

Petrochemical Industry Striving for Revitalization

By Takuya Araoka

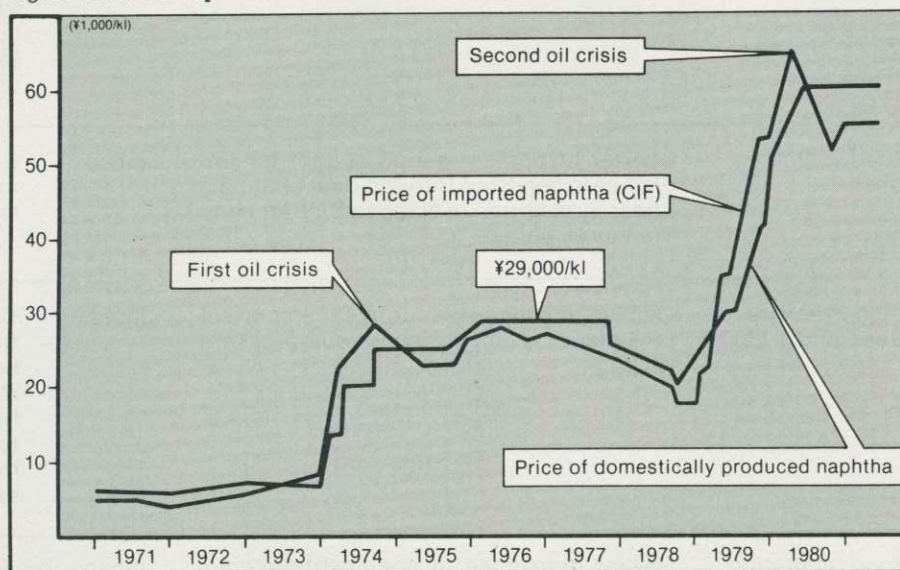
Japan's petrochemical industry is wallowing in a very serious recession. The earnings of petrochemical companies deteriorated rapidly starting in the mid-1980s when the second oil crisis, touched off by the stoppage of Iranian oil exports in November 1978, subsided. They have been in deep waters for two years now. The petrochemical industry's current recession is accompanied by the unprecedented phenomenon of an increase in imports and a decrease in exports of petrochemical products. There is no telling when the industry will be able to emerge from the long, dark tunnel. Against this background, the Minister of International Trade and Industry in April 1981 requested the Industrial Structure Council to conduct a study on "The Desired Structure of the Petrochemical Industry in the 1980s and the Measures Required to Achieve It."

After a year's study of the present situation and future outlook of the petrochemical industry, as well as the measures needed for its rehabilitation, the Industrial Structure Council submitted a general report to the MITI Minister in June 1982 and is now drawing up proposals for concrete measures for restructuring the petrochemical industry, with the recommendations due to be completed at the end of November. At the same time, the government and the industry are discussing ways and means to revitalize the industry, whose future is far from encouraging. This article reviews the process of development of the petrochemical industry, analyzes its present situation, projects its future and explains the basic thinking underlying the recommendations of the Industrial Structure Council.

A Prosperous Past but a Difficult Present

The petrochemical industry was established in Japan in the latter half of the 1950s and attained high growth as a basic material industry. The availability of a stable supply of crude oil smoothened the switch in the source of chemical raw mate-

Fig. 1. Trend of Naphtha Prices



(Source) Chemical Economy Research Institute

rial from coal to petroleum and demand for petrochemical products expanded steadily as a result of the series of technical innovations in the high polymer synthesis industry. Growing demand enabled the petrochemical industry to install large-scale production facilities whose scale merit resulted in the reduction of cost and in the lowering of the relative price. As a consequence, demand for petrochemical products expanded further, touching off a benign cycle. The scale of plant and equipment investment was huge. This capital investment and the diffusion of petrochemical products made it possible for Japan to attain high economic growth through the development of heavy and chemical industries which became the main pillars of her economy. Thus, the petrochemical industry grew into what was called a leading industry.

