# Summary Report on Japan's Long-Term Energy Supply-Demand Outlook And Future Energy Policy

## Changes in the external and internal energy situation

### 1. An easing of the international oil supply-demand situation

At its 67th extraordinary meeting on March 14, 1983, OPEC (Organization of Petroleum Exporting Countries) decided to cut its benchmark crude oil price by \$5 a barrel. This price cut, the first since the cartel's formation, was necessitated by the drop in world oil demand that resulted from the drastic increase in the price of OPEC crude oil following the second oil crisis.

	1979	1982
OPEC oil supply	32	20
Free world oil demand	52	46
Non-OPEC oil supply	22	24

(Million B/D)

### 2. Changes in the energy demand growth rate and the energy supply-demand structure in Japan

The growth rate of energy demand in Japan has dropped substantially in recent years. Energy demand increased 11% per annum before the first oil crisis; after the crisis this slowed to 3% per annum, and has reversed to a 3% per annum decrease for the three years since the second oil crisis.

These changes in energy demand were caused largely by structural changes in the industrial sector. Of all energy sources, oil suffered the severest drop. On the other hand, electricity experienced a slight increase, while demand for coal and city gas has also increased steadily.

### 3. Decreasing dependence on oil and progress in diversification of energy sources

Japan's dependence on oil dropped steadily from 78% of total energy supply in FY 1973 to 62% in FY 1982. This was the result of direct and indirect changes resulting from a change in the energy supply-demand structure. The direct effect was the development and introduction of alternative energy resources by the electric power generation industry and conversion to non-oil energy sources for fuel in the industrial sector. The indirect effect was the tendency toward increased generation demand.

### 4. Prospects for primary energy prices

With regard to mid- and long-term trends in energy prices, it seems appropriate to assume that world oil supply and demand will tighten, driving oil prices upward. On the other hand, coal prices can be expected to remain stationary in real terms. The price of LNG (liquefied natural gas) may increase along with oil prices, but this will be influenced by the outcome of negotiations between suppliers and Japanese LNG consumers, who now account for 75% of the world's LNG trade.

### 5. Effects of rising energy costs on the Japanese economy

Oil, coal and LNG prices have been rising steadily since the first oil crisis, with great effect on the Japanese economy and society. In the industrial sector, aluminum production dropped about 70% between FY 1979 and FY 1982. In the petrochemical industry, the production of ethylene fell by about 30% over the same period.

Furthermore, residential and commercial sector light and fuel expenses and the price of gasoline have risen faster than the overall consumer price index, owing to price increases for primary energy. These conditions and a relaxation in the world

oil situation have made reducing the cost of energy one of today's most pressing issues.

## Challenges to energy policy and appropriate responses

### 1. Basic concept

(1) Today, 10 years after the first oil crisis, the energy problem is at a turning point, as are Japanese society and the economy as a whole. New energy policy must be based on a recognition of changes in the interdependence of energy and the economy and the resulting structural changes in each sector. Moreover, it must restate basic policy principles if it is to gain the understanding of the nation.

(2) The basic objective of energy policy is to secure a stable energy supply in terms of quantity and price sufficient to meet the nation's energy demand. To this end, it is necessary to work first to guarantee security and secondly to minimize cost. Thirdly, it is essential to establish an optimum energy supply-demand structure that strikes an appropriate balance between security and cost minimization.

(3) With the government's supplemental energy measures, the price mechanism is expected to prove the basic, most efficient path to achieving such an optimum supply-demand structure.

### 2. Minimization of energy costs

(1) Energy costs are reducible to a considerable extent, depending on the energy supply-demand structure. So far, increasing energy costs have been modified by energy conservation, energy conversion and diversification of electric power generation. These efforts must be continued.

a. Energy consumption in FY 1982 declined by about 106 million kl compared with consumption figures for FY 1979, owing to a drop in the energy

consumption-GNP ratio. If all the reduction was in oil, the cost saving by energy conservation would have been approximately ¥6,000 billion.

b. After the second oil crisis, oil dependence in the manufacturing sector dropped from 38.3% (FY 1970) to 27.5% (FY 1981). The effect on energy costs in this one sector of the economy would be a 6.8% (¥310 billion) reduction, assuming coal conversion.

c. The diversification of electric power generation, including the introduction of nuclear power, coal and LNG, reduced power generating costs by some ¥600-700 billion in FY 1982, compared with pre-oil crisis figures.

(2) The government's supplemental energy measures must be employed in pursuing efforts to minimize energy costs. At the same time, the price mechanism must be employed to emphasize economic viability.

### 3. Clarification of the roles of different energy sources

(1) One important task is to clarify the future roles of different energy sources, with particular reference to reducing supply costs but also stressing stability of energy supply.

