5-2 Iron and Steel Industry

2.1 Policy Alternatives and Their Implications for Viet Nam

2.1.1 Current Situation and Future Prospects for Viet Nam's Steel Industry

The estimated domestic demand for steel in Viet Nam for 1996 was 1.3 million tons (mostly from construction demand). Domestic production amounts to 300,000 tons, and the rest was imported. The aim of the 5-year plan is to substitute imports with domestic iron sources, taking into consideration future increases in demand.

According to VSC predictions, the demand for steel will be 3.0 million tons in the year 2000. Rolling facilities for the lower process will be constructed through joint ventures with foreign companies, etc. The target for the steel industry in the 5-year plan is to produce 3.0 million tons by the year 2000.

The growth in demand for steel is strongly linked to the growth of the economy. Estimating demand from the growth of neighboring countries in the past, demand is expected to be 2.1 million tons by the year 2000 and 3.4 million tons by the year 2005, lower than as predicted by the VSC.

The various methods to supply steel for Viet Nam's domestic market are: (a) to import the product, (b) to import steel inputs and construct a rolling mill, (c) to construct an electric furnace mill, and (d) to construct an integrated steel mill. Of these, the government has consistently promoted the construction of an integrated steel mill as its industrial policy.

Iron can be produced from iron ore by: (a) direct reduction, (b) blast furnace, (c) direct smelting. (a) The direct reduction process has been adopted for integrated steel mills in ASEAN countries. Plants in Malaysia and Indonesia are currently running. But they are not operating smoothly and problems have been encountered. In Viet Nam, although it depends on the price of natural gas, profits could be difficult to obtain if the natural gas currently considered is used. (b) At present, the use of a blast furnace is the mainstream method adopted by large scale integrated steel mills all over the world. JICA's steel master plan team is undertaking an analysis of the construction of a blast furnace based on the estimated demand for the year 2010. (c) The direct smelting method is currently being studied jointly by leading companies in Japan as the next generation of steel manufacturing. Korea's POSCO was the first to complete a small-scale (around 500,000 tons per year) commercial furnace (in accordance with Australia's COLEX technology), and has already approached the Viet Nam government with this method.

2.1.2 Problems with the Construction of a Blast Furnace

A blast furnace requires an enormous initial investment for construction. In order to enjoy economies of scale from the plant, production capacity must be at least 3 million tons per year. Construction expenses are said to be $1,000 to $1,500 per ton produced annually. Thus 3 million tons would mean $3 to $4.5 billion. In addition, the furnace will require infrastructure such as ports, power generation, and roads. After Korean companies aggressively constructed their facilities, many countries have ceased construction of their own new and powerful facilities due to the risks involved with the massive investments.

In ASEAN, Indonesia and Malaysia started production by the direct reduction method, but neither is operating smoothly. There have been major problems in both countries. The direct reduction method cannot produce high value-added steel sheets for automobiles. Both countries are planning to construct blast furnaces inside their countries if domestic users increase. At the moment, Indonesia is

asking POSCO and Malaysia Kawasaki Steel for a feasibility study of blast furnace construction. Construction of a blast furnace is also under consideration in Thailand's private sector.

Japan is said to be the strongest steel producer for various reasons. Japan still stands unrivaled in terms of producing the highest value-added steel for automobiles. But Korea is also developing into a powerful competitor. The main factors for the launch of POSCO were the government's strong will and technical and financial support from Japan. China's Baoshan Iron and Steel was also launched with Japan's technical support. The construction of a blast furnace in an ASEAN country is an unprecedented investment, and should be planned with the awareness that failure would lead to the most distressing of consequences.

Compared to neighboring countries, Viet Nam's demand for steel is low, and the construction of a blast furnace to supply only the domestic market would not prove lucrative as yet. However, should CEPT be put into action within ASEAN, and the whole of ASEAN targeted as a market while being protected to a certain extent from external regions, it may be possible for the first blast furnace constructed to be profitable. Plans for a second furnace, however, may be excessive. If several blast furnaces are constructed, each country's self-interest will be prioritized, CEPT will not be put into action, and eventually domestic users may become the main clients.

2.1.3 Paths to Construct New Facilities in Viet Nam

Several scenarios exist for the construction of a steel mill in Viet Nam.

(1) Construction of a blast furnace

In the best of circumstances, the blast furnace in Viet Nam will become the only new and advanced powerful blast furnace in ASEAN, and become the sole supply source for automobile manufacturers throughout ASEAN. However, there are several challenges to overcome in order to achieve such a scenario. Even assuming things go smoothly technologically, if there is no market for the high value-added products, there will be neither the time nor the money to endure the surplus production, the investment for maintenance and repairs, and the facility will therefore age while deficits remain.

Thach Khe iron ore mine has 200 to 300 million tons of exploitable deposits and annual production is expected to be 10 million tons. This level is relatively small compared with current world production. Thus, if this mine is developed, the cost of domestically produced ore may turn out to be higher than the cost of imported ore. If the blast furnace is forced to use Thach Khe iron ore, the higher input costs will undermine the financial viability of the project.

(2) Construction of a direct reduction furnace

Since the production capacity of a direct reduction furnace is around 500,000 tons per year, the initial investment is not as large as for the blast furnace. However, unless natural gas can be obtained nearby and supplied cheaply, it is very unlikely that the project is financially viable. If natural gas is supplied through pipelines from distant sources, costs will increase. Moreover, even if gas can be obtained efficiently, poor planning will prevent the project from bringing in the level of profits achieved in the cases of Malaysia and Indonesia. This will impose an enormous burden on the national economy. But if gas fields are found near Thach Khe, it may be possible to build a small and efficient direct reduction furnace which will use domestic gas and iron ore.

(3) Construction of an electric furnace

Due to small investment requirements (50 to 120 million dollars), it is easy for the VSC to form a joint venture with overseas electric furnace manufacturers to engage in the construction of an electric furnace. This will supply the steel for construction demand. But with a rise in the demand for scrap metal in Southeast Asia anticipated, there is a risk that scrap metal will be expensive and difficult to import.

(4) Construction of a rolling mill based on imported steel inputs (billet).

The small investment requirement (20 million dollars) makes it easy for the VSC to do business alone or in a joint venture with foreign companies.

The amount of value-added production capacity which will remain in Viet Nam under each scenario decreases in the order of the presentation above. Cheap Russian exports are currently meeting construction demands and the international market is bearish. It is possible to simply import steel products. In this case, no value-added capacity will remain in the country and the trade deficit will grow.

2.2 Phased Development of the Iron and Steel Industry

2.2.1 Production Process and Product Characteristics

(1) Steel production process

The process of making steel consists of two stages: the upper and lower process. (Figure 2.1) The upper process contains three steps: iron making, steel making and casting. The lower process also has three steps: hot-rolling, cold-stripping and coating.

1) The upper process (iron making, steel making, casting)

Iron contains carbon. The higher the carbon content is, the harder and more fragile the iron becomes. On the contrary, the lower the carbon content, the softer and more flexible the iron becomes. Iron containing over 1.7 % carbon is called pig iron, and iron with less than 1.7% carbon is called steel.

Iron ore is turned into pig iron, after being melted and deoxidized in either a blast furnace or a direct reduction mill (the iron making process). Pig iron is turned into steel by melting it in an oxygen furnace or an electric furnace, adding certain metallic elements, and removing impurities (the steel making process). Steel is cast into semi-finished products such as slab, bloom and billet (the casting process).

According to the metallic element to be added, two sorts of steel are distinguished: ordinary steel and special steel. Ordinary steel is used for general construction. Special steel is used as an intermediate input for manufacturing. The steel industry in Japan, which has been altering its strategy from one based on quantity to one focused on quality in recent years, is making efforts to develop a special steel with high added value. The share of special steel has been rising every year, and is now up to 15% of all steel production.

2) The lower process (hot-rolling, cold-stripping, coating)

Semi-finished steel products are turned into long products, sheets, types and tubes through the process of rolling. Billets are formed into long products such as shapes or bars through the process of hot-rolling in which the steel ingot is heated very intensively and rolled. Wires are made from these long products through a cold rolling process. Sheets are made through the process of hot and cold

rolling. Cold rolled sheets are turned into high value-added coated sheets through treatment of the face, such as coating or plating. For production of high quality sheets, high quality steel ingots made in blast furnaces are needed.

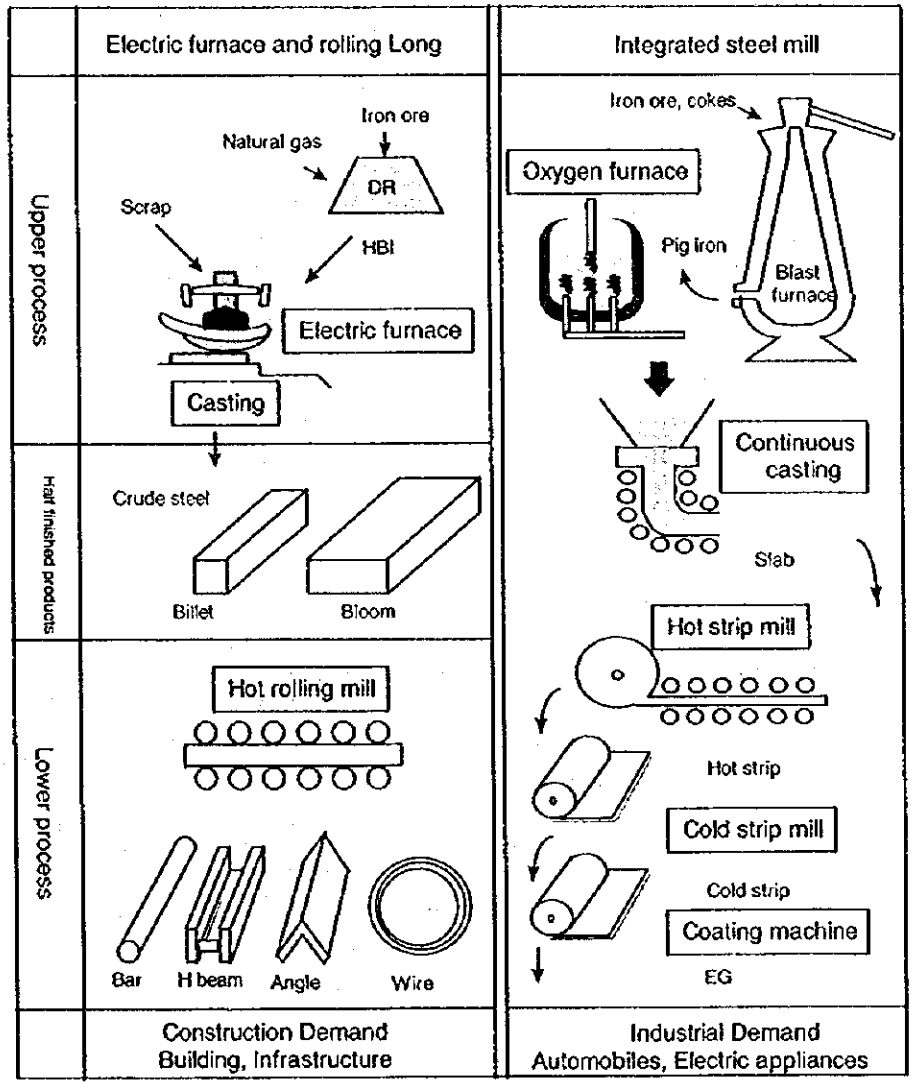


Figure 2.1 Two methods of steel production

(2) Product characteristics and type of buyer

Ordinary consumers scarcely have any chance to buy steel products as final consumption goods. Steel products, such as long products, sheets and types, derive the great variety of their sizes and shapes according to their demand sectors. The more they are processed, the higher their prices are.

1) Use of steel products

Bars, H beams, and angles are called long products. Long products are used for the construction of private housing, civil engineering and infrastructure. Demand for long products grows rapidly at the initial stage of industrialization.

The variety of steel sheets includes thick steel plates for ship building, hot rolled sheets for guardrails, cold rolled sheets for automobiles and household appliances, and coated sheets for zinc roofs, automobiles and cans. The demand for sheets increases during the second stage of industrialization when automobile and appliance manufacturers begin production.

2) Production on order vs. production on demand estimation

Steel products consumed in manufacturing industries are produced on order. After the acceptance of orders from manufacturers including the quality, volume and time of delivery desired, the steel company starts production. As for standardized long products for construction demand, the steel mill controls the production based on anticipation of demand in the future.

Goods produced on order, such as sheets or coated sheets, are high value-added and expensive. Steel sheet makers compete on quality. The characteristics of standardized long products, however, are without variation among steel makers. So enterprises producing long products compete on price in the international market, including Russia and the former socialist countries.

There are two conflicting qualities in modern steel production. As it is a typical capital intensive industry, economies of scale are achievable through mass production. However, when a customer requires many specific types of goods, steel producers must compete on quality using small-scale production.

2.2.2 Economic growth and steel demand

(1) Life cycle of steel products

According to the experience of countries such as the UK or USA where the steel industry prospered in the past, a pattern in steel demand can be observed. This is called the "product life cycle" and consists of five stages: accelerated growth, growth slowdown, maturity, decline, and stability. (Figure 2.2) The management strategy which POSCO, a Korean steel maker, published in 1995 is based on this idea of the product life cycle.

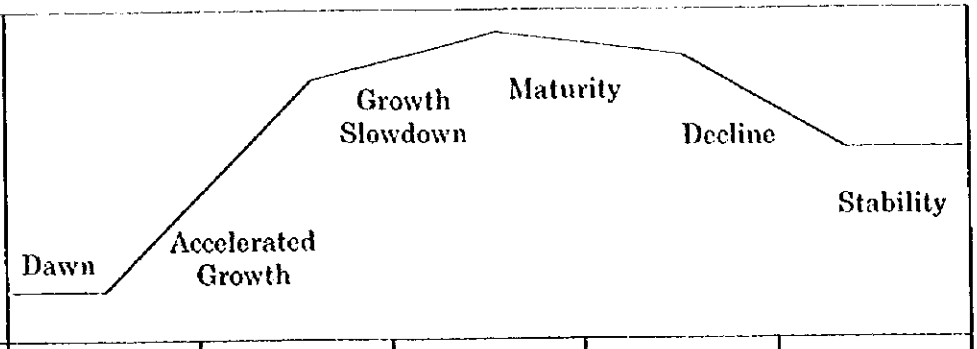
Stages of Domestic Demand					
UK	1890	1960	1964	1973	1985
USA	1900	1964	1973	1982	1990
Japan	1956	1970	1978	1986	1995
Korea	1976	1995	2000	2010	2020

Figure 2.2 Life cycle of steel products

Source Green Management Philosophy & Its Practice, POSCO, 1995

In order to predict the future development of the Vietnamese steel industry, we analyze the patterns of economic development and the growth of steel demand in Japan, Korea and four ASEAN countries.

1) Accelerated growth stage

At the initial stage of economic development, the dominant industry shifts from agriculture to manufacturing. This shift is called industrialization. At this industrialization stage of economic development, steel demand for construction including infrastructure development, construction of private hotels, offices, and factories, begins to increase rapidly. At this stage, the growth rate of steel demand is higher than that of GDP. ASEAN countries are now in this accelerated growth stage.

2) Growth slowdown stage

During the next stage, various industries, such as automobiles, household appliances and machinery begin to develop and the demand for steel for industrial production starts expanding. Steel demand for construction slows down. A management strategy based on economies of scale works well in this stage. Korea is now entering into this stage.

3) Stage of maturity and decline

When the industrial structure has developed further, the volume of demand itself will begin to alternate based on business cycles. Steel producers follow a business policy which emphasizes high value-added steel. Japan is now in this stage of development.

(2) Japanese industrialization and growth in steel demand

1) The Japanese steel industry from the Meiji period to World War II

As is commonly known, Japanese industrialization during the Meiji period began under an unequal tax treaty. Under this tax treaty, only developed countries had tariff autonomy while Japan did not.

The tariff rate concluded with the UK, France, USA and Germany in 1866 was very low: 5% on every product including steel.

The consumption of steel in Japan started to increase from the latter part of the 1880's. Chobei Tanaka was the first entrepreneur in Japan who succeeded in making steel with modern techniques. Tanaka bought Kamaishi Ironworks which the government had abandoned after a management failure. He resumed the production of pig iron using small sized blast furnaces and charcoal. It is remarkable that such a dramatic restructuring of Kamaishi Ironworks was achieved without government subsidies.

In 1900, the state-owned Yahata Ironworks was established. Throughout the history of the Japanese steel industry, steel enterprises which concentrated on the lower process such as rolling developed first. Pig iron and billet were imported. It took fifty years for Japan to attain self-sufficiency in pig iron.