In 1965, Japan's exports of petrochemical products exceeded imports for the first time and, in 1970, Japan boasted the world's second largest ethylene production, next only to the United States. The environment which nurtured the petrochemical industry began to change drasti-

cally around 1970. The deterioration of the environment picked up speed suddenly after the first oil crisis of 1973. In other words, the high economic growth throughout the world made possible by the stable quality and supply of low-cost petroleum had created a situation in which the demand for petroleum tended to exceed the supply. This trend became a pressure to push the price of petroleum sky high.

The environment being such, the Japanese petrochemical industry, which, like its European counterpart, depends on naphtha as the principal raw material, suffered from rising cost (Fig. 1). This cost rise was passed on to prices of petrochemical products with the result that the relative price was pushed upward and the growth of demand slowed down.

To meet the high demand in the 1960s, large-scale ethylene plants with an annual output capacity of 300,000 tons were constructed and the total ethylene production capacity increased sharply. The subsequent slowdown in the growth of demand caused a chronic surplus of production facilities in the Japanese petrochemical

industry. The skyrocketing price of crude oil after the first oil crisis caused the surplus in plant facilities to become an increasingly serious problem (Table 1). Affected by an increase in cost and sluggish demand, the petroleum industry's profit ratio constantly stayed far below the average of all manufacturing industries.

At the time of the second oil crisis of 1979, the Japanese petrochemical industry posted its biggest-ever profit and enjoyed short-lived prosperity, as it did at the time of the first oil crisis. However, in the second half of 1980, the petrochemical industry as a whole began to suffer losses, plunging headlong into a serious slump. Table 2 shows that only three petrochemical companies posted profit in the settlement of accounts for 1981. The profits of two of these companies were due to big earnings in divisions other than the petrochemical division. Their petrochemical divisions suffered losses. Thus, in actuality, only one of Japan's 12 companies owning naphtha centers posted a profit in 1981.

Raw Material Cost-Gap Cuts International Competitiveness

Another factor which has made the situation extremely rigorous for the Japanese petrochemical industry is the increase in imports and decrease in exports of petrochemical products even while the industry is suffering from a recession. This has resulted primarily from the lowering of Japan's international competitiveness consequent to the rising cost of raw material.

The erosion of competitive edge has occurred mainly in relation to the petrochemical industry of other countries which use as raw material ethane extracted from natural gas. For instance, Japanese imports of petrochemical products from natural gas-rich America and Canada have increased sharply. As Fig. 2 shows, the price of ethylene made from naphtha in Japan and the price of ethylene made from ethane in the United States were almost the same until 1972. But the disparity grew after the first oil shock, and it continued to widen further after the second oil crisis. The disparity in cost competitiveness has caused Japanese imports of petrochemical products (in ethylene equivalent) to increase sharply since 1978 (Table 1).

This diminishing price competitiveness has weakened Japan's position in the Southeast Asian market which used to be her big export market, whereas exports to Southeast Asia from the United States have increased, Japan's exports to that region have shrunk proportionately. Moreover, newly industrializing countries,

Table 1. Supply-Demand in Ethylene Equivalents

(Units: 1,000 tons, %)

	Ethylene output (A)	Imports in ethylene equivalents (B)	Exports in ethylene equivalents (C)	Net domestic demand (D) (A + B - C)	Ratio to output		Ratio to domestic demand		Ethylene plant operation rate
					Imports	Exports	B/D	C/D	
1960	78	36	13	101	46.2	16.7	35.6	12.9	97.4
61	107	58	13	152	54.2	12.1	38.2	8.6	75.5
62	232	29	28	233	12.5	12.1	12.4	12.0	75.4
63	346	30	42	334	8.7	12.1	9.0	12.6	82.7
64	505	31	45	491	6.1	8.9	6.3	2.4	69.1
65	777	9	119	667	1.2	15.3	1.3	17.8	82.4
66	1,065	5	218	852	0.5	20.5	0.6	25.6	104.0
67	1,368	13	229	1,152	1.0	16.7	1.1	19.9	92.2
68	1,793	8	280	1,521	0.4	15.6	0.5	18.4	93.3
69	2,400	6	285	2,121	0.3	11.9	0.3	13.4	101.9
1970	3,097	9	567	2,539	0.3	18.3	0.4	22.3	78.3
71	3,537	13	677	2,863	0.4	19.1	0.5	23.6	88.0
72	3,851	22	783	3,090	0.6	20.3	0.7	25.3	80.0
73	4,171	80	616	3,635	1.9	14.8	0.2	16.9	84.5
74	4,176	132	621	3,687	3.2	14.9	3.6	16.8	82.0
75	3,399	3	730	2,672	0.1	21.5	0.1	27.3	66.5
76	3,803	42	672	3,173	1.1	17.7	1.3	21.2	73.2
77	3,979	34	800	3,213	0.9	20.1	0.4	24.9	74.4
78	4,387	113	793	3,707	2.6	18.1	3.0	21.4	73.3
79	4,784	207	588	4,403	4.3	12.3	4.7	13.4	78.7
1980	4,175	197	466	3,906	4.7	11.2	5.0	11.9	69.2
81	3,655	275	446	3,484	7.5	12.2	7.9	12.8	59.8