(2) **Petroleum:** This will continue to be the largest energy source, maintaining its own demand areas and imparting flexibility to the energy supply-demand structure. From the standpoint of ensuring energy security and minimizing cost, however, it will be necessary to reduce Japan's dependence on oil in a flexible and realistic way. This will also meet the need to reduce the nation's energy costs.

(3) **Alternative energy sources:** Generally speaking, it will be necessary to develop and introduce these energy sources steadily and systematically. Alternative energy sources must be promoted selectively, making the best use of the price mechanism and taking security and cost into consideration.

### 4. Requirements for improving the efficiency of the energy industry

(1) **Petroleum industry:** Abolish excess capacity, build more sophisticated facilities, and promote structural improvements.

(2) **Electric power industry:** Create a desirable power load, and build plants efficiently and on schedule.

(3) **Gas industry:** Create a desirable power load, and convert from petroleum to LNG.

(4) **New energy industry:** Establish an economical viable new industry with positive government support. (The potential market is estimated to be several trillion yen after the year 2000.)

### 5. Realization of an optimum long-term energy supply-demand structure

(1) In formulating a demand outlook, it is important to identify structural changes in energy supply and demand and seek

realistic figures. It is also essential to understand future demand trends for each energy source based on final consumption.

(2) From the standpoint of ensuring energy security, it is preferable to lower Japan's dependence on oil. However, oil dependence cannot be reduced to below 50% by FY 1990. It is appropriate to set a policy objective of reducing dependence on oil to below 50% by FY 1995 with proper government support. Flexible and realistic efforts are needed to achieve this goal.

(3) Japan's primary energy supply structure must shift toward minimizing energy cost.

(4) Based on the consideration outlined above, it is possible to arrive at tentative estimates of the primary energy supply-demand structures in FY 1990 and FY 1995 (Table 1).

### 6. Securing energy financing

Huge amounts of capital will be required in the energy field. In the private sector, steady investment in energy-related fields can be promoted by creating conditions conducive to smooth financing. In public financing, policy must first be prioritized and greater efficiency pursued, while expenditures should be carefully reviewed in order to provide a sound basis for securing needed funds.

## Prioritized efficient promotion of integrated energy measures

### 1. Requirements for securing a stable petroleum supply in light of changes in the supply-demand structure

(1) Secondary oil processing facilities should be expanded and production adjusted toward an increasingly lighter product mix, with the available crude oil mix shifting toward a heavier one. Structural improvements such as inter-firm cooperation and business consolidation of firms should be promoted. The current pattern of importing crude oil and refining it locally should remain the basic method for the future. However, a gradual shift toward internationalization should also be encouraged when necessary conditions are satisfied.

(2) The current policy objective for oil stockpiles (equivalent to 90 days consumption by private firms and 30 million kl by the government) should be maintained and achieved. However, this policy should be applied flexibly in the case of government stockpiling, allowing for shifting stockpiles from tankers to vacant private tanks onshore or even postponing the completion of permanent facilities.

(3) Overseas petroleum development by Japanese companies is the best way to procure stable crude oil supplies. It should be actively pursued in keeping with the development target.

## 2. Promoting the development and introduction of alternative energy sources with emphasis on mid- and long-range supply costs

### (1) Development of new energy technologies

Various projects will continue to be evaluated in an integrated way, with an emphasis on mid- and long-range supply costs.

a. Projects to be positively promoted  
Coal liquefaction and gasification (with the three processes currently under separate development to be unified into the new NEDO system), photovoltaic, fuel cells, oil shale, etc.

b. Projects not to be stepped up for the time being  
Solar thermal power generation, hydrogen production by water electrolysis

### (2) Development of alternative energy resources

With respect to liquefied natural gas (LNG), the most pressing task is to review the existing rigid pricing formula linking LNG prices to crude oil prices and to modify supply conditions, which now require a "take or pay" clause.

As for coal, plans for developing overseas coal resources are being slowed down in light of the recent sluggish demand for energy. From a long-term perspective, however, constant efforts must be made to promote coal development to keep pace with an expected steady increase in demand in the future.

In the case of uranium fuel, half of all new acquisitions should be developed by Japanese firms overseas, and supply sources diversified.

### (3) Introduction of alternative energy resources

Studies are to be made as to how enterprises can introduce alternative energy in the energy supply-demand structure. There is also need for a system by which distributed-type energy resources can be supplied stably and at low cost. Energy source selection will in principle be based on the price mechanism.

### 3. Promotion of mid- and long-term energy conservation

Energy conservation must evolve from a temporary stop-gap measure into a long-term structural approach encompassing the development of new technology and transformation of the production process.