2) The Japanese steel industry after World War II

The increase in demand for steel in Japan after World War II can be divided into three stages; accelerated growth from the middle of the 1950's to the early part of the 1970's, growth slowdown after the latter part of the 1970's to around 1990, and maturity since 1990. (Figure 2.3)

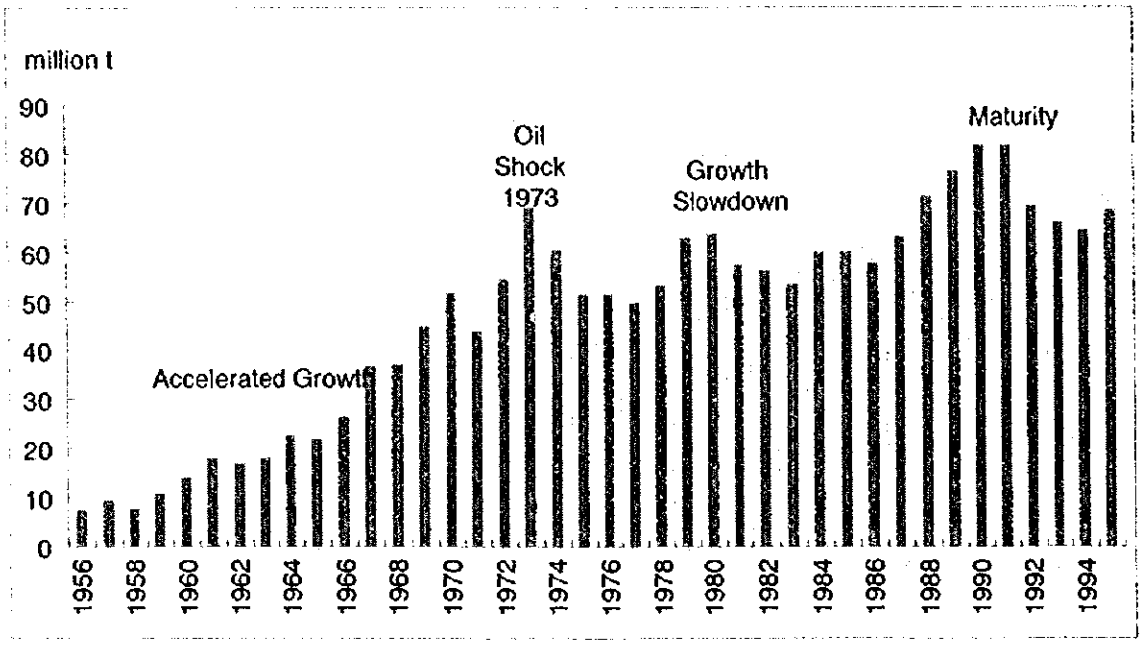


Figure 2.3 Domestic steel demand in Japan (after World War II)

Source Committee on Iron and Steel Statistics, Handbook for Iron and Steel Statistics

In Japanese economic history, the 1950's were known as the era of "post war rehabilitation" and the 1960's as the "high economic growth" period. GDP growth rates reached 10.5% in the 1960's. This period corresponds to the accelerated growth stage of steel demand in Japan. The growth rate of steel demand was higher than that of GDP. Steel demand in 1955 was only 5.5 million tons and it grew to 69 million tons in 1973. The average growth rate during this period was 15% per year, demand for long products for construction was the main force which supported this rapid growth in steel demand. From the middle of the 1960's, demand for flat products from manufacturing industries

started to expand its share of steel demand.

After the latter part of the 1970's, the rate of growth of steel demand began to decline. Demand for long products began to change in line with business fluctuations. Steel makers were requested to adopt "multi-small-product" production to meet the various needs of customers, such as high quality sheets, coated sheets and special steel.

(3) Steel demand growth in Korea

In Korea, the demand for steel reached the accelerated growth stage in the middle of the 1970's, and by the latter part of the 1990's, it arrived at the growth slowdown stage.

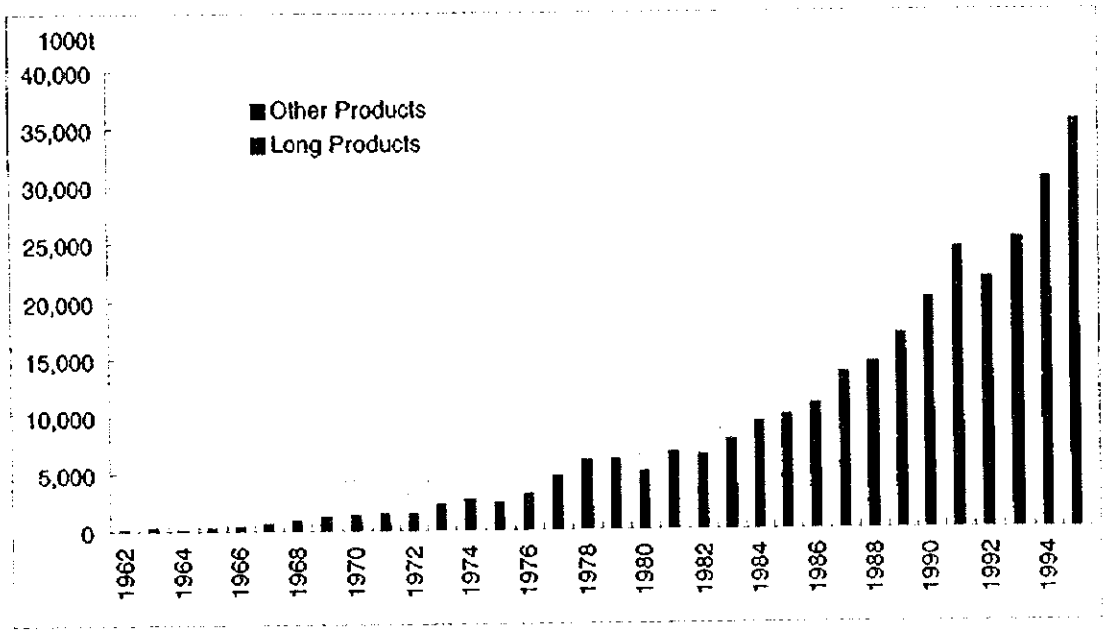


Figure 2.4 Steel demand structure in Korea

Source Korea Iron and Steel Association, Steel Statistical Yearbook

(4) Steel demand growth in ASEAN 4

ASEAN countries began the industrialization stage of economical development during the latter part of the 1980's. Along with economic development, steel demand in these countries entered the accelerated growth stage. In spite of its high growth rate, steel demand in ASEAN countries is relatively small. The demand for steel in ASEAN in 1995 was 31 million tons. This level is equal to that of Korea, half of the demand in Japan, and one third of demand in China.

The annual growth rate of steel demand from 1985 to 1994 for each ASEAN country was 22.6% in Thailand, 14.2% in Malaysia, 9.7% in Indonesia and 17.8 in the Philippines. During the same period, the growth rate of steel demand for the whole world was 0.6%, that of Asia was 5.3% and that of Japan was negative 0.6 %.

The demand in each ASEAN country was 9 million tons in Thailand, a little less than 8 million tons in Malaysia, a little over 6 million tons in Indonesia, a little over 3 million tons in the Philippines, a little less than 4 million tons in Singapore, and a little over 1 million tons in Viet Nam. The construction sector is the biggest customer for steel in ASEAN countries. Long products, such as bars

and H-beams for ferro-reinforced concrete buildings are in particular demand. After 1994, the demand for flat products, such as cold stripped sheets for household appliances and automobiles, has expanded in Thailand and Malaysia.

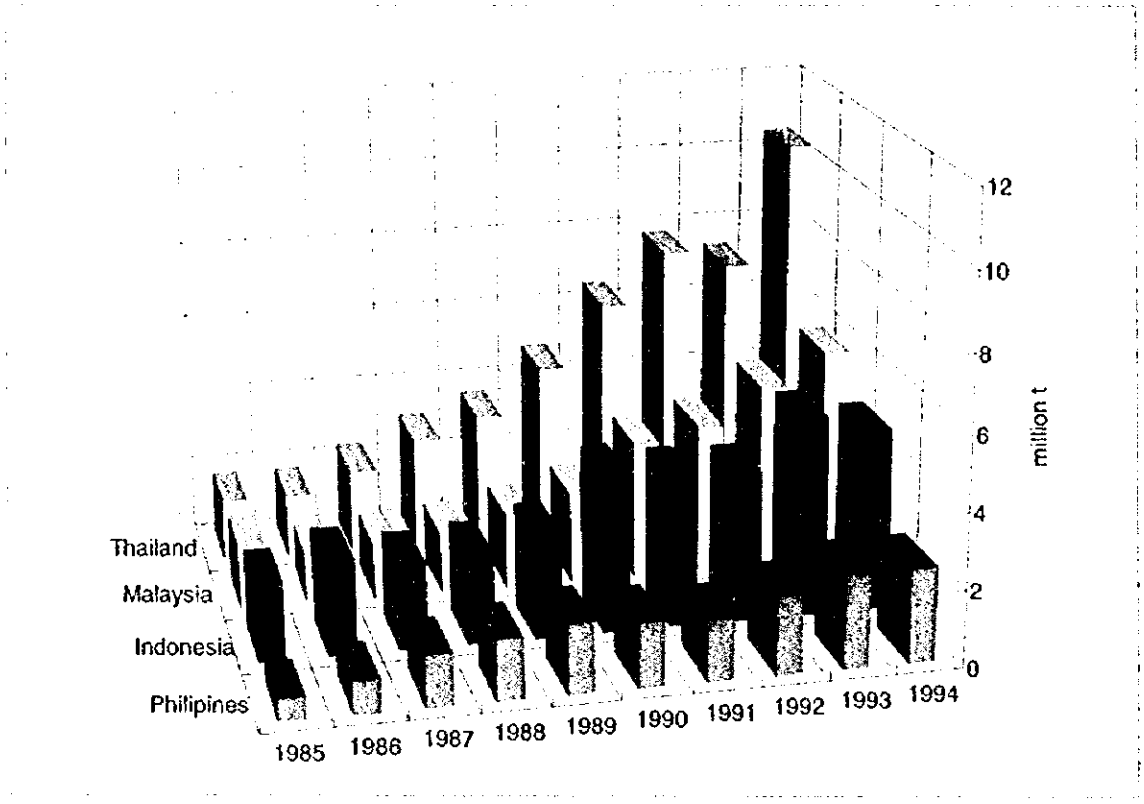


Figure 2.5 Steel consumption in ASEAN 4

Source IISI Steel statistical yearbook 1995

ASEAN countries cannot supply the rapidly expanding demand for steel by themselves and have been depending on steel imports. The rate of import dependence (import / domestic demand) in 1995 of each ASEAN country was 69% in Thailand, 70% in Malaysia, 35% in Indonesia and 41% in the Philippines.

As the demand for steel increases, the demand structure changes from long products to flat products. At the initial stage of industrialization, the demand for long products increases, pulled by the explosion in construction activity. Most of the long products for construction demand are standardized and can be imported from the international market. Meanwhile, the steel sheets for manufacturing demand are produced after taking orders from customers. Along with the development of steel consuming industries, demand for flat products starts to increase. Consumers of steel sheets prefer domestic steel products because they can receive more benefits, such as quick delivery or flexible payment, from domestic producers than from overseas suppliers. In Thailand and Malaysia, manufacturing industries such as toys, sundry goods, household appliances and automobiles have started to develop. Consequently, the demand for flat products started to increase in the late 1980's.

Table 2.1 Steel industry in ASEAN countries

	General situation of capital investment										Supply and demand in 1995				
	Capacity (end of 1996)				Principal capital investment plans						(1,000t)	Production	Imports	Domestic demand	Excess demand
Thailand	DRI/HBI	no capacity			Bar steel rolling	720,000	t/y	Scheduled for 1996	Sahaviriya		DRI/HBI	0	NA	NA	NA
	Electrical furnace	total 2,300,000	t/y	12 firms	Electric furnace + thin slab	1,500,000	t/y	Scheduled for 1998	Nakorn Thai		Crude steel total	2,134	3,428	NA	NA
	Long steel rolling	total 3,420,000	t/y	More than 40 firms	Hot Strip Mill	2,400,000	t/y	Scheduled for 1998	Nakorn Thai		Long	2,248	1,640	3,733	1,485
	Hot Strip Mill	2,400,000	t/y	Sahaviriya	Cold Strip Mill	1,200,000	t/y	Scheduled for 1997	Sahaviriya		Flat	1,131	3,022	3,985	2,354
	Cold Strip Mill	no capacity			Cold Strip Mill	1,000,000	t/y	Scheduled for 1999	Siam United		Product total	5,610	6,205	9,057	NA
Malaysia	DRI/HBI	1,900,000	t/y	1 state- owned firm, and 1 private firm	Electric furnace + shape steel	700,000	t/y	Scheduled for 1997	Perwaja		DRI/HBI	1,178	NA	NA	NA
					DR, electric furnace + wire rod	750,000	t/y	Scheduled for 1998	Amsteel		Crude steel total	2,450	631	NA	NA
	Electrical furnace	total 3,186,000	t/y	6 firms	Electric furnace + bar steel	400,000	t/y	Scheduled for 1997	Southern Steel		Long	3,071	852	3,733	662
	Long steel rolling	total 3,600,000	t/y	More than 30 firms	Hot rolled thick plate	250,000	t/y	Scheduled for 1997	Gunawan		Flat	230	1,939	2,086	1,856
	Hot Strip Mill	no capacity			Hot Strip Mill	2,000,000	t/y	Scheduled for 1998	Megasteel		Product total	4,409	5,489	7,799	NA
	Cold Strip Mill	no capacity													
Indonesia	DRI/HBI	2,250,000	t/y	1 state-owned firm	DR facility No. 1 stop	1,000,000	t/y	Scheduled for 2004	Natural gas stop		DRI/HBI	1,709	NA	NA	NA
	Electrical furnace	total 6,415,000	t/y	18 firms							Crude steel total	4,130	1,389	NA	NA
	Long steel rolling	total 4,609,000	t/y	More than 40 firms	Blast furnace	2,500,000	t/y	Pre F/S	Krakatau JV		Long	2,835	442	3,186	351
	Hot Strip Mill	2,000,000	t/y	1 state-owned firm	Electrical furnace + thin slab	1,000,000	t/y	Scheduled for 1999	Krakatau JV		Flat	806	1,137	1,477	671
	Cold Strip Mill	no capacity									Product total	5,190	2,230	6,358	NA
Philippines	DRI/HBI	no capacity			Electrical furnace, bar steel	300,000	t/y	Scheduled for 1998	Bacnotan		DRI/HBI	0	NA	NA	NA
	Electrical furnace	total 1,013,000	t/y	1 state-owned, and 14 private firms	Electrical furnace, thin plate, hot rolled	1,200,000	t/y	Scheduled for 1998	F Jacinto		Crude steel total	923	2,257	NA	NA
	Long steel rolling	total 2,100,000	t/y	About 50 firms	HSM expansion	1,100,000	t/y	Scheduled for 1998	National Steel		Long	1,345	386	1,731	386
	Hot Strip Mill	1,700,000	t/y	1 state- owned firm	CSM expansion	700,000	t/y	Scheduled for 1999	National Steel		Flat	258	574	804	546
	Cold Strip Mill	840,000	t/y	1 state- owned firm							Product total	2,263	1,389	3,399	NA
Singapore	DRI/HBI										DRI/HBI	0	NA	NA	NA
	Electrical furnace										Crude steel total	769	227	NA	NA
	Long steel rolling										Long	741	1,827	2,135	1,394
	Hot Strip Mill										Flat	0	683	543	543
	Cold Strip Mill										Product total	758	4,099	3,842	NA
Viet Nam	DRI/HBI	Several old blast furnaces		1 state- owned firm	DRI	1,000,000	t/y	Planning	VSC		DRI/HBI	0	NA	NA	NA
	Electrical furnace	430,000 tons	t/y	1 state- owned firm	3 electrical furnaces	1,300,000	t/y	Planning	VSC		Crude steel total	271	110	NA	NA
	Long steel rolling	1,290,000 tons	t/y	1 state- owned firm, JV4	Bar steel single rolling	120,000	t/y	Scheduled for 1997	Tay Do Steel		Long	419	90	508	89
	Hot Strip Mill	no capacity			Hot Strip Mill	1,000,000	t/y	Planning	VSC		Flat	0	28	27	27
	Cold Strip Mill	no capacity			Cold Strip Mill	250,000	t/y	Planning	VSC		Product total	476	151	569	NA

Source Various sources SEAISI Statistical Yearbook

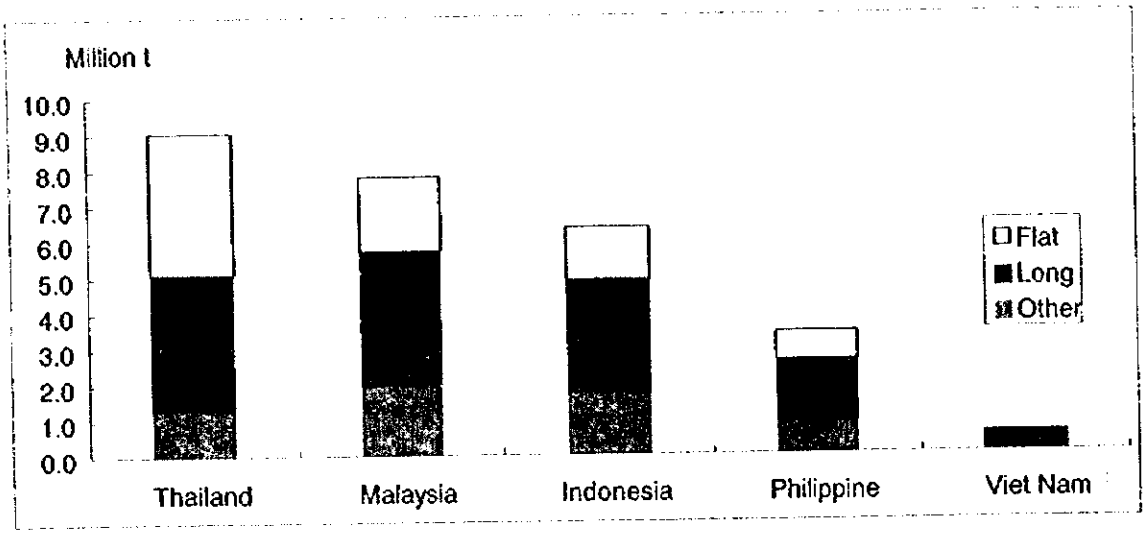


Figure 2.6 Steel demand in ASEAN countries in 1995

Source SEAISI, Steel statistical yearbook 1995

When the gap between the supply and demand for domestic steel sheets increases to the limit of the economies of scale, enterprises begin to produce steel sheet rolling. Thailand entered this stage at the end of the 1980's, and steel sheet rolling facilities constructed by domestic private enterprises started operation in 1994. In Malaysia, the first strip mill is expected to come on-line in 1998.

(6) Correlation between economic growth and steel demand

Based on the data from NIEs and ASEAN countries from 1985 to 1994, the correlation between per capita steel consumption and per capita GDP is very high. A regression analysis shows 98% for adjusted-R squared and a t-value of 60.

From the experience of the Japanese steel industry in the 1960's and the above mentioned data from NIEs and ASEAN countries, it can be concluded that during early stages of economic development, steel demand increases faster than economic growth.