(Source) Ministry of International Trade & Industry

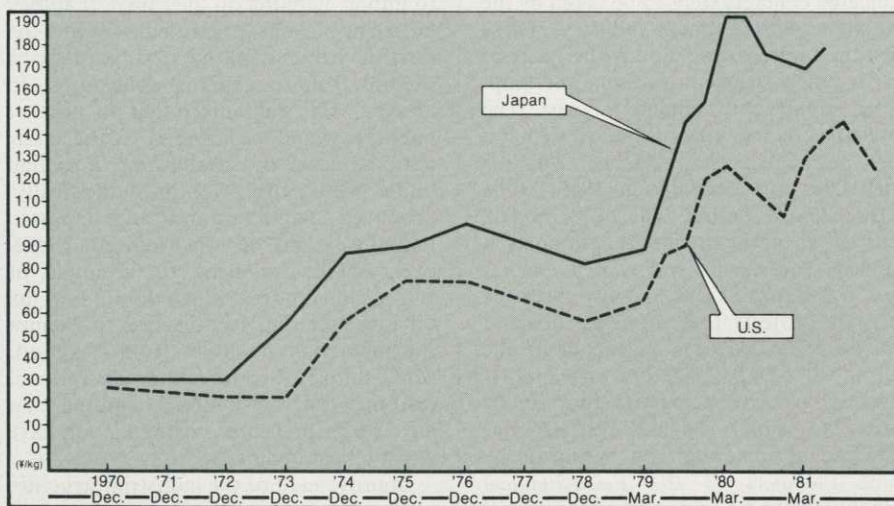
Table 2. Earnings Performance of 12 Companies Operating Naphtha Centers (1981 Fiscal Year)

(Units: ¥1 million, %)

	Sales	Operating profit	Current profit	Before-tax profit	Net profit	Profit carried over to next term
Mitsubishi Petrochemical Co., Ltd. (Jan.-Dec.)	370,846	1,596	-11,325	-3,639	-1,391	680
Mitsui Petrochemical Industries, Ltd. (Apr.-Mar.)	280,341	7,197	-7,019	-2,390	-1,905	4,700
Showa Denko K.K. (Jan.-Dec.)	384,490	18,883	1,487	1,589	572	304
Maruzen Petrochemical Co., Ltd. (Apr.-Mar.)	138,365	-615	-911	-819	-819	-763
Idemitsu Petrochemical Industries, Ltd. (Apr.-Mar.)	300,561	7,673	-3,170	-1,189	-1,189	-68
Nisseki Petrochemical Co., Ltd. (Apr.-Mar.)	297,452	-6,287	-8,504	-5,812	-4,532	828
Tonen Petrochemical Co., Ltd. (Jan.-Dec.)	255,968	5,240	3,552	3,928	1,555	23,899
Shin-Daikyo K.K. (Apr.-Mar.)	128,213	2,081	-3,529	-3,151	-3,151	-3,973
Osaka Petrochemical Co., Ltd. (Apr.-Mar.)	82,727	1,634	-1,008	-1,008	-1,010	-3,986
Sanyo Petrochemical Co., Ltd. (Apr.-Mar.)	192,822	343	-712	-673	-410	-91
Mitsubishi Chemical Industries, Limited (Feb.-Jan.)	756,095	21,951	4,081	3,458	3,008	4,673
Sumitomo Chemical Co., Ltd. (Jan.-Dec.)	640,760	14,725	-2,814	2,342	2,342	502
Total	3,828,640	74,421	-29,872	-7,364	-6,930	26,705
Compared with previous year	-3.5	-61.1	-	-	-	-39.2

(Source) Chemical Economy Research Institute

Fig. 2. Ethylene Price Trends in Japan and the U.S.