### 4. Encouraging diversified power generation to reduce generation costs

(1) Reduce construction costs of new power plants (a 10% reduction is expected provided safety can be guaranteed).

(2) Diversification of electric power sources contributes to lower electric

power costs as well as guaranteeing a stable power supply. The basic directions for the development of electric power sources are described below.

a. **Basic supply capacity:** Nuclear power, coal-fired power generation (nuclear fuel cycle must be established for nuclear power plants).

b. **Middle supply capacity:** Coal-fired, LNG-fired power generation (LNG transaction conditions must be improved. It will not be appropriate to promote LNG-fired power generation over the long term unless it can be rendered economically viable).

c. **Peak supply capacity:** Utilization of existing oil-fired power generation (development of pumped hydro electric storage should be kept to the necessary minimum).

(3) Power demand should be managed so as to reduce power costs through creating a desirable power load; this could involve expansion of the supply-demand adjustment contract system.

(4) Measures should be studied to make the system for setting electricity prices more responsive to changes in the demand structure while maintaining fairness and the cost-price principle.

**5. Formulating a long-term energy supply-demand outlook that harmonizes energy security, cost and other factors**

This report includes tentative estimates for FY 1990 and FY 1995 which provide for a balance among security, cost and other factors. The previous outlook should be promptly reviewed based on these figures.

Target years:

- (a) FY 1990  
(estimate-based target)
- (b) FY 1995  
(policy-oriented target)
- (c) FY 2000  
(prospective target)

**Table 1 Tentative Estimate of Primary Energy Supply-Demand Structure**

Energy type	Fiscal Year	FY 1990		FY 1995
		Actual	Present estimate	Previous estimate
<b>Alternative energy source</b> (million kl)				
		149	Approx. 220-230	300
Coal		72	81-86	115
Nuclear power		27	48-51	67
Natural gas		27	56-60	68
Hydraulic		22	26-27	30
Geothermal		0.4	1.5-2	6
New fuel oils, new energy, etc.		0.9	7-12	15
<b>Petroleum</b> (million kl)		240	Approx. 240-250	290
<b>Total supply</b> (million kl)		389	450-480	590
				500-550

Note: Fiscal year = March-April

**Table 2 Assessment of Five Major Alternative Energy Sources**

	Coal	Nuclear power	Natural gas	Hydraulic power	Geothermal energy
<b>Supply stability</b>	Coal resources exist in abundance primarily in industrialized countries, assuring stable supplies on a long-term basis. Expanded use of a wide variety of grades of coal through development of new technologies will increase the overall coal supply volume.	Nuclear fuel, once charged into reactors, lasts about one year, exhibiting the same effect as stockpiling fuel. Establishment of a fuel cycle assures supply stability as a semi-indigenous energy. Commercial operation of fast breeder reactors will drastically improve effective utilization of uranium resources.	World reserves as large as oil's. Maldistribution of reserves is limited. Long-term contracts assure supply stability.	Wholly indigenous and inexhaustible energy source with high supply stability.	Indigenous energy resources exist in abundance throughout the country and long-term supply stability can be expected.
<b>Economic viability</b>	Competitive with oil in price.	Competitive with conventional thermal power. Moreover, high capital cost makes it increasingly competitive as depreciation of plant and equipment proceeds, while relatively lower fuel cost makes it immune to fuel cost fluctuations, thereby increasing economic viability from a long-term perspective.	Current pricing formula on a crude oil parity basis needs revision. "Take or pay" clause reduces responsiveness to demand fluctuations.	Initial capital cost high, but fuel cost zero, and as operation continues, the cost becomes progressively lower over the resource's long useful life.	Initial capital cost high, but fuel cost zero, and as operation continues, the cost becomes progressively lower, thus making it economical over long term. How to minimize financial risks involved in finding good production wells a crucial problem.
<b>Usage</b>	New coal utilization technologies will expand use of coal in addition to existing applications as raw material for steel mills and fuel for thermal power generation and industrial uses. Continued environmental considerations necessary for its use as fuel.	Most promising base supply of electric power. Safety precautions an essential prerequisite.	Ease of combustion control and cleanliness make natural gas a suitable fuel/raw material for thermal power generation and city gas production near urban areas.	Contributes to electric power supply stability and to the local community as it provides local energy and multiple utilization of water resources.	Primarily supplied as electric power, but small-scale utilization of hot water as local energy source also possible. Harmony with environment essential for development.

NEDO is a governmental body established under the Law Concerning Promotion of the Development and Introduction of Alternative Energy Sources on Oct. 1, 1980, to develop such technology for oil alternative energies as is particularly needed to be commercialized, to assist the development of geothermal resources and overseas coal resources, and to comprehensively carry out other lines of business necessary, to promote development of oil alternative energies, etc.