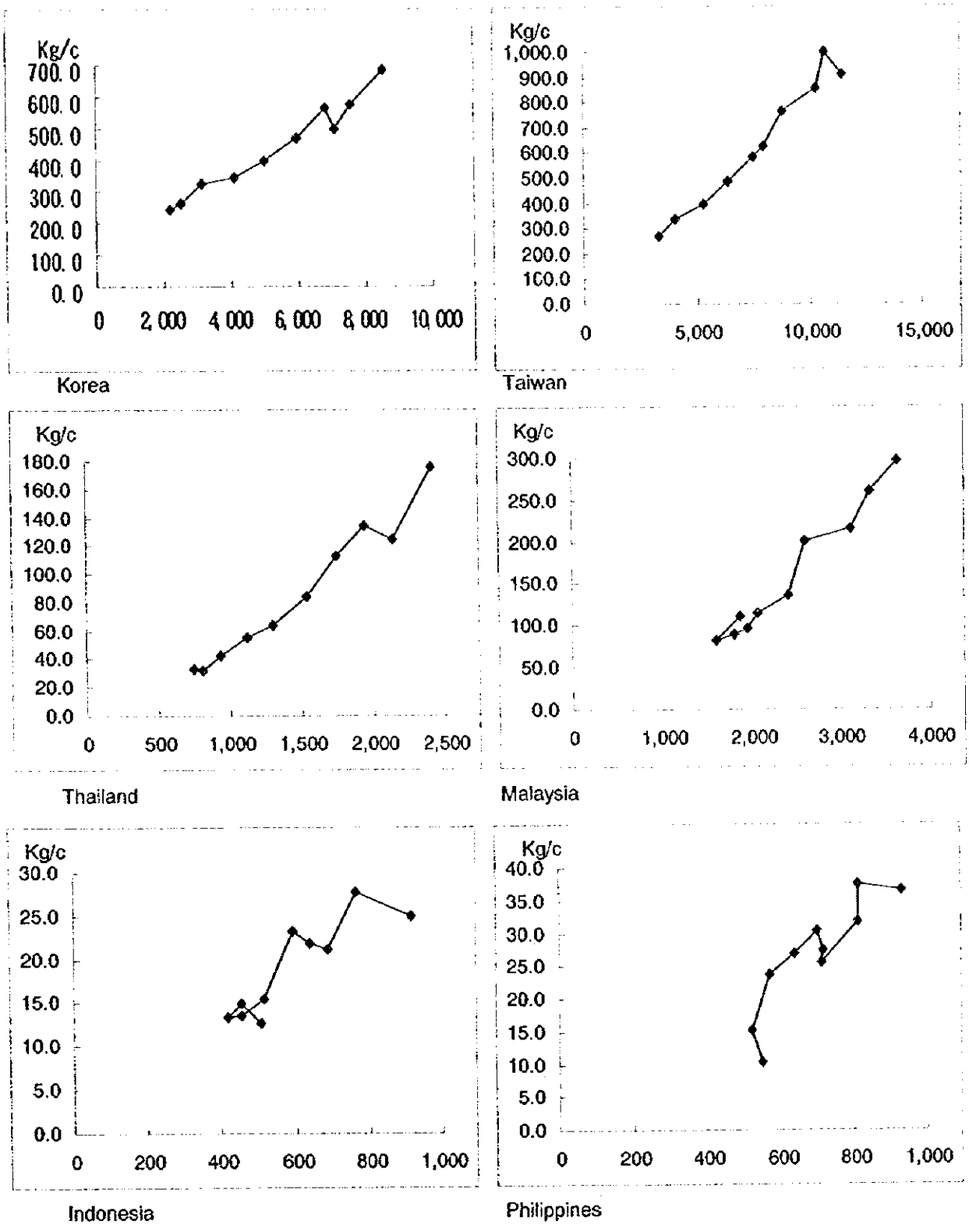
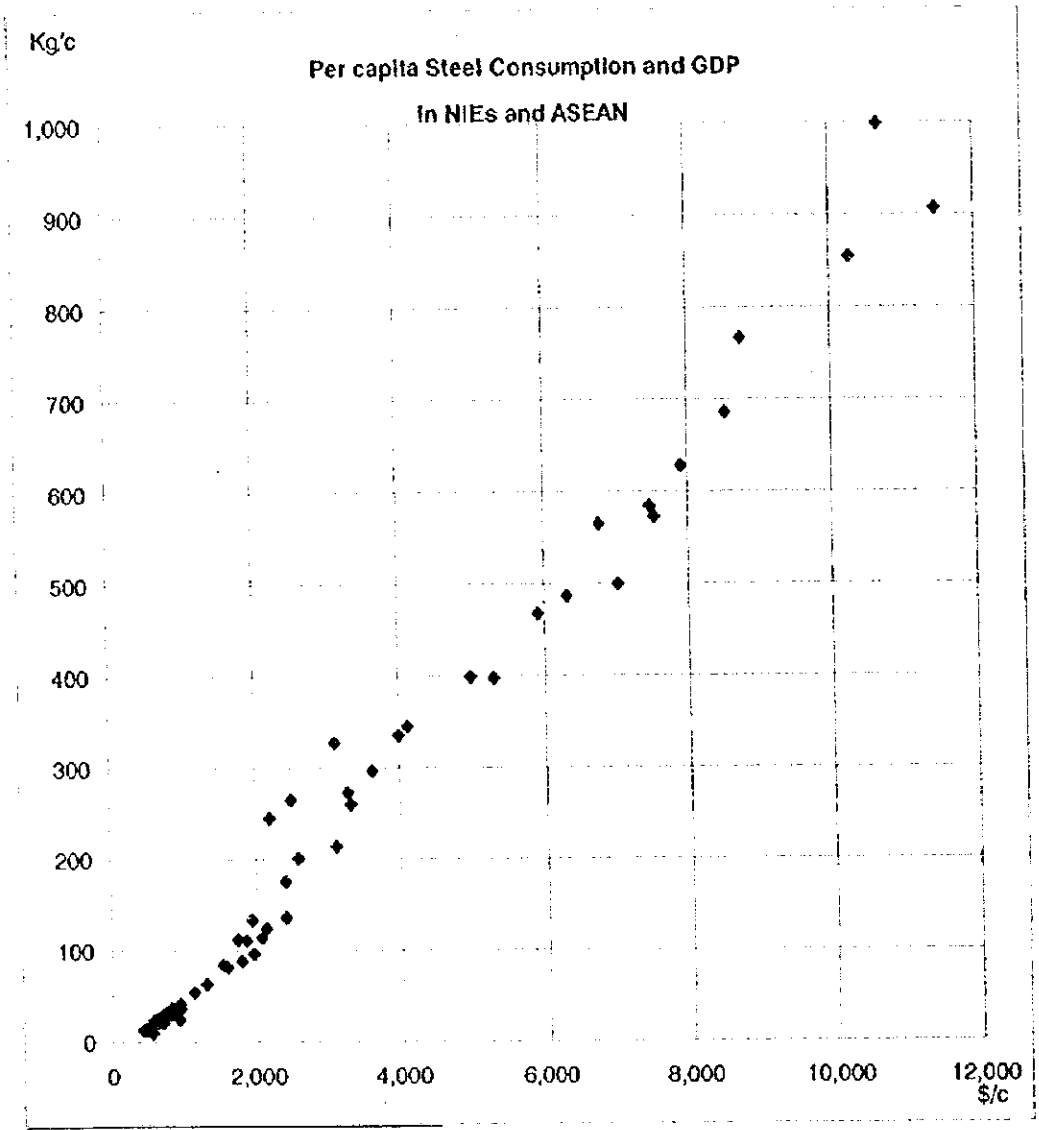


Figure 2.7 Correlation between per capita steel consumption and per capita GDP (1985-1994)

vertical axis: per capita steel consumption (kg/c)
horizontal axis: per capita GDP ($/c)



Regression Data	
Multiple correlation R	0.9922
Multiple correlation R2	0.9844
Adjusted R2	0.9842
Standard error	32.4969
Number of observations	60.0000

Variance analysis

	Degree of freedom	Variation	Variance	Observed variance ratio	Significant F
Regression	1.0000	3,871,482	3,871,482	3,666.0045	0.0000
Residual	58.0000	61,251	1,056		
Total	59.0000	3,932,732			

	Coefficient	Standard error	t	P-value
Intercept	-33.3268	5.9884	-5.5652	0.0000
X value	0.0862	0.0014	60.5475	0.0000

Figure 2.8 Regression results on steel demand GDP

2.2.3 Economies of Scale and Phased Development

(1) Type of business and economies of scale

In the iron and steel industry, there are many types of businesses. Each type of business employs different forms of production technology and equipment, uses different raw materials, and sells different products. Typical business types include Rolling Long, Electric Furnace, Direct Reduction, Coating Flat, Rolling Flat, and Integrated Mill. The amount of investment required to attain economies of scale varies for each type of business.

The history of the steel industry in developed and ASEAN countries shows a pattern of new entry by entrepreneurs along with the expansion of domestic steel demand. When domestic steel demand starts to expand, the smallest business type which requires the least amount of investment enters into the market. As domestic demand grows, other business types which require a higher level of investment begin to operate. The most commonly observed order of entry into the domestic steel business is as follows: Rolling Long, Electric Furnace, Coating Flat, Rolling Flat.

Table 2.2 Type of steel business; manufacturing facility, economies of scale, product characteristics

Type of business	Rolling Long	Electric Furnace	Direct Reduction	Rolling Flat	Integrated Mill
Iron making			DR		Blast Furnace
Steel making		EF	EF		Oxygen F
Casting		Casting	Casting		Continuous C
Hot rolling	Long product	Long products	Long products		Hot Strip Mill
Cold rolling				Cold Strip mill	Cold Strip Mill
Coating					Coating Mill
Economy Scale	2-500,000t/y	0.5-1.0 mil t/y	0.5-1.0 mil t/y	250,000t/y	3mil t/y+
Investment	$20-50mil	$50-100mil	$1-200mil	$100mil	$4500mil+
Cap /Inv.	$100	$100	$200	$400	$1300+
Gestation	1-2year	2-3year	3-4year	2-3year	10-15year
Products	Long	Long	Long	Flat	High quality F
Int'l price	400-450$/t	400-450$/t	450-600$/t	650-800$/t	1000$/t+
Use	Small construction	Big construction	Big construction	Consumer goods	Electric Apps. Automobile
Characteristics	← Price competition			Quality competition	→
Demand	← Construction			Manufacturing	→
Estimation method	← Correlation between per capita steel consumption and per capita GDP			Hearing from buyer	→

This pattern of new entry into the steel industry can be explained as follows. When the domestic steel market grows large enough that economies of scale in production become possible, entrepreneurs seize the opportunity to join the market.

In this chapter, after a description of the various types of businesses in the steel industry, the different phases of development of the steel industry in one specific country will be explained. The phased development of the steel industry is analyzed in terms of three aspects: 1) the growth pattern of steel demand, 2) the different characteristics of steel products, and 3) economies of scale in the production of steel.

1) Rolling long products (Rolling Long)

In Rolling Long businesses, producers invest only in hot rolling machines, buying half-finished products such as billets from domestic producers or importing them from outside sources. Then they turn such half-finished products into bars and other shapes and sell them in the domestic market. The

appropriate annual production capacity for this type of business is from 200,000 to 500,000 tons. The amount of investment required is from $20 million to $50 million, the lowest level of initial investment in the steel industry. Therefore this type of business is always the first to enter the market when the demand for steel for construction increases rapidly during the early stages of economic development. In Viet Nam, VINA KYOEI and VINAU STEEL can be classified as Rolling Long businesses.

2) Making long products by electric furnace (Electric Furnace)

In Electric Furnace businesses, producers invest in electric furnaces as well as hot rolling machines. When the price of scrap metal and the cost of making half-finished ingots through the process of melting scrap is cheaper than the market price of ingots, this business type is more profitable than Rolling Long. Furthermore, if they properly adjust the connection between the upper process and the lower process, producers are able to increase their profit by saving the cost of the thermal energy necessary for the heating process prior to rolling. The appropriate production capacity for this type of business is from 500,000 to 1 million tons per year. The amount of investment required for plant and facilities is from $50 million to $100 million, which is relatively small for the steel industry. Therefore, existing Rolling Long businesses often evolve into Electric Furnace businesses in developing countries simply by adding electric furnaces to plants after accumulating sufficient profits. VINA KYOEI's plan for investment in electric furnaces is a typical example of this process.

3) Making long products by direct reduction furnace (Direct Reduction)

As there is a boom in electric furnace construction in Southeast Asia, a shortage of scrap metal and an increase in price are expected. The VSC is now examining a strategy to construct a direct reduction (DR) furnace and produce pig iron from domestic natural gas and iron ore. If the VSC constructs a steel mill consisting of a direct reduction furnace, electric furnaces and hot rolling mills, the amount of investment required will be from $100 million to $200 million. When considering the feasibility of such a plan, a comparison of the cost of imported billet and self-made billet is necessary.

A direct reduction furnace uses natural gas as a deoxidizer. Natural gas is supplied via a pipeline from a gas well. Natural gas occupies a large portion of the production cost of pig iron. If a steel mill can secure a cheap supply of natural gas, it will be cost competitive. The price of natural gas is set by gas producers and usually depends on the length of the pipeline. A long pipeline will thus generate expensive natural gas and a higher cost of steel. A steel mill with a DR furnace must therefore be located near a natural gas well to be cost competitive.

4) Rolling flat products (Rolling Flat)

Rolling Flat steel producers invest in a cold strip mill. The producer imports hot rolled sheets, rolls them into cold rolled sheets and sells them to domestic customers. The appropriate scale of facilities for this business type is an annual production capacity of 250,000 tons, and the necessary amount of investment is $100 million. When industrialization reaches a stage where home electric appliances and automobile manufacturers start production, demand for cold rolled sheets starts to increase. At this stage, a careful response to the needs of domestic customers will enable domestic steel manufacturers to sell the products at a more expensive price than that of imported steel. Among ASEAN countries, Thailand and Malaysia have reached this stage, and private enterprises have begun this type of business. As Rolling Flat businesses require sophisticated production techniques, marketing and financing, cooperation with steel manufacturers in developed countries is essential to enter into the market.

5) Integrated steel mill (Integrated Mill)

Integrated Mill producers invest in both the upper and lower process. Blast furnaces, oxygen furnaces, continuous casting equipment, hot rolling mills of long products, hot rolling mills of sheets, cold rolling mills of sheets and coating facilities are installed in the same site. Iron ore and coal are procured as raw materials. Various sorts of products such as long products, sheets and coated sheets are manufactured and sold to domestic customers. The minimum production capacity to attain economies of scale for this business type is 3 million tons per year, and the amount of investment in plant and facilities required is more than $4.5 billion. It is the most advanced technique for making steel at present.

(2) Phased development of the iron and steel industry

As mentioned above, a certain pattern of expansion in steel demand can be observed depending on the specific stage of economic development. A typical pattern begins with a rapid rise in the demand for construction during the early stages of industrialization, followed later by a rise in demand for the manufacturing industry, which itself begins to expand along with the advance of industrialization.

It has also been shown that long products and sheets differ significantly in terms of product uses, consumers, prices, styles of distribution and marketing. In fact, most of the specifications for long products for construction demand are standardized and produced based on the prospect of demand. Long product manufacturers compete based on price in the international market. On the other hand, steel sheets for manufacturing industries are produced after receiving orders from customers. The specification of each order varies widely and the production lot tends to be small.

There are many types of businesses in the steel industry. Production capacity to attain economies of scale varies according to each business, and the amount of investment required ranges from $20 million to $4.5 billion.

Table 2.3 Type of business, economies of scale, product characteristics

Type of business	Rolling Long	Electric Furnace	Direct Reduction	Rolling Flat	Integrated Mill
Economy Scale	2-500,000t/y	0.5-1.0 mil t/y	0.5-1.0 mil t/y	250,000t/y	3mil t/y+
Investment	$20-50mil	$50-100mil	$1-200mil	$100mil	$4500mil+
Products	Long	Long	Long	Flat	High quality F
Int'l price	400-450$/t	400-450$/t	450-600$/t	650-800$/t	1000$/t+
Use	Small construction	Big construction	Big construction	Consumer goods	Electric Appl. Automobile
Characteristics	← Price competition			Quality competition	→
Demand	← Construction			Manufacturing	→

The history of the steel industry in Japan, Korea and ASEAN countries shows a certain pattern of market entry of the various types of businesses. According to this pattern, the expansion in domestic demand for steel and the relative amount of investment required for each business type determines the order in which the various types of steel manufacturing businesses enter into the market. Usually the order begins with Rolling Long producers, followed by Electric Furnace, Direct Reduction, Rolling Flat, and finally the Integrated Mill.

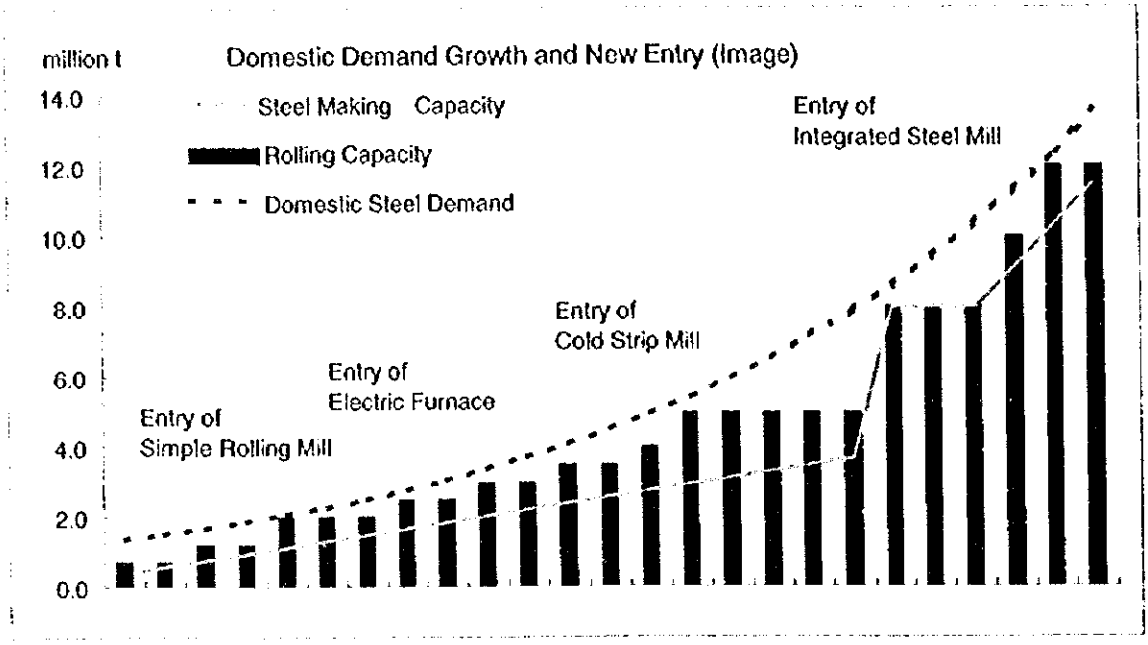


Figure 2.11 Sequence of new entry: from small to large investment

In 1900, state-owned Yahata Ironworks was established. In the history of the Japanese steel industry, steel enterprises which concentrated on the lower process such as rolling developed first. Pig iron and billet were imported. It took fifty years for Japan to attain self-sufficiency in pig iron.