(Sources) 1. Data on Japan furnished by the petrochemical industry.
2. U.S. data based on ECN contract price.

such as Taiwan and the Republic of Korea (South Korea), have become increasingly self-supporting in petrochemical products, and they now export a sizeable quantity of petrochemical products.

A new situation marked by increased imports and diminishing exports, coupled with further dwindling of demand for petrochemical products in Japan, has made the problem of surplus plant facilities more serious. At the same time, the drop in plant operation rate resulted in increasing cost of products, which in turn aggravates the loss suffered by petrochemical companies. The loss of competitiveness to ethane-based petrochemical industries has reduced naphtha-based petrochemical industries to the position of limited suppliers in the international market, making them susceptible to changes in the international supply-demand situation. Moreover, because the ethane-based petrochemical industry is producing ethylene almost exclusively, the possibility has appeared that the naphtha-using petrochemical industry's established production system for continuous production of propylene, butadiene, BTX and the like might be ruined, and the operation of their petrochemical plants rendered difficult. Thus, the environment surrounding the Japanese petrochemical industry is extremely severe today.

Supply-Demand Outlook Darkens

The Industrial Structure Council's report in June 1982 suggested medium- and long-range prescriptions for the survival of the Japanese petrochemical industry. The most important point was the call on the industry to uphold the principle of free trade and make positive efforts to cope with international industrial adjustment in the midst of rigorous international competition.

After stressing this point, the report indicated concrete steps to be taken by the Japanese petrochemical industry. These measures were drawn up on the basis of an extremely stringent medium- and long-range supply and demand forecast. The forecast predicts that domestic demand for petrochemical products will be 4,040,000 tons annually in 1985, while petrochemical output will be 3,760,000 tons a year on the premise that imports in ethylene equivalents will exceed exports by 280,000 tons in 1985. As for 1990, the forecast projects that domestic demand will be 4,760,000 tons a year, while the output will be 4,050,000 tons with imports expected to exceed exports by 710,000 tons. This supply-demand forecast was criticized as somewhat too optimistic by some members of the Petrochemical Supply-Demand Council which compiled the medium-range outlook leading up to

Table 3. Ethylene Supply-Demand Forecast

Ethylene total	1981 (actual)			(Unit: 1,000 tons)	1985			1990					
	Domestic demand	Export-import balance	Production		Domestic demand	Export-import balance	Production	Domestic demand	Export-import balance	Production			
	3,484	171	3,655		Interim recommendations			4,340	- 180	4,160	5,078	- 570	4,508
					Final recommendations			4,041	- 277	3,765	4,757	- 712	4,045
					Supply-Demand Council	Optimistic forecast	4,050	- 250	3,800				
Pessimistic forecast	3,870	- 380	3,490										

(Notes) 1. Demand in 1981 is production minus export-import balance.

2. Export-import balance is exports minus imports.

(Source) Ministry of International Trade & Industry

1986. Thus, two outlooks, one optimistic and the other pessimistic, were compiled. The pessimistic outlook projects that domestic demand in 1985 will be 3,870,000 tons while output will be 3,490,000 tons with imports expected to exceed exports by 380,000 tons (Table 3).

According to this pessimistic forecast, Japan's domestic production of ethylene will revert to the level at the start of the 1970s. Apart from the question of whether or not this forecast will prove true, there is no doubt that we must take into consideration the stagnation of domestic demand resulting from price rises and the potential future impact of Middle East countries and Canada which enjoy strong cost competitiveness.

On the basis of these supply-demand forecasts, the Industrial Structure Council's recommendations said that the Japanese petrochemical industry should promote the following fundamental measures: (1) reduction in cost, (2) creation of higher value added, and (3) improvement of the industrial system.