In Thailand and Malaysia, manufacturing industries such as toys, sundry goods, household appliances and automobiles have already started to develop. Consequently, the demand for flat products started to increase in the late 1980's. When the gap between the supply and demand for domestic steel sheets grows large enough that economies of scale in production become possible, enterprises will begin steel sheet rolling. Thailand experienced this stage at the end of the 1980's, and the steel sheets' rolling facilities which received investment from domestic private enterprises began operation in 1994. In Malaysia, the first strip mill is expected to come on-line in 1998.

Indonesia began producing flat products in a state-owned enterprise in the 1970's, when the domestic steel demand had not reached sufficient levels for economies of scale for flat products. Though the state owned enterprise was protected by import restraints and a high tariff, there was no choice but to export the surplus production at a low price due to the small level of domestic demand. As a result, the firm was unprofitable and Indonesia is now struggling to restructure its steel industry.

2.3 Current Status of the Steel Market and Policy Tools

2.3.1 Current Status of the Steel Market in Viet Nam

(1) Balance between demand and supply in the steel market in 1996

The imbalance between demand and supply in 1996 resulted in a huge over-supply of steel due to the sudden expansion of imports. As a result, stocks increased, and domestic steel prices fell significantly. It is estimated that domestic steel demand in 1996 was over 1.3 million tons, an increase of 20% from the previous year. Most of the demand was for construction, and 70% of the demand was for long products. Domestic steel production was 0.8 million tons and steel imports totaled 1.0 million

tons, resulting in a total supply of 1.8 million tons. Accordingly, about 0.5 million tons of steel products, which accounts for 30% of the annual demand, remained in stock due to the over-supply.

(2) Production capacity in Viet Nam

The existing facilities for steel production in Viet Nam at the end of 1996 consisted of: two VSC mills for long products with electric furnaces (TISCO 180,000 t/y, SSC 250,000 t/y), three rolling mills for long products, owned by joint-ventures between foreign steel manufacturers and the VSC (VSC-POSCO 200,000 t/y, Vina Kyoei 240,000 t/y, Vinau Steel 180,000 t/y), and some joint ventures for hop-dip galvanized sheets.

1) Facilities at TISCO

TISCO is an electric furnace plant used for the production of long products, and managed directly by VSC, with 180,000 tons of production capacity per year. It is classified as an "electric furnace" type of business. Its production capacity is smaller than the optimum 500,000 tons of annual production necessary to take advantage of economies of scale in electric furnace plants. Therefore, it is estimated that TISCO's cost competitiveness is low.

TISCO has three small sized blast furnaces and is producing pig iron. Pig iron is mixed with scalps and melted in electric furnaces. A part of the "hot water" poured from the electric furnaces is turned into billets in continuous casting machines, while the rest is cooled in ingot-making molds. These billets are rolled in hot rolling mills, and turned into long products, mainly into bars.

2) Facilities at Vinau Steel

Vinau Steel began operation in September, 1985 as a joint venture between the VSC and an Australian steel company. Its business is classified as "Rolling Long" production, and its production capacity is 180,000 tons, a sufficient level to fulfill the economies of scale in this business type.

(3) Profitability of steel manufacturers in Viet Nam

Although it is difficult to find reliable data on the profitability of steel enterprises, it is estimated that the VSC group was in the red in 1996, as all state-owned plants controlled by the VSC seemed to be in the red. Only a few joint ventures between the VSC and foreign steel companies managed to record a small profit.

International prices for long products are relatively low, especially for steel bars whose quality requirement is not as strict as that for flat products used for manufacturing. Indeed, cheap exports from Russian producers in search of foreign currency have pushed prices below the marginal cost of many steel enterprises in western Europe. In Viet Nam, the domestic price fell to international levels because of the over-supply.

(4) Comparison of the scale of supply and demand

Compared with other Asian countries, Viet Nam's domestic steel demand of 1.3 million tons is very small. The amount represents only a sixth of the demand in Thailand, which has the largest demand in ASEAN, with 9 million tons, a twentieth of the demand in South Korea (30 million tons), a fiftieth of the demand in Japan (80 million tons), and an eightieth of demand in China (118 million tons). As for the scale of crude steel production, Viet Nam's current supply is one-seventh of the production in Thailand (2 million tons), while South Korea produces 120 times the amount of Viet Nam (37 million tons), China produces 300 times more (93 million tons), and Japan produces 340 times (100 million tons) the amount of steel produced in Viet Nam.

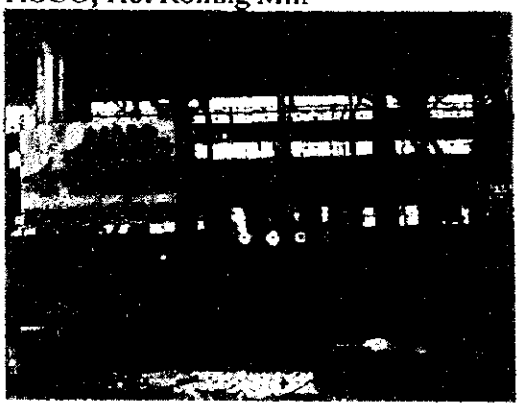
TISCO, Blast Furnace

TISCO, Scrap

TISCO, Pig Iron from Blast Furnace

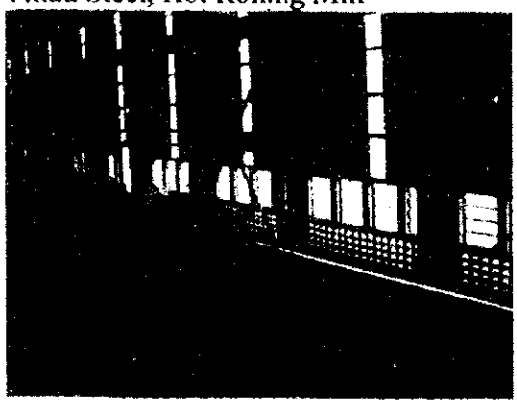
TISCO, Electric Furnace

TISCO, Hot Rolling Mill



TISCO, Steel Bar

Vinau Steel, Hot Rolling Mill



Vinau Steel, Steel Bar

Viet Nam's demand for steel is very small and is concentrated in the construction industry. Production facilities consist of rolling mills and electric furnaces. Given the scale of demand production facilities, it can be concluded that the steel industry in Viet Nam is still in the early stages of development immediately prior to the surge in demand caused by the overall economic development process.

(5) Projects which the VSC is now examining

VSC classifies its projects under consideration in two categories: 1) projects to be completed and operational by the year 2000, and 2) projects to be planned and prepared by the year 2000 and constructed soon after. In order to plan industrial policies for the steel industry, an estimation of the long-term prospects for domestic demand is a prority. It is possible to make a forecast of such demand through the relationship between GNP per capita and steel consumption per capita. If supply capacity exceeds domestic demand, the steel price tends to fall, thus damaging the profitability of steel manufacturers. Therefore, projects to be completed before the year 2000 might be too ambitious.

Table 2.4 Projects under consideration by the VSC

Type of business	Production capacity	Investment per project	# of projects	Total investment
Electric Furnace	500,000 t/y	$120 million	3	$290 million
Direct Reduction	1,000,000 t/y	$250 million	1	$250 million
Hot Dip Coating	50,000 t/y	$20 million	3	$100 million
Cold Strip Mill	250,000 t/y	$100 million	1	$100 million
Hot Strip Mill	1,000,000 t/y	$650 million	1	$650 million
Operational by the year 2000 Total				$1,390 million
Direct Reduction	1,000,000 t/y	$300 million	1	$300 million
Hot Strip Mill	1,000,000 t/y	$550 million	1	$550 million
Development of Iron ore		$1,000 million	1	$1,000 million
Integrated Steel Mill	3,000,000 t/y	$3,000 million	1	$3,000 million

2.3.2 Development Phases and Policy Tools (AFTA/WTO)

As mentioned above, the steel industry has developed in line with the market economy and factors such as the increase in domestic demand and entrepreneurial pursuit of profits. We now examine the possibility that the government can also facilitate the development process or enhance the function of the market.

Viet Nam has entered the early stage of industrialization. Compared with the period when other ASEAN countries entered into the same stage of industrialization, two changes in international trade and investment have occurred. One change is that it has become more difficult to enforce policies to restrain imports due to the global movement toward the liberalization of trade. The other change is that multinational enterprises, including Japanese firms, are increasing their investment in ASEAN countries.

Based on these changes, a combination of the following three policy approaches is important: 1) import protection through tariffs or quotas, 2) attraction of foreign direct investment, and 3) enhancement of market forces.

(1) Import protection through tariffs or quotas

Protective measures such as high tariff rates and import quantity restrictions are known as border protection. The development of the steel industry by border protection is shown below.

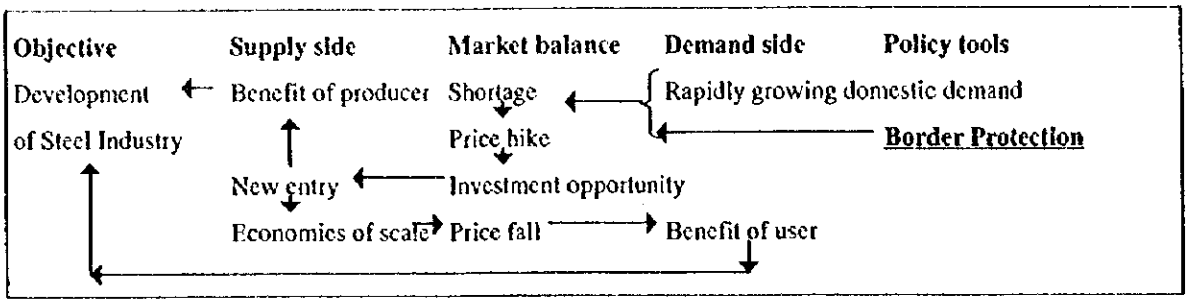


Figure 2.12 Import protection through tariffs or quotas

If protective measures which restrain imports are imposed when domestic demand for steel is growing rapidly, a shortage of steel in the domestic market will occur and the price of steel rises. As demand increases and the price rises, steel manufacturers will find opportunities for profits. Accordingly, if these market conditions are expected to continue for some time, it will induce an expansion of capacity at existing steel enterprises or the entry of new domestic or foreign entrepreneurs. As a result, the supply capacity of the steel industry will increase.

More specifically, the expansion of demand will induce an increase in capacity in the following order of investment: rolling long, electric furnace, rolling flat, and integrated mill.

There are several merits to the import protection approach. First, it becomes possible to induce domestic or foreign enterprises to enter the market and to expand the production capacity. Second, the approach can protect those state-owned enterprises whose production costs are comparatively high by keeping the domestic market price of steel higher than international prices.

On the other hand, the protective approach places the burden of higher steel prices on the demand side of the market including government investment, public construction, the automobile industry, household appliance industry, and the can industry. Furthermore, this approach will minimize competition among steel manufacturers, thereby prolonging the low efficiency of such enterprises.

Participating in AFTA/WTO and protective policies for the steel industry

In order to examine the experience of other countries with similar development characteristics, we now review the industrial policy measures taken by Thailand and Malaysia.

In Thailand, per capita GDP reached $1000 in 1988, and the domestic demand for steel was over 6 million tons by 1991. In Malaysia, although GDP per capita was over $2000 in 1989, domestic demand for steel remained at 3.5 million tons in 1991 because of a smaller population than in Thailand. It wasn't until 1995 that steel demand reached 6 million tons in Malaysia.

In Thailand, entrepreneurs began to examine investment in rolling flat businesses in the latter half of the 1980's, and decided to invest around 1990. The first hot strip mill, with an annual production capacity of 2.4 million tons, came on line in 1994. In Malaysia, they began feasibility studies for a hot strip mill in the early part of the 1990's, and the first hot strip mill, with an annual production capacity of 2.0 million tons, will start running in 1998. At present, both private businesses in Thailand and the state-owned steel industry in Malaysia have conducted feasibility studies for an integrated steel mill with a blast furnace.

The Thai government tried to support the steel industry through an investment approval system during the latter half of the 1980's. By limiting investment in a hot strip mill to only one company, that company became the sole producer of flat steel in Thailand. This created a tight market for flat steel during a time when demand was rising and therefore facilitated the investment decisions taken by the investor. The domestic demand for flat steel, however, increased faster than expected due to an increase in the production of automobiles and household appliances. Thus, the industrial policy for the steel industry was changed to a more liberal stance which utilized market forces. Two incidents which symbolized this change of policy happened at the middle part of 1990's. One was the liberalization of the investment approval system in 1994 so that any company who applied for investment in steel production capacity could get immediate approval. The second was a reduction in the tariffs on flat steel. In the CEPT schedule which the Thai government submitted to the AFTA secretariat in 1995, flat steel belonged to the normal track products group. The Thai government committed that tariffs on flat steel would decrease to 5 % by 2003.

The Malaysian government's policies for the steel industry were quite different from those in Thailand. There were two streams in the development of the steel industry in Malaysia: the state-owned steel manufacturer put priority on the upper process while private enterprises invested in the lower process when the demand began to increase. The state-run enterprise is still suffering from the burden of a large investment in the upper process including a direct reduction furnace, but in the private sector, long product manufacturers enjoy a rapidly growing market and some of the producers are now preparing to enter in the flat steel business. The Malaysian government is taking protective measures to support flat steel manufacturers. The tariff rate on flat steel is very high at 25 % and flat steel is temporarily exempt from the CEPT schedule.

(2) Attraction of foreign direct investment

Attracting foreign direct investment in order to promote the steel industry is another policy alternative. Foreign manufacturers make investment in steel production equipment in the pursuit of profit. Therefore policies for the introduction of foreign investment are more effective when they are aligned with the goals of foreign companies. The tariff structure and target business type is also important for promoting the steel industry.

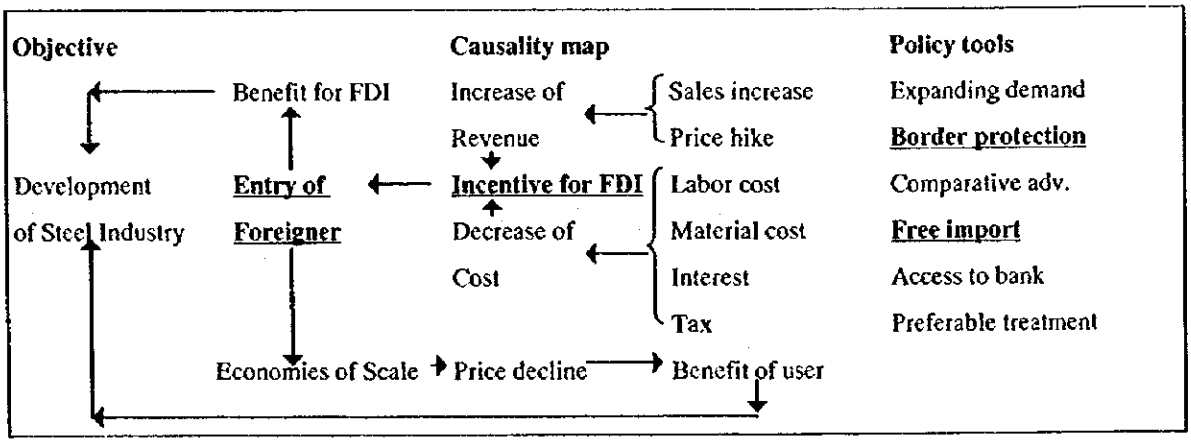


Figure 2.13 Attraction of foreign direct investment

In Viet Nam, there is basically no steel making facility at present. Therefore the tariff rate on half-processed products such as billets is low, from 0% to 5%. The demand for long products is increasing sharply, and the rolling capacity for long products is not sufficient. Tariff rates on long products is higher, from 30% to 40%. As there is no equipment for the production of flat products, the tariff rate on steel sheet is 0%.

This tariff rate structure is effective for protecting rolling long state-owned enterprises. It is, however, not effective for inducing foreign investment in electric furnace businesses where scrap is imported and melted into billet. Because the tariff rate of both scrap and billet is low, from 0% to 5%, the operation of an electric furnace business is not protected. In general, to protect a specific production facility, tariff rates for inputs must be lower than that of output.

(3) Enhancement of market forces

When Viet Nam adopts policies which utilize market forces to develop the steel industry, it will be possible to exploit the glut in the international steel market. The exploding demand for long products in Viet Nam can be covered by low priced imports which will in turn reduce the cost of infrastructure construction.

Based on the experience of other ASEAN countries, when the demand for flat products reaches 5 million tons per year, the rolling flat businesses will enter the market and entrepreneurs may begin to examine the feasibility of integrated steel mills with blast furnaces. Integrated steel mill can realize economies of scale and supply high quality flat products at a reasonable price. During this phase, both steel suppliers and consumers will benefit.

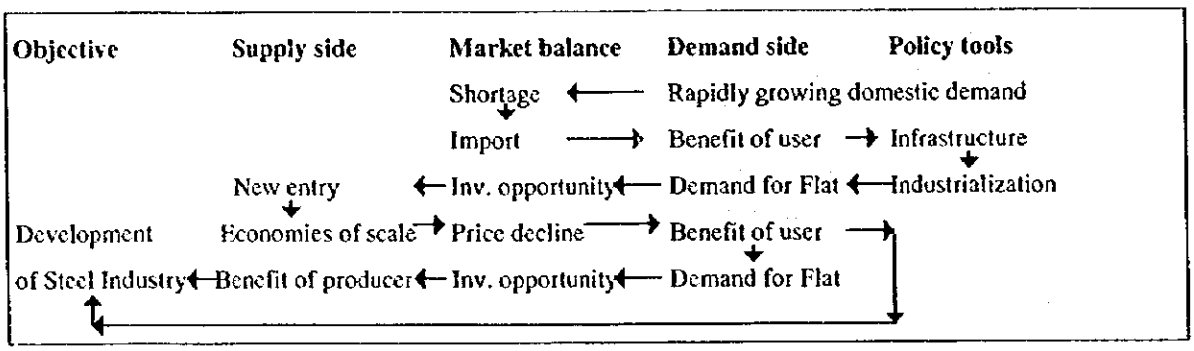


Figure 2.14 Enhancement of market forces

Naturally, the development of the steel industry through the use of market forces requires less government intervention in the market than is necessary when implementing a protective approach. Given the current international steel market in which the cheaper long products can be imported, the net financial burden of the government will be smaller if it utilizes the market forces approach.

The protection approach to develop infant industry can be justified only when the industry gains competitiveness after the protection is removed in the future. In order to enhance the competitiveness of industry, measures to improve the productivity of state-owned enterprises and private enterprises must be enforced along with the protective policies. One of the most effective measures to inspire self-restructuring of state-owned enterprises is to set an end date for protection measures. In this sense, the CEPT schedule of tariff reduction plays an important role.

Table 2.5 Tariff reduction schedule of the CEPT scheme

Iron and steel	Base Rate (other than ASEAN)	AFTA.CEPT (96-03)	WTO-related	Comment
Thailand Long Flat	 10- 18 Low specific duties	 NT 5- 15 - 5 NT 20 - 5	Became a member in January 1995. There is an investment approval system, but all cases are approved immediately. This system is not used to protect domestic industries.	Private sector-led industrial growth. "Free and neutral" policy without industrial protection or nurturing. A protection policy was previously attempted in order to take advantage of the rapid increase in demand in 1988, but the nation returned to a free trade and investment policy in 1994.
Malaysia Long Flat	 30 25	 NT TE	Became a member in January, 1995. Import restrictions (AP system) remain in effect and may be enforced after the completion of cold strip mill.	Two policies are being pursued, a state-owned steel making process and a private process. Protection is extensive, with customs duties and restrictions on imports applied in proportion to the development of domestic industry. Close coordination among the ministries and agencies makes this system highly effective.
Indonesia Long Flat	 5 5- 10	 NT 5- 20 - 5 NT 5- 10 - 5	Became a member in January, 1995. Exclusive import rights which were held by the state-owned steel company and were considered a barrier to imports, were abolished in 1993.	A strategy with priority on the steel making process based on protection of the state-owned firm was adopted in the 1970s. Decreased revenues from oil production from the 1980s on led to a policy of fostering the private sector. Privatization of state-owned firms is slow.
Philippines Long Flat	 5- 15 5- 15	 NT 3- 10 - 3 NT 3- 10 - 3	Became a member in January, 1995	
Singapore Long Flat	 0 0	 NT 0 - 0 NT 0 - 0	Became a member in January, 1995	Virtually no steel industry
Viet Nam Long Flat	 30- 40 0	 TE FT 0 - 0	Applying for membership. Imports and exports are controlled by the Ministry of Commerce.	Import ban on long products has been enforced since July 1997.

Various sources

Table 2.6 Import required by type of business

	Steel Product Import	Rolling Long	Electric Furnace	DR Long	Coating Flat	Rolling Flat	DR Flat	Integrated Mill
Import goods		Billet	Scrap	Iron ore	Flat	Hot coil	Iron ore	Iron ore
	Long Flat HQ Flat C Steel	Flat HQ Flat C Steel	Flat HQ Flat C Steel	Flat HQ Flat C Steel	Flat HQ Flat		HQ Flat	
Production Process	No			DR			DR	Blast Furnace
			E Furnace Casting	E Furnace Casting			E Furnace Casting	Oxygen F Continuous C
		Rolling mill	Rolling mill	Rolling mill			HS Mill	HS Mill
						CS Mill	CS Mill	CS Mill
					Hot dip		Hot dip	EGI
Domestic Demand	Long Flat HQ Flat C Steel	Long Flat HQ Flat C Steel	Long Flat HQ Flat C Steel	Long Flat HQ Flat C Steel	Long Flat HQ Flat C Steel	Long Flat HQ Flat C Steel	Long Flat HQ Flat C Steel	Long Flat HQ Flat C Steel
Exportable	No	No	No	HBI	No	No	No	HQ Flat
Value-added	No	Long -Billet	Long -Scrap	Long -Iron ore +HBI export	C Steel -Flat	Cold coil -Hot coil	All products -Iron ore	All products -Iron ore + HQ Flat exp

HQ Flat: High quality flat products, C Steel: Coated steel, CS Mill: Cold Strip Mill

2.3.3 Trade Balance and Value-added

The table on the previous page shows the imports required when each business type has domestic value-added production facilities in Viet Nam. The trade balance and the value-added for each business type are as follows.

(1) Steel product import

The demand for long products for construction will be covered by low-priced imports from Russia. There is no need for investment in production facilities for long products. However, there is no possibility for value-added domestic production. The experience in ASEAN countries shows that the demand for steel products expands rapidly in the early stage of industrialization and the trade deficit in steel products will increase as well.

(2) Rolling long

In this business type, billets and half-finished products are imported and long products are produced and sold for domestic construction. In 1997, cheap billets from Russia are available. Production of rolling long can begin with a relatively small ($20 million) investments. The value-added is the domestic sales of long products minus the cost of imported billets.

(3) Electric furnaces

Imported scrap steel is used in the production of long products for domestic demand. The value-added is the domestic sales of long products minus the cost of imported scrap steel. Because of the boom in electric furnace construction in ASEAN countries, the market for scrap steel has become tight. Therefore, the price of imported scrap steel is expected to rise.

(4) DR long

In this type of business, manufacturers invest in a direct reduction furnace, an electric furnace and a rolling mill for long products. In a direct reduction furnace, iron ore is melted into HBI, a kind of pig iron. HBI is used as a substitute for scrap steel and melted into billet. Free from the shortage of scrap steel in ASEAN countries, long products can be produced by using imported iron ore. There is some possibility to export HBI to ASEAN countries, which are suffering from a shortage of scrap steel. The value-added is the domestic sales of long products minus the cost of imported iron ore plus exports of HBI.

(5) Coating flat

In this type of business, manufacturers invest in coating equipment. Flat products are imported and coated and sold in the domestic market. The value-added is the domestic sales of coated sheets minus the cost of imported flat products. The investment required for this business is relatively small and the VSC is now planning to enter this market.

(6) Rolling flat

In this business type, hot coil is imported, rolled and sold in the country. The value-added is the domestic sales of cold-rolled sheets minus the cost of imported hot coil. The scale of investment in this field is very large, for example, facilities producing 2 million tons per year need more than $1 billion in investment. Therefore, establishing joint ventures with integrated steel manufacturers in developed countries is needed to manage such facilities. This business is known as the "entrance to the modern steel industry" because it requires such sophisticated management.

(7) DR flat

In this type of business, the manufacturer is equipped with a direct reduction furnace, an electric furnace, a continuous casting machine and strip mills. Iron ore is imported as raw material and the value-added is the domestic sales of steel products minus the cost of imported iron ore.

(8) Integrated steel mills with blast furnaces

The value-added in this type of business is the domestic sales of all steel products minus the cost of imported iron ore and other raw material plus the export of high quality flat products.

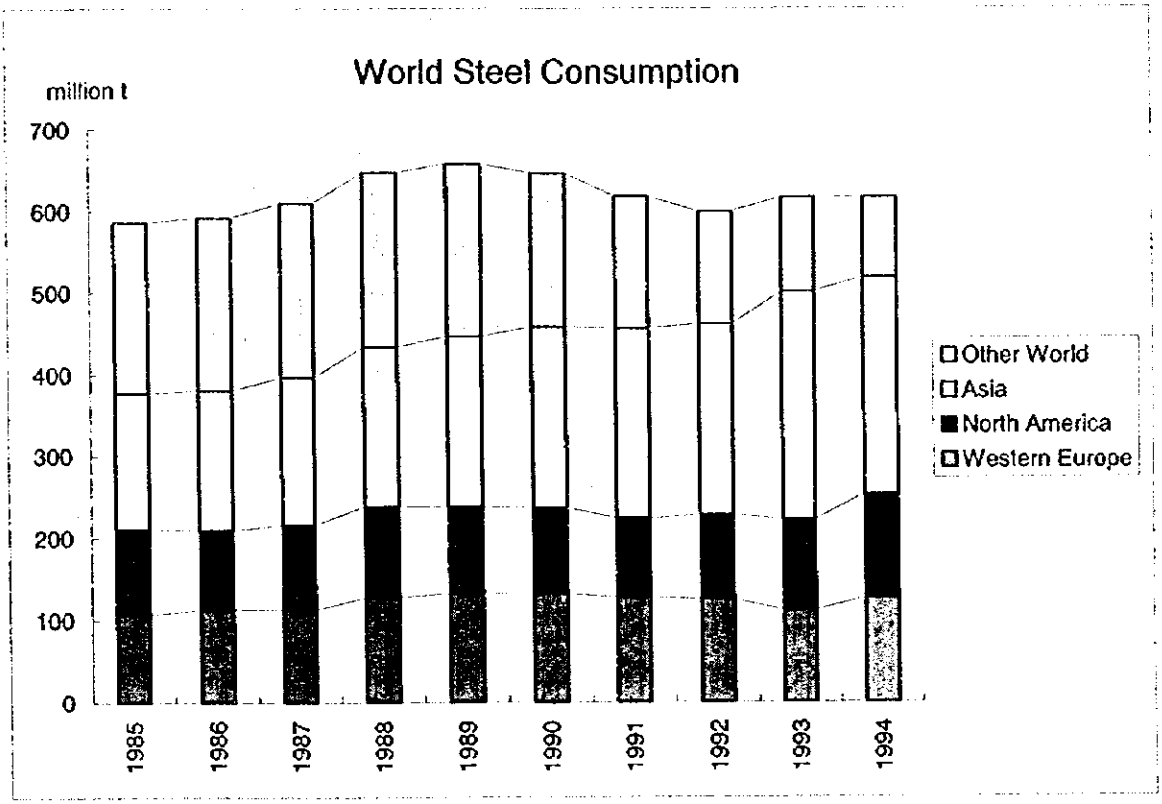
Appendix

World Steel Consumption

(1000t)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Western Europe	107,201	112,717	113,291	128,224	132,479	132,401	127,944	125,782	112,057	126,668
Eastern Europe	41,625	42,363	42,034	40,674	40,396	29,173	16,422	12,985	13,245	13,884
former USSR	119,340	122,890	124,216	125,557	123,266	116,568	100,703	76,795	51,007	35,640
North America	103,298	96,420	102,717	110,669	105,163	105,143	96,090	102,836	110,016	126,300
South America	15,517	19,129	20,224	18,305	17,871	14,851	16,189	17,551	19,451	21,128
Africa	13,729	12,134	11,752	12,631	13,001	12,624	12,813	12,864	12,581	12,799
Middle East	13,266	9,915	9,904	10,647	10,397	9,836	10,080	12,502	12,521	8,537
Asia	166,899	170,360	180,453	194,076	208,670	220,347	232,125	232,820	279,372	265,193
Oceania	5,181	5,613	5,236	6,283	6,591	5,461	5,062	5,115	5,913	6,438
World	586,057	591,539	609,827	647,064	657,835	646,405	617,428	599,252	616,163	616,586

Source: IISI Steel Statistical Yearbook 1995

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Western Europe	18%	19%	19%	20%	20%	20%	21%	21%	18%	21%
Eastern Europe	7%	7%	7%	6%	6%	5%	3%	2%	2%	2%
former USSR	20%	21%	20%	19%	19%	18%	16%	13%	8%	6%
North America	18%	16%	17%	17%	16%	16%	16%	17%	18%	20%
South America	3%	3%	3%	3%	3%	2%	3%	3%	3%	3%
Africa	2%	2%	2%	2%	2%	2%	2%	2%	2%	2%
Middle East	2%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Asia	28%	29%	30%	30%	32%	34%	38%	39%	45%	43%
Oceania	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
World	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%



Steel Consumption in Asia

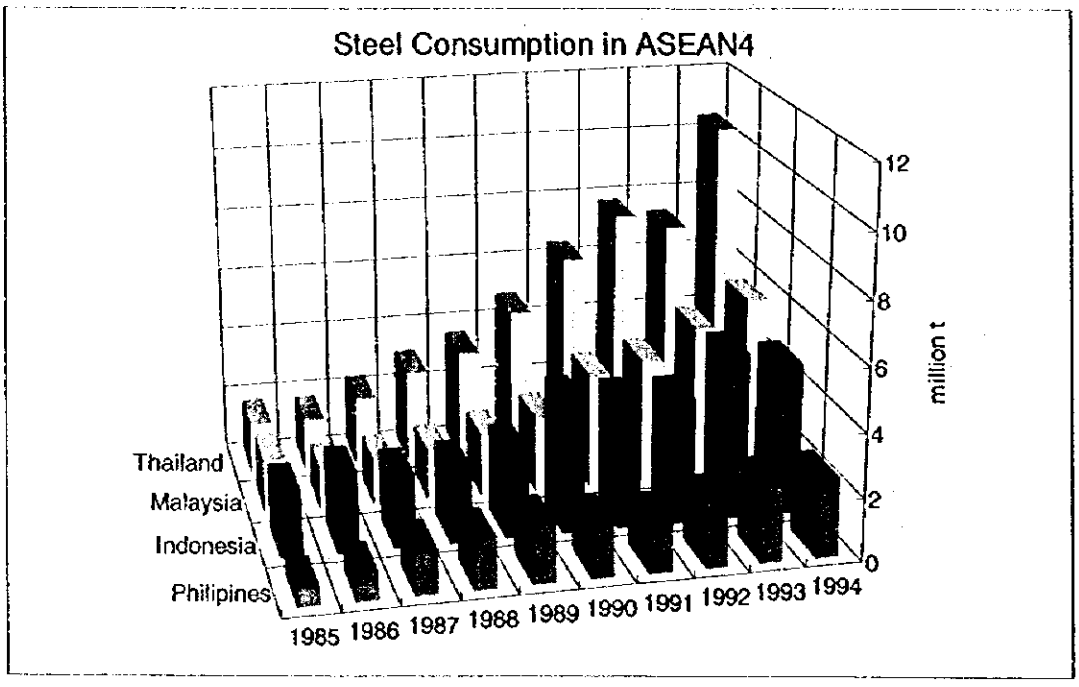
(1000t)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Japan	69,861	67,702	72,891	80,961	88,306	92,807	93,132	79,029	74,155	64,867
South Korea	10,020	10,934	13,642	14,519	16,946	20,054	24,454	21,820	25,246	30,510
Taiwan	5,263	6,529	7,834	9,690	11,750	12,790	15,770	17,750	20,920	19,150
Thailand	1,674	1,666	2,252	2,989	3,513	4,744	6,402	7,737	7,276	10,447
Malaysia	1,744	1,326	1,473	1,640	1,985	2,424	3,665	3,997	4,966	5,784
Indonesia	2,085	2,507	2,284	2,396	2,756	4,162	3,994	3,939	5,244	4,800
Philipines	562	850	1,353	1,584	1,826	1,678	1,601	2,035	2,464	2,456
ASEAN4	6,065	6,349	7,362	8,609	10,080	13,028	15,662	17,708	19,950	23,487
Asia	166,899	170,360	180,453	194,076	208,670	220,347	232,125	232,820	279,372	265,193
World	586,057	591,539	609,827	647,064	657,835	646,405	617,428	599,252	616,163	616,586

Source: IISI Steel Statistical Yearbook

Growth Rate of Steel Consumption

(1000t)	1986	1987	1988	1989	1990	1991	1992	1993	1994	85-94
Japan	-3.1%	7.7%	11.1%	9.1%	5.1%	0.4%	-15.1%	-6.2%	-12.5%	-0.8%
South Korea	9.1%	24.8%	6.4%	16.7%	18.3%	21.9%	-10.8%	15.7%	20.9%	13.2%
Taiwan	24.1%	20.0%	23.7%	21.3%	8.9%	23.3%	12.6%	17.9%	-8.5%	15.4%
Thailand	-0.5%	35.2%	32.7%	17.5%	35.0%	34.9%	20.9%	-6.0%	43.6%	22.6%
Malaysia	-24.0%	11.1%	11.3%	21.0%	22.1%	51.2%	9.1%	24.2%	16.5%	14.2%
Indonesia	20.2%	-8.9%	4.9%	15.0%	51.7%	-4.5%	-1.4%	33.1%	-8.5%	9.7%
Philipines	51.2%	59.2%	17.1%	15.3%	-8.1%	-4.6%	27.1%	21.1%	-0.3%	17.8%
ASEAN4	4.7%	16.0%	16.9%	17.1%	29.2%	20.2%	13.1%	12.7%	17.7%	16.2%
Asia	2.1%	5.9%	7.5%	7.5%	5.6%	5.3%	0.3%	20.0%	-5.1%	5.3%
World	0.9%	3.1%	6.1%	1.7%	-1.7%	-4.5%	-2.9%	2.8%	0.1%	0.6%