As regards reduction in cost, the petrochemical industry argued that the unreasonably high price of naphtha in Japan was the biggest obstacle to cost-cutting, and requested that they be given freedom to import naphtha on their own, that they be exempt from the petroleum tax and the tariff levied on naphtha, and that they be exempt from stockpiling obligations. In answer, MITI guaranteed that the price of naphtha would be lowered to the international level by establishing a system under which the price of domestically-produced naphtha and of imported naphtha would be synchronized. Moreover, MITI, following the example of European countries which do not levy tax on raw material, has decided to exempt raw material naphtha from taxation. MITI thinks, therefore, that institutional restraints on raw material naphtha that have so far prevented cost reduction have already been removed.

Improvement of the industrial structure and system is most vital to the Japanese petrochemical industry's survival. The

industry has to concentrate production in highly efficient plants and to raise industrial efficiency through joint purchase of raw material and joint marketing of products. There is a strong possibility that surplus plant facilities may touch off extremely intense competition among Japanese petrochemical companies. The long-range target is to strengthen the constitution of the industry ultimately by reducing the number of petrochemical companies. The Industrial Structure Council is expected to submit shortly recommendations on concrete measures to attain this target.

The June report pointed out the importance of the government's trade policy. It was noted that American and Canadian petrochemical products have strong competitiveness because the price of ethane is virtually pegged down by controlling the price of natural gas. Based on this perception, the Council said the Japanese Government must negotiate with these countries to seek abolition of their artificial control of the market mechanism as soon as possible. The Council also urged that if practices in violation of the principle of free trade, such as dumping and export subsidies, should be detected, the government should take appropriate steps according to the GATT (General Agreement on Tariffs and Trade) rules.

Capital Concentration in the Process of International Industrial Adjustment

The Japanese petrochemical industry today consists of 12 companies with 15 ethylene centers. The combined production capacity is 6,240,000 tons a year. However, the total capacity of plants in actual operation today is 5,010,000 tons a year. Considering the fact that ethylene output in 1981 was 3,660,000 tons, it must be recognized that 27% of the existing plant capacity is surplus. The Industrial Structure Council and the Petrochemical

Table 4. Comparison of Production Capacity and Degree of Concentration in Principal Countries (1980)

		Japan	U.S.	W. Germany	U.K.	France	Italy	Canada
Ethylene	Total production capacity (in 1,000 tons/year)	6,257	16,792	4,755	2,075	2,645	1,746	1,793
	Number of companies	12	25	10	5	8	6	6
	Production capacity of biggest company (in 1,000 tons/year)	772	1,909	1,100	650	800	875	546
	Herfindahl Index	0.088	0.067	0.160	0.252	0.190	0.331	0.238
Polypropylene	Total production capacity (in 1,000 tons/year)	1,194	2,423	385	405	350	440	136
	Number of companies	11	12	3	2	5	2	2
	Production capacity of biggest company (in 1,000 tons/year)	220	610	190	255	90	380	68
	Herfindahl Index	0.112	0.118	0.341	0.534	0.207	0.882	0.500
Low-density polyethylene (including LLPE)	Total production capacity (in 1,000 tons/year)	1,681	4,450	1,200	570	1,085	820	444
	Number of companies	10	13	3	4	5	3	4
	Production capacity of biggest company (in 1,000 tons/year)	290	825	740	250	425	430	231
	Herfindahl Index	0.112	0.099	0.461	0.316	0.264	0.389	0.368
High-density polyethylene	Total production capacity (in 1,000 tons/year)	824	3,080	985	166	220	380	256
	Number of companies	10	14	5	1	3	4	3
	Production capacity of biggest company (in 1,000 tons/year)	226	660	420	166	100	160	124
	Herfindahl Index	0.145	0.107	0.284	1.000	0.355	0.304	0.385
Polystyrene	Total production capacity (in 1,000 tons/year)	794	2,670	750	308	530	380	150
	Number of companies	8	19	2	5	7	5	n.a.
	Production capacity of biggest company (in 1,000 tons/year)	254	470	610	80	150	190	n.a.
	Herfindahl Index	0.173	0.099	0.696	0.212	0.169	0.333	n.a.