Source: IISI Steel Statistical Yearbook



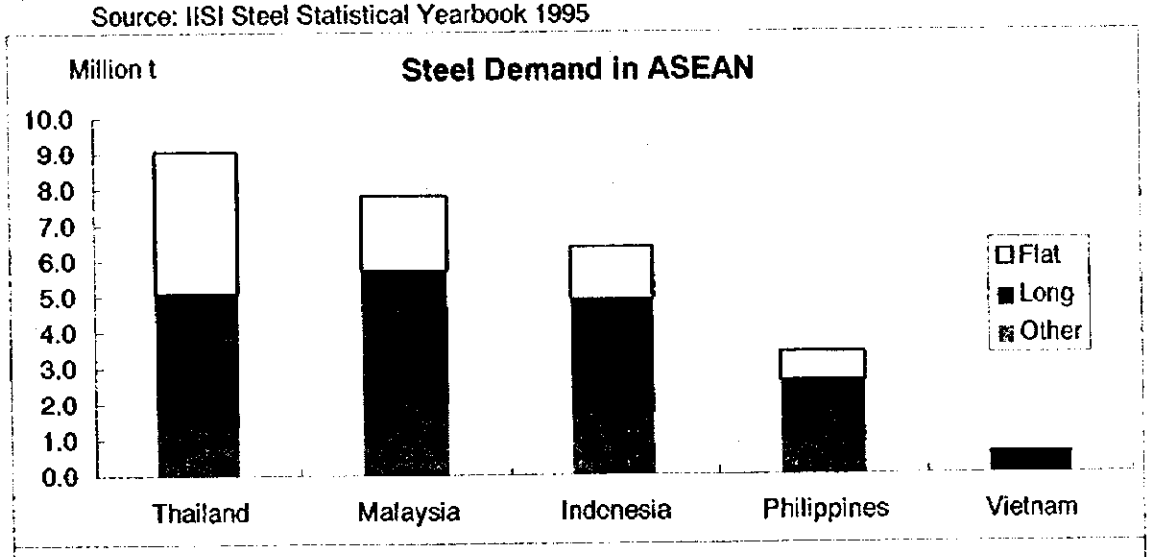
Current Situation of Steel Industry in ASEAN (1995)

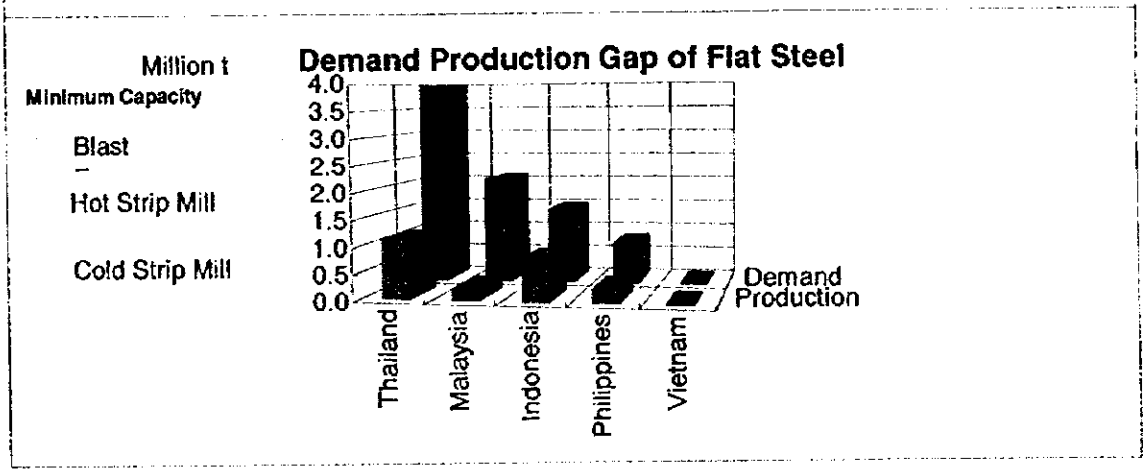
	(1000t)	Thailand	Malaysia	Indonesia	Philippine	ASEAN4	Vietnam	ASEAN
a	Demand	9,057	7,799	6,358	3,399	26,613	569	27,182
b	Long	3,733	3,733	3,186	1,731	12,383	508	12,891
c	Flat	3,985	2,086	1,477	804	8,352	27	8,379
d	Production	5,610	4,409	5,190	2,263	17,472	477	17,949
e	(Crude Steel)	2,134	2,450	4,130	923	9,637	271	9,908
f	Long	2,248	3,071	2,835	1,345	9,499	419	9,918
g	Flat	1,131	230	806	258	2,425	0	2,425
h	Import	6,205	5,489	2,230	1,389	15,313	151	15,464
I	(Semi-finished)	3,428	631	1,389	2,257	7,705	110	7,815
j	Long	1,640	852	442	386	3,320	90	3,410
k	Flat	3022	1939	1137	574	6,672	28	6,700

Source: SEAISI, Steel Statistical Yearbook 1995

l	h/a	Import Dependency	69%	70%	35%	41%	58%	27%	57%
m	j/b	Long	44%	23%	14%	22%	27%	18%	26%
n	k/c	Flat	76%	93%	77%	71%	80%	104%	80%
o	e/d	Crude Sufficiency	38%	56%	80%	41%	55%	57%	55%
p	l/a	% of Semi Import	38%	8%	22%	66%	29%	19%	29%
q	c/a	% of Flat Demand	44%	27%	23%	24%	31%	5%	31%

Source: IISI Steel Statistical Yearbook 1995



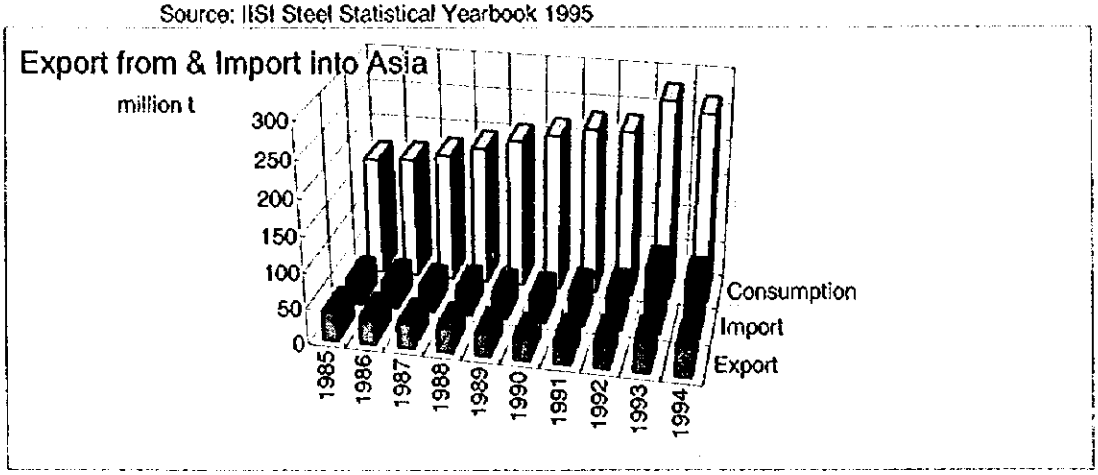


Steel Trade in Asia

Export from Asia, Import into Asia

(1000t)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Export	40,879	37,941	34,687	34,672	32,361	30,461	34,621	38,710	43,204	42,575
Import	38,241	38,100	36,317	38,815	39,670	38,988	49,997	54,585	92,123	82,071
Exp-Imp	2,638	-159	-1,630	-4,143	-7,309	-8,527	-15,376	-15,875	-48,919	-39,496
Consumption	166,899	170,360	180,453	194,076	208,670	220,347	232,125	232,820	279,372	265,193

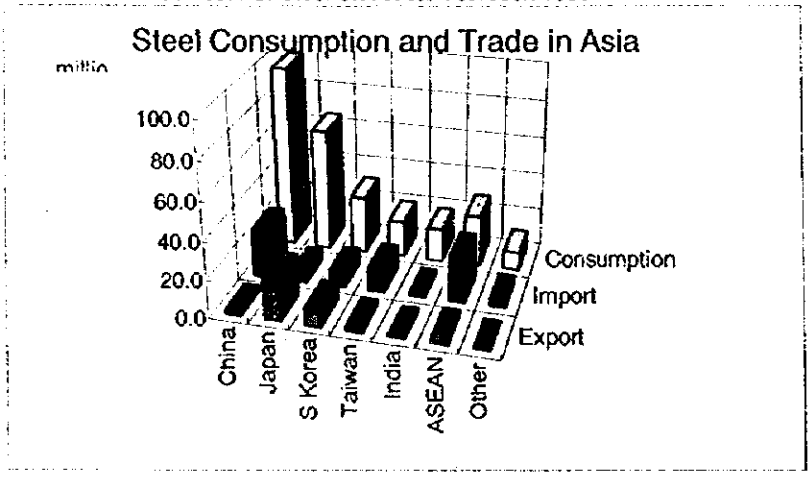
Source: IISI Steel Statistical Yearbook 1995



Steel Consumption and Trade in 1994

(1000 t)	Consumption	Import	Export	Exp-Imp
China	96,305	25,462	2,405	-23,057
Japan	64,867	5,686	22,407	16,721
S Korea	30,510	8,380	9,620	1,240
Taiwan	19,150	12,812	2,800	-10,012
India	17,560	1,528	1,310	-218
ASEAN	27,201	24,469	3,482	-20,987
Other	9,600	3,734	551	-3,183
Asia	265,193	82,071	42,575	-39,496

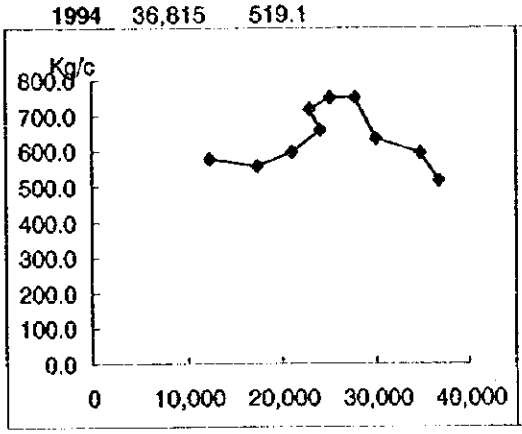
Source: IISI Steel Statistical Yearbook 1995



Steel consumption per capita and GDP per capita 1

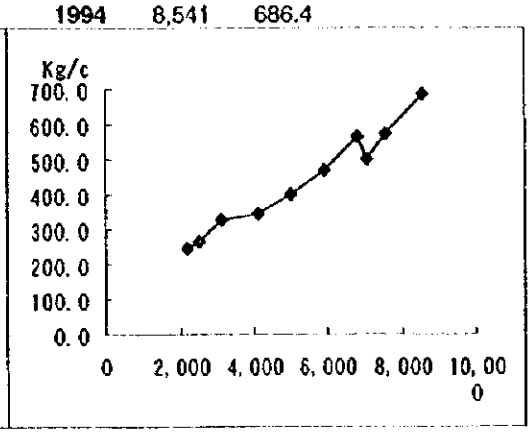
Japan

	GDP $/c	Steel Kg/c
1985	12,305	578.1
1986	17,438	557.3
1987	21,028	597.0
1988	23,986	660.3
1989	22,879	717.2
1990	24,990	751.2
1991	27,677	751.5
1992	29,948	635.7
1993	34,724	594.8
1994	36,815	519.1



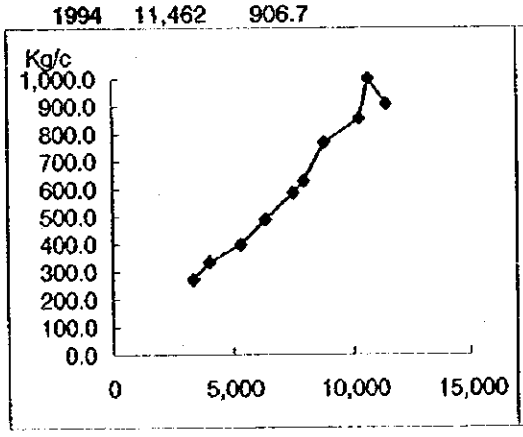
Korea

	GDP $/c	Steel Kg/c
1985	2,200	245.5
1986	2,504	265.3
1987	3,109	327.8
1988	4,122	345.4
1989	4,993	399.2
1990	5,917	467.8
1991	6,799	565.1
1992	7,053	499.8
1993	7,554	573.0
1994	8,541	686.4



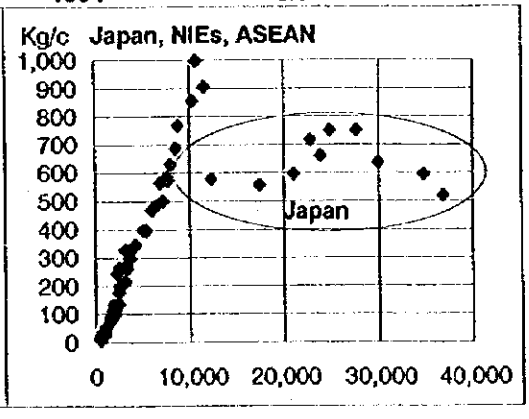
Taiwan

	GDP $/c	Steel Kg/c
1985	3,287	273.3
1986	3,990	335.6
1987	5,293	398.2
1988	6,330	486.9
1989	7,497	584.3
1990	7,917	628.5
1991	8,768	767.0
1992	10,267	855.4
1993	10,679	999.0
1994	11,462	906.7



Vietnam

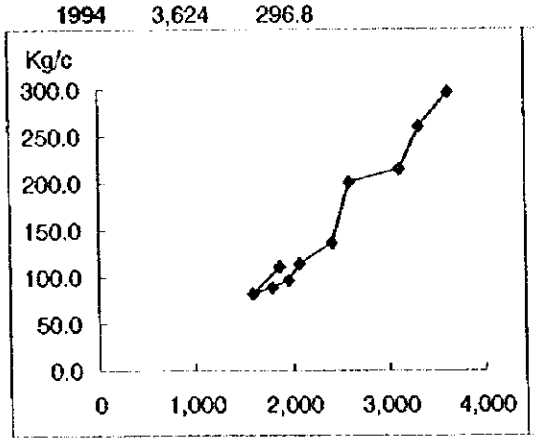
	GDP $/c	Steel Kg/c
1985		1.9
1986		2.4
1987		4.1
1988		1.6
1989		2.5
1990		2.7
1991		3.1
1992		5.8
1993		10.3
1994		5.0



Steel consumption per capita and GDP per capita 2

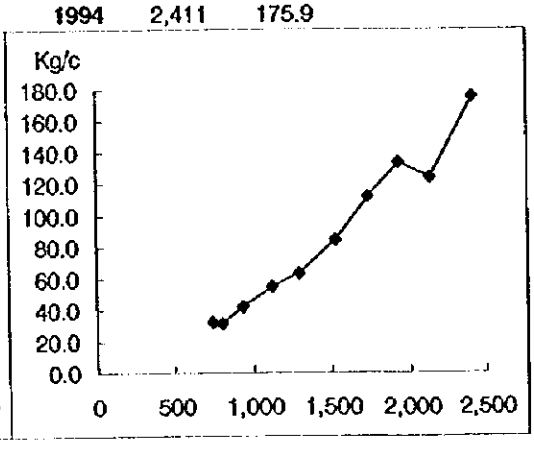
Malaysia

	GDP $/c	Steel Kg/c
1985	1,855	111.2
1986	1,589	82.3
1987	1,786	89.1
1988	1,947	96.8
1989	2,066	114.4
1990	2,411	136.5
1991	2,591	201.6
1992	3,116	214.8
1993	3,323	260.6
1994	3,624	296.8



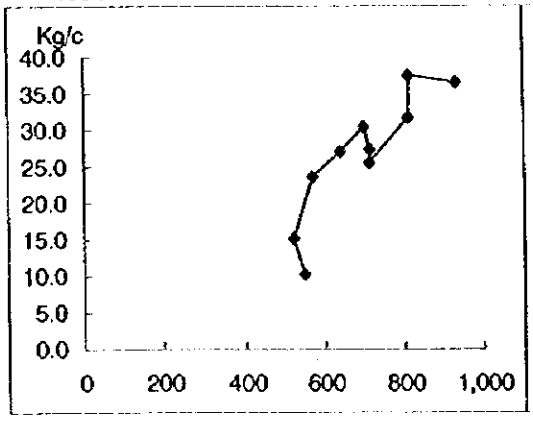
Thailand

	GDP $/c	Steel Kg/c
1985	740	32.5
1986	802	31.7
1987	929	42.1
1988	1,119	55.0
1989	1,292	63.6
1990	1,526	84.6
1991	1,734	112.5
1992	1,930	134.0
1993	2,130	124.2
1994	2,411	175.9



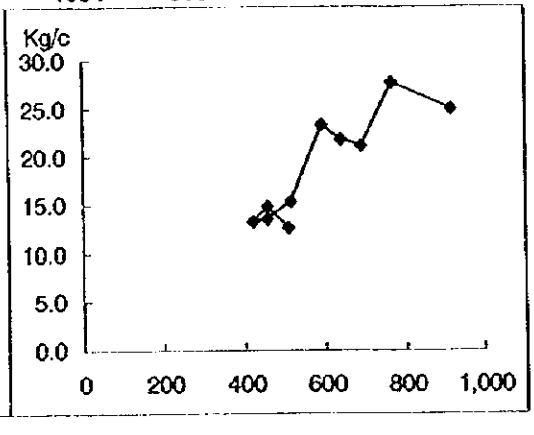
Philipines

	GDP $/c	Steel Kg/c
1985	548	10.3
1986	520	15.2
1987	569	23.6
1988	640	27.0
1989	699	30.4
1990	715	27.3
1991	713	25.5
1992	811	31.7
1993	812	37.5
1994	931	36.6



Indonesia

	GDP $/c	Steel Kg/c
1985	509	12.7
1986	456	14.9
1987	420	13.3
1988	457	13.6
1989	515	15.4
1990	592	23.3
1991	638	21.8
1992	688	21.2
1993	765	27.7
1994	916	25.0



5-3 Oil Refining Industry

3.1 Policy Alternatives and Their Implications: A Scenario of the Introduction of Oil Refining Business to Viet Nam

3.1.1 Trend of Demand for Petroleum Products in Viet Nam and Abroad

Demand for Petroleum products in Viet Nam drew close to about 90,000B/D in 1995, and the Petroleum Association of Japan forecasts that it will double to 180,000B/D in 2005, resulting from economic development. Currently the refineries in Viet Nam are very small and cause the country to depend on import for nearly all petroleum products.

Demand for petroleum products in Asian countries surrounding Viet Nam is rapidly growing, with the outlook for an increase close to 5 million B/D by 2005 over the current 10 million B/D. Against this, the forecast in terms of supply is that while there is active equipment investment in the ASEAN countries, delay or no progress in the development of refineries such as in China and Hong Kong will cause a shortage of supply capacity to extend to more than 1 million B/D.