(Source) Ministry of International Trade & Industry

Table 5. International Comparison of Earnings Performances of Chemical Industries (1979)

(Units: \$1 million, %)

Country	Corporation	Sales	Ratio of net profit to sales	Total liabilities and net worth	Ratio of net profit to total liabilities and net worth	Equity ratio
U.S.	Du Pont (E.I.) de Nemours & Co.	12,572	7.5	8,940	11.0	59.4
	Union Carbide Corporation	9,177	6.1	8,803	6.7	45.9
	Dow Chemical Company	9,255	8.5	10,252	8.2	42.1
	Monsanto Company	6,193	5.3	5,539	6.3	50.2
W. Germany	Hoechst	14,785	1.0	12,750	1.1	21.6
	Farbenfabriken Bayer A.G.	14,196	1.7	13,819	—	20.4
	BASF (Badische Anilin & Soda-Fabrik AG)	14,139	2.4	10,077	1.7	38.8
U.K.	ICI (Imperial Chemical Industries, Ltd.)	11,391	—	12,810	2.6	48.5
France	Rhone-Poulenc S.A.	2,944	—	7,811	2.4	24.0
Japan	Company A (integrated chemical company)	3,559	1.0	4,813	0.8	11.9
	Company B (integrated petrochemical company)	954	2.0	1,214	2.1	12.6
	Company C (integrated petrochemical company)	1,564	1.2	1,551	1.1	10.0

(Source) Ministry of International Trade & Industry

Supply-Demand Council believe that 24-31% of the industry's plant capacity is surplus even in the medium and long run. In order to maintain a proper plant capacity utilization rate, reduction of production facilities is vital.

In terms of the scale of the ethylene production plant, the Japanese petrochemical industry is made up primarily of ethylene plants whose annual capacity is over 300,000 tons. In point of scale, the Japanese petrochemical industry is not inferior to its foreign counterparts. However, from an overall standpoint, it is evident that the Japanese petrochemical industry has relatively small-scaled plants scattered here and there compared with the petrochemical industries of European countries which use the same raw material and which are at the same stage of eco-

nomic growth as Japan (Table 4). This de-concentrated structure is particularly conspicuous in the field of petrochemical intermediates (Table 4). In order to maintain a certain scale, the Japanese petrochemical industry, which has to be content with being a supplier of limited capacity, must combine naphtha centers and intermediate production plants, thus raising production efficiency through concentration of plants as well as improving the industry's cost competitiveness and earnings.

Petrochemical industries throughout the world are suffering from excess plant facilities, as in Japan. The world's combined ethylene production capacity was about 50 million tons in 1981, but the actual ethylene output in that year was only 31 million tons. Even if demand for

petrochemical products should increase in the future, there is little possibility that current surplus plant facilities will become effective supply capacity. This is because, despite the worldwide surplus of petrochemical plant facilities, oil-producing and/or natural gas-rich countries are implementing projects to construct new petrochemical plants to modernize their economies. As a result, the world petrochemical market is destined to become increasingly unstable and risky. The role of governments in effecting global industrial adjustment will assume greater importance now that the world is loaded with surplus facilities.

From its inception through the period of its development and expansion, the Japanese petrochemical industry always borrowed funds from outside sources for purchasing equipment and building plants, because producers had no accumulated capital of their own. Moreover, because they competed against each other in their constant race to grow bigger, they still have little capital accumulation. Compared with their American or European counterparts, Japanese petrochemical companies have a very weak financial constitution (Table 5). To make the situation worse, the operating funds they need have become enormous as a result of the skyrocketing of raw material costs after the two oil crises. The Japanese producers' financial fragility weakens their resistance to recession. Under such circumstances, it is imperative for them to improve their earning power by concentrating capital and scrapping surplus production facilities so that they can cope with the changes expected to sweep the petrochemical industry throughout the world.

The petrochemical industry reorganization plan aimed at concentration of capital and disposal of surplus production facilities is now under study both within and outside the industry. A semi-governmental petrochemical survey mission was dispatched to study the current state of the European petrochemical industry and to obtain pointers for revamping the industrial structure of the Japanese petrochemical industry. On the basis of the findings of this mission, the Industrial Structure Council will shortly present its recommendations which are being awaited with great expectation. ●

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