Among some ASEAN countries, the supply capacity is considerably reinforced, especially in Thailand where an export refinery is planned as well. On the other hand, no prominent equipment reinforcement is planned in Singapore which is now an export base, and the outlook in the ASEAN countries as a whole is for the maintenance of the current supply and demand structure.

With respect to the world's supply and demand for crude oil in recent years (about 70 million B/D in 1995), demand has conspicuously expanded in Asia-Pacific regions such as China, and the outlook is for further increased dependence of the region on the Middle East. From the viewpoint of energy security, however, the security of the procurement capacity of petroleum products rather than crude oil appears to be the focal point. A higher degree of price response for petroleum products than for crude oil was experienced during the Gulf War.

3.1.2 Characteristics of Refinery Business

The keys to the world's oil industry in recent years have been "the principle of locating the refinery in the consumption area," and "recognizing the demand for lighter gravity petroleum products."

The world's refinery business, in which Middle East oil companies make prominent inroads into the downstream and distribution fields in oil-consuming countries, often locates plants on the periphery of big cities in a country as well. This principle of locating the refinery in the consumption area is aimed at reducing transportation cost for consumer goods production industry with thin profit margins, such as for gasoline.

Among petroleum products in recent years, increased demand for light gravity products such as gasoline and diesel oil, and reduced demand for heavy oil are prominent. With the increased demand for lighter gravity petroleum products and with environmental restrictions on sulfurization of gasoline, the significance of secondary refinery equipment has increased and the period for investment recovery in this capital-intensive equipment industry is extending.

Singapore has become an export base for petroleum products produced by the refineries of major international oil companies. In general, export refineries have difficulty securing profit margins under circumstances where each country has different environmental standards, thus causing diversified demand for products in addition to disadvantageous transportation cost. This business is realized in Singapore because of advanced equipment depreciation, demand being available for bunker heavy oil, sales capacity of the major international oil companies, etc. Many planned export refineries such as in

Indonesia (EXSOR) are subject to change, or have a slimmer prospect for realization.

The characteristics of the oil-related industries in the ASEAN countries other than Singapore are such that state-owned oil and gas businesses take the initiative in many cases. While state-owned enterprise monopoly characteristics such as restrictions on entry partially remain, the recent trend is toward the opening of the refining business to private and foreign capital. As the background for this, there is an objective of reducing the burden on national resources which is up against vigorous demand for refinery construction, but in countries where the distribution field (the wholesale and the retail) is closed, procurement of private funds is left undone and prevents project progress.

3.1.3 Crude Oil and Refinery in Viet Nam

Crude oil production is gradually increasing in Viet Nam, reaching 150,000B/D in 1995. Crude oil produced in Viet Nam is a light gravity crude oil (API degree: 40.5), which is similar in nature to Sumatra crude oil (such as Minas crude oil). It is about $2.00/Barrel more expensive than Dubai crude oil produced in the middle East, and is exported for the most part to Japan.

As a result, Viet Nam's oil-related income and expenditure, for example 1995 petroleum product imports of $867 million compared to crude oil exports of $1,033 million, has continued to be in the black since 1991. This contributes greatly to trade balance. However, the country wants to absorb the value added into the national economy and further improve income and expenditure by refining oil at home.

However, in addition to a big burden imposed on national economic resource distribution, other negative aspects or risks to the national economy must be taken into consideration such as an unavoidable deterioration in the current account balance. This deterioration results from the need to import refining equipment and others between construction and the start of operation. With respect to the business field as well, there is the possibility that with the refining cost, domestic product price will exceed the import price due to depreciation, interest burden, etc.

3.1.4 Scenario for Realizing Refinery Business

A refinery, which initially was to be located in a southern district near a large consumption area, is now planned to be constructed in a middle district (Dung Quit) with a view toward integrating nationwide development. The district, which is located 100 km south to Da Nang, is an agricultural and fishing village where no industrial infrastructure is available. According to the government's long-range plan, a petrochemical complex will be constructed, with the refinery as the nucleus, and the infrastructure development cost for things such as port facilities and power plants is expected to reach $1 billion.

(1) Development of Infrastructure

Industrial infrastructure is useful on a long-term basis for the integration of petrochemical businesses and other industries as well. In order for the refinery to be able to shoulder development costs for the moment, it is essential that the contents of the development should be limited to those associated with the refinery business, and that the cost should not expand more than necessary. It should cover only the parts of infrastructure, such as port facilities, which are dedicated to refining.

The petrochemical business and the refinery are interrelated in the respect that naphtha, a coproduct in the refineries, is the material for ethylene and propylene monomer, and that propylene is co-produced in FCC (cracker) as well. Accordingly, integrated development is highly merited, but it is difficult to foresee demand for these upstream petrochemical products 10 years from now in Viet Nam. There should be an option to postpone the construction of refinery No.2 and review the location and

production plan, unconnected with the petrochemical industry.

If government assistance can be expected for development of infrastructure, the refinery business will have enhanced feasibility, and it is more likely that a JV in which foreign enterprises participate will become a business entity. For fund raising in such a case, the introduction of ODA funds, etc. from the home countries of foreign enterprises that participate is regarded as an option.

(2) Crude oil used and equipment composition

The product composition (yield) at a refinery changes depending upon the crude oil used. Equipment composition as well may change the product composition. Therefore, selecting whether the crude oil used in the projected refinery will be a home-produced crude oil or an imported crude oil (or a combination), determines the equipment composition of the refinery under a certain outlook for demand, and is accordingly an important factor in the refining cost.

For example, 100% home-produced crude oil will be about $50 million - $100 million more expensive annually than 100% Middle East crude oil according to a test calculation (on the assumption that the difference in price between the types of oil is $1.5 - $2/barrel with 90% operation). An additional investment of several hundred million dollars is required for higher grade equipment such as reformers and crackers (secondary equipment) to cope with demand for lighter gravity (in the case of a low API degree Middle East crude oil), and this necessitates an integrated judgment together with the sales capacity of coproducts, etc.

(3) Profitability and distribution field

If Viet Nam desires foreign participation in this project, they must assume that the foreign enterprise will pursue business profitability, and will call on the government for its commitment to the business.

To secure business feasibility, depending upon the method of determining the invoice price of petroleum products for distributors, there may possibly be a system under which cost is guaranteed to the refining enterprise. In this case, the risk when invoice prices rise is covered by a state-owned enterprise in the distribution sector or by the local/regional government in Viet Nam where the controlled retail price is maintained. However, even this system does not provide a profitable business for foreign enterprises. The greatest incentive for attracting foreign capital is the Viet Nam market with a population of 100 million in the near future. How to cope with the expectation of access to the distribution retail sector is the greatest focal point.

In the distribution sector of Viet Nam's petroleum products (especially fuel oil), Petrolimex captures 60% - 70% of the market share throughout the country, with import and sales rights held by state-owned enterprises under the control of different competent authorities. Foreign capital participating in refinery can be allowed entry into this distribution sector step by step with the timing and quantity restricted. Examples include, (1) refinery - operation - approval of entry after a certain period of time, (2) approval of domestic sales of products in proportion to the share of investment, etc.

(4) Other incentives for foreign enterprises

Preferential treatment for foreign capital and industrial protection measures through the taxation system, especially at the startup of business, are widely taken in the ASEAN countries. In addition to the reduction or exemption of corporation tax for a certain period of time, preferential measures such as the reduction and exemption of import duties on equipment during the construction period are provided for in the Foreign Investment Law for some industries in Viet Nam.

Industrial protection via import duties is also effective. There may be room for its implementation

until 2006, although AFTA/CEPT is making progress within ASEAN. However, it may possibly cause problems with respect to export products.

Preferential acquisition of the rights to develop oil and gas in Viet Nam may also have an appeal for foreign oil enterprises. This would merit review as an option in the case where no access approval is given to the distribution field.

3.1.5 Conclusion

Rearing of Viet Nam's oil refining industry is considered a necessary policy, not only from the viewpoint of strengthening the foundation of the national economy but also of the securing of national energy. In realizing this business, however, structure and business entity in particular, through distribution field, will determine the tempo of industrial development.

In order for a foreign oil enterprise to have an interest in the refinery business without having access to the distribution field on a perfect and long-range basis, it will be necessary to prepare a substantial incentive in respect to the development of infrastructure and invoice product prices, etc.

It can safely be said that the incentive to a foreign oil enterprise will be raised by leaps and bounds if entry is admitted. Such an event would allow the country to significantly count on its fund raising capacity in realizing business, operating techniques, and product sales capacity abroad.

In any case, the oil refining business, whose feasibility should fundamentally be considered integrated with the distribution and retail businesses, is an industry which essentially requires protection if this integration does not exist.

3.2 Participation with AFTA and WTO, and Their Influence on Viet Nam

3.2.1 Import Tariff Levels and the CEPT Schedule in ASEAN Countries

For CEPT (Common Effective Preferential Tariff) purposes, Thailand and Indonesia, as well as Singapore, have listed petroleum products on NT (Normal Track), and the CEPT of those are schedules to be lowered to 5% or less by the year 2000. Though the tariff in Indonesia has been as low as 5% previously, Pertamina, a state-run enterprise with an exclusive import right, controls import volumes. In the Philippines, petroleum products are designated as temporary exclusion (TE) items, and Malaysia also treats some petroleum products as TE items.

Thus, there are differences among countries in tariff rates and exclusion items, and it seems that some items could be placed on exclusion list for energy security view points. When tariffs for petroleum products in ASEAN countries are examined, it appears that in general tariffs have been going down. However, there are various internal situations by countries other than Singapore, and future developments need to be monitored closely.

3.2.2 Non-Tariff Barrier and WTO

What appears to give difficulty to the ASEAN countries as they promote AFTA (ASEAN Free Trade Area), as regards petroleum products in particular, is the fact that their petroleum industries are structured with and around state-run enterprises. In such countries, petroleum products are treated as strategic materials, and their prices are controlled by the government for energy security reasons. To make this possible, the Indonesian government has given Pertamina, a state-run enterprise, exclusive import-export rights, and does not allow entry of private companies in the distribution sector. In Malaysia, also, the government controls retail prices, while in Thailand any foreign entity desiring to newly enter the refinery business can do so only through a joint venture with PTT, the state-owned enterprise.

Of all the actions, the monopoly of the import-export rights by a state-run enterprise in Indonesia is

clearly tantamount to quantity control. There are many things about the way (non-tariff barriers are handled under AFTA) that are not clear, but as a general rule, a member country exporting some items under CEPT is required to abolish such barriers within five years after it received application of a bound rate from the other member country. In other words, it would seem that such a country would not be required to abolish its non-tariff barriers as long as it does not export to a country under CEPT tariff from that country. On the other hand, quantity control constitutes a violation of the basic principles of the WTO. Besides quantity control, a violation of the national treatment principle, preventing foreign companies from selling its products on grounds of price control or foreign investment control, is also likely to constitute a WTO violation. Moreover, the United States and EU are taking a tough attitude toward new member countries, and it is unlikely that any country can affiliate with the organization on more favorable terms than existing member countries. However, it can also be said that whether these will become real issues depends on how strictly WTO will enforce its rules.

3.2.3 Influence on Industrial Policies in Viet Nam

Tariffs in Viet Nam on major petroleum products are fairly high — 60% for gasoline, 40% for naphtha, and 25% for kerosene and diesel oil, and so on. Viet Nam's aim in imposing such high tariffs when it has no domestic refining industry to protect is believed to be to control imports as it does not have enough foreign currencies, as well as to gain tax revenue on petroleum products, its main import items. Also, for CEPT purposes, petroleum products are designated as GE (General Exclusion) items probably for energy security reasons, which sets Viet Nam apart from the other countries.

With respect to industrial policy, Viet Nam will need to apply protective tariffs when it has built a refinery, so that import prices (international prices) will be higher than the prices of its domestic products, in order to raise the operating rate of the local refinery, a process-industry. This is because the refining cost during initial periods is expected to be quite high due to equipment costs, among other things. (See Supplement 2)

As stated previously, in AFTA it is possible to protect domestic industries by means of quantity control as long as exports are not contemplated. Therefore, it would be possible for Viet Nam to foster a domestic refinery by shutting out imports temporarily through coordination among Petrolimex and other state-run enterprises. However, if production exceeds domestic demand and some portion is exported within ASEAN, quantity control will have to be abolished immediately. In such a case, efforts will have to be made to make the domestic refinery cost competitive while protection by tariff is still allowed (for Viet Nam until 2006).

The first conceivable alternative for introducing refining industry in Viet Nam is to construct the refinery as soon as possible and start production within the parameters of domestic demand. There are many uncertainties regarding AFTA's handling of non-tariff barriers, as stated above; in this case, however, it may be possible to buy time until Viet Nam can gain competitiveness in petroleum products without inviting too much strong objection even if import-restrictive measures may remain for a while. Secondly, it is important to try and keep the tariff rates as high as possible when negotiating for affiliation with WTO. WTO is expected to be flexible with tariff rates, preferring even high rates to non-tariff barriers. As regards CEPT, it is difficult to judge how much room is left to change the schedule and the rules, but for the extension of the period of transition to Inclusion List or the period of transition to bound rates, it will be necessary to pursue the possibility of negotiation while monitoring the moves of the other member countries.

Tariff Reduction Schedule on CEPT Scheme

Petroleum refining	Base Rate (other than ASEAN)	AFTA, CEPT (96-03)	Relation to WTO	Comments
Thailand			Jointed in January, 1995.	PTT, a state-owned oil company is a leading firm in the industry. Private firms are, however, able to enter the market fairly freely (from refining to sales).
Gasoline	0.01B/L	NT 15 - 5		
Kerosene	0.049B/L	NT 15 - 5		
Diesel oil	0.01B/L	NT 15 - 5		
Malaysia			Jointed in January, 1995.	Although Petronas, a state-owned firm has a monopoly in upstream products, the petroleum industry from refining to sales operates in a largely free market. Prices are controlled by the government.
Gasoline	5	NT		
Kerosene	-	TE		
Diesel oil	2(-)	NT 2 - 2(TE)		
Indonesia			Jointed in January, 1995.	Pertamina, a government-run firm, has a monopoly on almost the entire industry, including refining, imports and sales. Private companies, however, may now enter the market.
Gasoline	5	NT 2.5-2.5		
Kerosene	5	NT 5 - 5		
Diesel oil	5	NT 5 - 5		
Philippine			Jointed in January, 1995.	
Gasoline	-	TE		
Kerosene	-	TE		
Diesel oil	-(20)	TE		
Singapore			Jointed in January, 1995.	Singapore is urging the creation of AFTA within ASEAN.
Gasoline	0	NT 0 - 0		
Kerosene	0	NT 0 - 0		
Diesel oil	0	NT 0 - 0		
Viet Nam			Any policy violating the TRIM agreement is prohibited. For example, 1) Products mandates (duties on import of specified products in certain regions), 2) Production licensing (Quotas).	PetroViet Nam, a state-owned companies operate in retailing. Viet Nam is applying for membership of WTO.
Gasoline	60	GE		
Kerosene	25	GE		
Diesel oil	25	GE		

3.3 Supplement 1: The Refinery Business in ASEAN Countries

3.3.1 Business Surroundings of Refinery Business in ASEAN

(1) The World Oil Market and ASEAN Countries

ASEAN and East Asian demand for oil products is rising rapidly in line with the remarkable economic development of the region. The same may be said of demand for crude oil in the Asia-Pacific region: the region which represented only 18% of worldwide demand in 1985, now accounts for approximately 25% of worldwide demand (70 million b/d in 1995). (Demand for oil in the Asia-Pacific region over the past ten years has grown at a yearly average of 5.3%, compared to a world average of 1.6%.) Meanwhile, there has been no significant growth in local oil production and as a result, the region has become even more dependent on the Middle East for its oil. (See Table 3.1)

Overall supply and demand for crude oil has, relatively speaking, stabilized in recent years, partly because worldwide demand for crude oil is increasing at a decreasing rate. This has resulted from diversification and energy saving measures made possible by technological innovation and increased production in non-OPEC countries. Although many uncertainties still exist, including the likelihood of China becoming a major importer of crude oil and changes in the former Soviet Union related to oil production, the general opinion is that supply and demand will remain stable well into the next century. At the same time, it is generally believed that even a crisis in the Middle East, is unlikely to disrupt oil supplies or hike up oil prices over.

Refined oil products, on the other hand, are restricted in transport and storage, and political or military change in the Middle East would push up the international price in the short-term and make oil temporarily difficult to obtain. Figure 3.1 depicts such a situation based on the movements of oil prices and an oil product (naphtha) when the Gulf War broke out. It is clear from the table that the price of naphtha rose far more quickly than the price of crude oil immediately after Iraq's invasion to Kuwait, and that naphtha prices remained high for some time even after that. The Iraqi invasion also made it difficult for Pakistan to continue to procure oil products primarily through a tie-up with Kuwait. This experience prompted Pakistan to complete the construction of 120,000 b/d refinery joint-venture with Iran. Concern over such energy security problems is partly responsible for recent rise in construction of domestic refineries for self-supply of oil products in ASEAN countries.

(2) Supply and Demand of Oil Products In and Around ASEAN

The actual demand for oil products in the six ASEAN countries in 1995 is estimated at approximately 2,910,000 b/d[1]. Demand is expected to increase to 3,660,000 b/d by the year 2000 and to 4,210,000 b/d by 2005, growing at annual rates of 4.7% and 3.8%, respectively, over the two time spans from 1995. Especially demand for gasoline, naphtha and middle distillates such as kerosene and diesel oil is expected to grow rapidly. Table 3.3 shows the breakdown of demand for oil products in ASEAN in 1995[2]. A characteristic feature of this demand breakdown is that middle distillates collectively occupy a greater portion of total demand than in Japan or in NIEs. This can be explained by the fact that there are more diesel vehicles than gasoline in the ASEAN countries, and that demand for naphtha for petrochemical products is still fairly limited.

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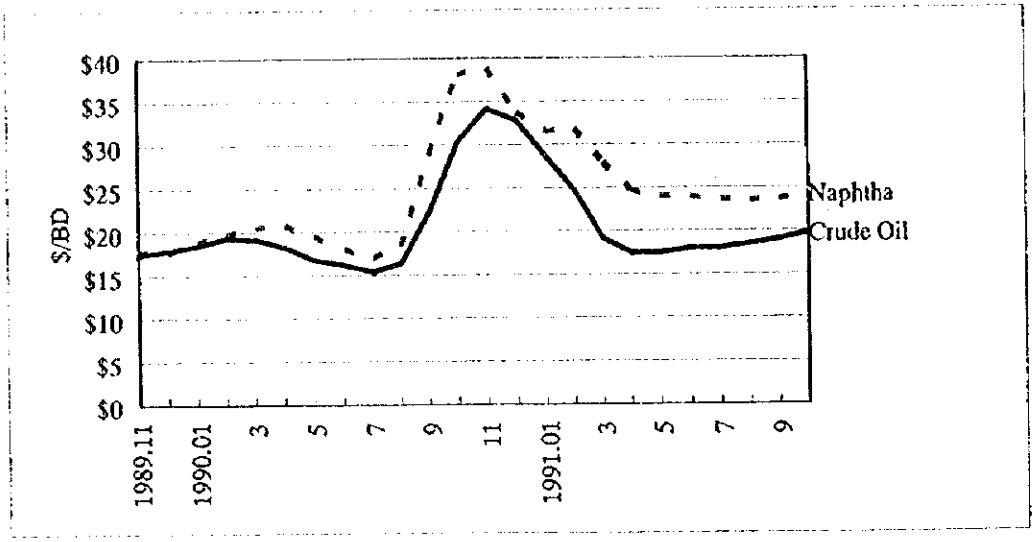
[1] Petroleum Association of Japan. See Table 3.2

[2] The Institute of Energy Economics, Japan



Change (%)

	90/7→9	90/7→11
Crude Oil	36.7	109.1
Naphtha	58.6	112.9

Figure 3.1 Change in the price of crude oil and petroleum products during the Gulf War

On the supply side, the Petroleum Association of Japan forecasts that the production capacity, standing at 3,420,000 b/d in 1995, will increase to 4,130,000 b/d by the year 2000 and to 4,830,000 b/d by 2005. It is generally believed that though supply will become temporarily scarce in 1997 and 1998, there will be no major change in the supply-demand situation in ASEAN as a whole because the various countries have definite plans to expand capacity. However, there are many uncertainties concerning the outlook for 2005.

On a national level, capacity expansion in Thailand, which had a supply shortage of more than 200,000 b/d in 1995, is remarkable. It is possible that Thailand will become self- sufficient by 2000, and will even gain extra capacity for exports by 2005. Indonesia, on the other hand, will almost certainly suffer supply shortages of at least 100,000 b/d by 2000 because there is a lack of funds to finance the necessary expansion of capacity to meet rising demand.

Developments in East Asian countries around ASEAN are major factors in the consideration of supply and demand for oil products in the region. The influence of China, NIEs (South Korea and Taiwan), and India also needs to be taken into account. In China, first of all, the construction of refineries is being delayed while demand is increasing rapidly, and the capacity shortage is expected to more than double from the present level (170,000 b/d) by the year 2000. This is believed to be because of regulations that do not allow foreign capital to enter its domestic markets, and also because of poor infrastructure, employment problems and the government's plan to require producers to concentrate on exports. Another reason is that China has to modify its existing refineries to be able to treat the high-sulfur crude oil that it imports from the Middle East. The NIEs and India are also faced with substantial capacity shortages at present, but the above-mentioned forecast indicates that except for Hong Kong, the situation should gradually improve.

3.3.2 Structure of the Oil Refining Industries in ASEAN Countries

A survey of the refinery business entities and development in the industry in four ASEAN countries (Thailand, Indonesia, Malaysia, Singapore) shows that Singapore alone is markedly different from the other three in two aspects: competition in every level from production (refining) to distribution (sales) is completely free for private and foreign enterprises, and most products are exported. Characteristic features of each country are summarized below. (See Table 3.4, 3.5, 3.6)

(1) Thailand

The Petroleum Authority of Thailand (PTT) plays a key role in the oil industry through special subsidiaries particularly in areas such as refining and distribution. Although privatization and deregulation is in progress, PTT still has controlling power and is expanding its business into the petrochemical segment.

Two refineries started operations in early 1996 to expand Thailand's refining capacity to 745,000 b/d among five refineries. There has always been an influx of private and foreign capital since before PTT was founded, and the two new refineries are 64% owned by Shell and Caltex, respectively. (However, an official joint venture with PTT is obligatory.) The distribution sector is also open to foreign capital for free competition (PTT's share, excluding heavy oil for electric power: 26% in 1995), but pricing seems to be controlled by the government's monitoring system through PTT's pricing.

Addition of two refineries means there is now enough capacity to enjoy temporary surpluses. In addition, there are projects to build two further refineries by 2000 for an additional capacity of approximately 420,000 b/d, and it is reported that one of them (120,000 b/d) has been authorized as an export refinery.

(2) Indonesia

In Indonesia, a state-operated oil company (Pertamina) exercises exclusive control over everything from the upstream operations (oil exploration, oil production) to the downstream operations (distribution, sales). In the refining sector, Pertamina owns all of the seven refineries (994,000 b/d in total capacity), and enjoyed a complete monopoly until the government deregulated entry of private and foreign capital last year. Without private and foreign capital, Pertamina is no longer financially capable to expand its supply capacity and increase production to satisfy the rising demand for oil products.

Pertamina, however, still enjoys a monopoly of the distribution operations (wholesaling, retailing), including imports, and here, early deregulation is not expected. This is why there has been no progress in the twelve projects by private and foreign[3] concerns authorized by the government (the Investment Coordination Bureau). It is difficult to raise funds for projects that are deemed unprofitable while distribution remains strictly regulated.

Pertamina's principal refinery project is called the "EXOR project." EXOR1 started operations in 1995, and EXOR2 through EXOR4 have been announced. However, the chances of their being implemented have become extremely small. (The construction of EXOR2 supposedly started to be completed in 1997, but it remains uncertain when it will be completed.) The EXOR project was a refinery project originally intended for exports as its name implies (Export-oriented Refinery). Most of the products from the existing EXOR1 (Balongan) are sold in domestic markets, and exports are mainly in heavy oil. This can be attributed to growth of domestic demand, but also reflects the low

[3] Includes none of the major international oil producers.

profitability of an export-oriented refinery.

(3) Malaysia

Petronas, the state-owned oil enterprise is under direct control of the Office of the Prime Minister and has exclusive control over upstream operations, and enjoys a share of approximately 30% in the retailing part of the distribution sector. However, the sectors between refining and distribution have been fairly open to private and foreign capital, especially refining and wholesaling, and it is possible to find businesses wholly owned by foreign concerns.

Malaysia's refining capacity is estimated at 350,000 to 400,000 b/d among five refineries (including approximately 150,000 b/d of the 2 Petronas refineries). This is not sufficient to fully meet domestic demand, and products are imported from mainly Singapore. The Malacca-2 refinery, a joint venture of Petronas, Conoco, and Statoil, is scheduled to start operations by 1998, but no other project is showing progress. After obtaining a license, there are no limitations on importing and selling oil products and subsequently it is more profitable for the five international oil majors (which have entered the distribution sector) to supply from their refineries in Singapore.

Selling prices of fuel oils are controlled by the government, and if product costs change, the government adjusts the amount of tax (sales tax) to prevent fluctuation of retail prices. (Petronas calls this an "automatic pricing mechanism.")

(4) Singapore

Singapore's refining capacity is approximately 1,130,000 b/d. There has been no major capacity expansion during the last several years, but current capacity is third largest in the world after Houston and Rotterdam. Singapore has secured its position as a swing refinery for supplying to countries in the Asia-Pacific region from the four refineries of Exxon, Mobile, Shell, and SRC (Singapore Refining Company). (BP's facility was shut down in June 1995.) In contrast to the surrounding ASEAN countries, Singapore has always had a free system for new entry, production, export, and import. This reflects government efforts to attract foreign capital based on what might be called a national policy which it has followed ever since independence in 1965. Singapore's advantages as a swing refinery are said to include 1) geographical location, 2) industrial infrastructure including ports and harbors, and 3) the existence of trading firms in the country.

As a result, at this point its bunker oil is in demand, it has secured demand by getting on the major international oil producers' network, and also in terms of refining cost, the orderly depreciation of its basic facilities has progressed (though there have been additional investments), and these factors have helped enhance its price competitiveness. Though it has no present major expansion project, Singapore has indicated that it plans to upgrade its secondary refining facilities (cracking facilities in particular) watching refinery investments in neighboring countries.

3.3.3 Current Demand for Oil Refining Goods and Refinery Business

As mentioned earlier, demand for oil products in ASEAN countries has been growing remarkably. The outlook is that future demand will be oriented more toward lighter (or white oil), low-sulfur, and higher quality products. Increased demand for lighter products indicates that demand for transport fuels such as gasoline and diesel oil will grow faster than demand for the various heavy oils. This trend is more clearly visible in developed countries such as Japan and the NIEs, and among the ASEAN countries, Thailand and Malaysia are expected to lead the others. Demand for heavy oils is not growing partly because of expanding coal use and introducing natural gas, and it is generally believed that their supplies tend to be excessive. In some countries, however, heavy oils are being

used to meet growing demand for energies because the above-said plans are being delayed. In Viet Nam and the three CLM countries soon to join the ASEAN, it is possible, for example, that industrialization will lead to expansion of demand on heavy oil for power generation, but all in all, the trend for lighter products will gradually strengthen in the ASEAN countries. (See Table 3.3)

There is a need to upgrade oil products. A switch to low-sulfur products and production of lead-free gasoline are examples of needed environmental measures in developing countries where air pollution is worsening. In the ASEAN nations, diesel oil for automobiles and heavy oil used are required to have a low sulfur content; the need for low sulfur content is especially acute in the case of diesel oil which is widely used and increasingly in demand as a transport fuel.

Because of the growth of demand for oil products and shifts towards lighter and low-sulfur products, refineries in the ASEAN countries show shortages not only in overall refining capacity but also in refining capacity for handling lighter and low-sulfur products. It is obvious that any future project to expand refining capacity must also upgrade the secondary facilities to fulfill these needs. Production of low-sulfur, lighter crude oil within the area is slowing down while demand for crude oil is growing. A corresponding increase in the amount of high-sulfur, heavier crude oil from the Middle East also needs to be taken into consideration.

Crude oil produced within the area, represented by Tapis crude oil of Malaysia and Sumatra Light of Indonesia (e.g., Minas crude oil), are considerably lower in sulfur content and also lower in specific gravity (higher in API degree) than Middle East crude oils. (See Supplement 2) Therefore, if these regionally produced crude oils are refined, even refineries with a relatively simple equipment composition (consisting of atmospheric distillation equipment (TP), vacuum distillation equipment and reformers) can obtain low-sulfur petroleum products, with product mixes which are generally high in yields of gasoline ~ diesel oil.

Table 3.7 clearly shows these circumstances. Among refineries in Thailand, Indonesia, Malaysia, Singapore, and Japan, those in Malaysia have a remarkably low secondary equipment percentage of 26.6%. This is because the Malacca Refinery, the major refinery in Malaysia, uses a locally produced crude oil for 100% having the above-said characteristics. The secondary equipment ratio in Indonesia is also fairly low because Indonesia, has mostly been using local crude oil. The secondary equipment ratio in Singapore is similar to that of Japan, which suggests that Singapore mostly treats Middle East crude oil.

However, the reduction of regionally produced crude oils has made it difficult for refineries (traditionally dependent on the above characteristics) to maintain or expand production levels. Production of crude oil in Indonesia had dropped to 1,180,000 b/d in 1985 after reaching a peak amount of 1,690,000 b/d in 1977. Production has now recovered to around 1,500,000 b/d, but is expected to gradually decrease over the long term mainly because of limited reserves. In Malaysia, also, Petronas is controlling oil production to about 650,000 b/d in line with its policy to preserve oil resources.

Indonesia is willing to maintain its exports of local crude oil, and at the same time is trying to cope with the increased treatment of Middle East crude oil by adding TP and other secondary facilities at its existing refineries. In Malaysia, the Malacca-2 Refinery now under construction is to install a hydrocracking process facility and other secondary equipment to treat Middle East crude oil.

Thus, rising demand for lighter, lower-sulfur petroleum products and the corresponding trend toward more sophisticated refineries (with higher secondary equipment ratio) is directly related to the energy situation and policies of individual countries. Moreover, refineries in each country need to have equipment makeups consistent with domestic/local demand if they are to maintain their economic viability, while closely monitoring the price differences (of which the tendency is

widening) between regionally-produced crude oils and low-sulfur, lighter crude oils and other Middle East crude oils. This is because equipment investment (construction costs) of a refinery varies significantly depending on the equipment makeup to be installed.[4]

3.4 Supplement 2: The Introduction of Oil Refining Business and the Effect of Import-Substitution in Viet Nam

3.4.1 Characteristics of Petroleum-Related Business in Viet Nam

Oil-related business in Viet Nam is a national strategic industry in the sense that it supports Viet Nam's trade balance. They are all national businesses also because the exploration, production and export of crude oil and the import and sales of petroleum products are all monopolized by state-run enterprises, and the state controls domestic prices. The following outlines the business and its characteristics.

(1) Production and export of crude oil

The value of crude oil exported by Viet Nam amounted to $1,033 million in 1995, accounting for 19% of all exports. On a volume basis, Viet Nam produced 7.7 million tons (150,000 b/d according to the Petroleum Association of Japan) in the same year, and exported all of it. Crude oil is mainly produced at the Bach Ho oil field (White Tiger) and total production is increasing. The length of recoverable period based on currently proved reserves is only around 10 years. However, some forecasts indicate that because development of oil wells in Viet Nam is expected to progress, production will have more than doubled from the present volume by the peak period from 2000 to 2010. The Crude oil produced at Bach Ho is characterized by lighter specific gravity and low sulfur content, its API being 40.5 degrees, sulfur content 0.03%, and specific gravity 0.823. Therefore, it reportedly commands premiums of 50 to 90 cents/bbl over Minas crude (Indonesian crude), which is priced approximately $1.5/bbl higher than Dubai crude, in the international market. According to a survey by Viet Nam, Japan accounts for 70-80% of its oil exports, and Singapore 17-20%. In Japan, the Vietnamese crude oil is mostly used for crude-oil burning as a replacement of Minas crude. (See Table 3.9, 3.10, Figure 3.2)

It is a state-run oil company, Petro Viet Nam (General Corporation), as in the other ASEAN countries, that is undertaking the crude oil development and production on an exclusive basis. The company runs its business through PS (production sharing) contracts with foreign enterprises and others. Export of crude oil is also controlled exclusively by Petro Viet Nam through its subsidiary, and only the petroleum products import and distribution parts of the oil business, discussed later, are outside its control.

(2) Import and domestic sales of petroleum products

Viet Nam is almost entirely dependent on imports for Petroleum products such as gasoline and diesel oil. Ho Chi Minh Refinery (refining capacity: 8,800 b/d), a small facility owned by Saigon Petro, a state-run enterprise under the People's Commission of Ho Chi Minh City, is the only refinery in the country. The refinery does not seem to be refining crude oil.

Table 3.11 shows the breakdown of imported products based on a survey by Viet Nam. The

[4] Examples include two refineries in Thailand, Rayong and Star. Though they were constructed and began operations in 1996 almost at the same time, their equipment makeups are significantly different probably because they use different crude oils.

imported product mix is characterized by large portions occupied by diesel oil and gasoline. Demand for heavy oil is extremely small. Virtually the same trend is to be seen in actual domestic consumption shown in Table 3.11 (based on the same survey). There is some disparity between imports and consumption because in 1995 the country reexported approximately 500,000 tons of Petroleum products, diesel oil for the most part, to neighboring countries (Laos, Cambodia).

Diesel oil occupies a significant portion of total volume, a trend that can be seen in all Southeast Asian countries with many diesel trucks. Meanwhile, demand for heavy oil is expected to grow in the future as the country becomes more industrialized.

The three state-run enterprises almost exclusively control the import and resale rights of fuel oils (gasoline, kerosene, diesel oil). (See Table 3.12. The rights to handle lubricant oil, etc. are open to foreign enterprises as well.)

It is worth noting that approximately two-thirds of imports and domestic sales are controlled by Petrolimex which is under the umbrella of the Ministry of Trade, and that the share of Petro Viet Nam's own subsidiary is extremely small. Reportedly, the government plans to increase the number of importers in response to growing demand, but what with the integration and abolition of organizations, it is quite difficult for an outsider to understand the industrial structure. Saigon Petro, which is said to have a 50% market share in the south, is outside the jurisdiction of the Ministry of Trade, and this is one reason why the distribution sector in Viet Nam is said to be overcrowded with government agencies.

Foreign capital is allowed to enter distribution of LPG, asphalt, and lube oil, but not fuel oils. There are estimated to be approximately 2,000 SS (Service Stations) in the country, and all of them are under the umbrella of Petrolimex and other state-run enterprises.

Prices of major Petroleum products are controlled by the government through the Price Commission under the Office of the Prime Minister. According to a survey by Viet Nam, domestic prices are not necessarily linked with import prices alone, but also reflect tax revenue and energy-related policies. However, prices in Viet Nam are generally kept lower than international level. (Examples - 1997 prices: 4,200-4,300 VND/l for gasoline, 3,600-3,700 VND/l for kerosene).

3.4.2 Implementing the Introduction of Oil Refining Business to Viet Nam

The primary implication of introducing refineries to Viet Nam is a change in the present trade pattern of exporting crude oil and importing refined products, and a new self-sufficiency in oil products. What this means for the national economy is that the country will take the added values to improve its trade balance, and in the long term, reduce energy costs. Secondly, it is also important to be able to secure the procurement of petroleum products which are said to be more important than crude oil from the viewpoint of energy security. This also includes ensuring reliable supplies of raw materials for the petrochemical industry. Other benefits might include providing more jobs. The following will consider the economic benefits of the introduction of the refinery business and precautions from the viewpoint first cited above.

(1) Import substitution = Change in trade structure

As stated previously, Viet Nam produces 7.7 million metric tons of crude oil (1995) and imports close to 6 million metric tons of petroleum products (1996). The construction of refineries for self-sufficient petroleum products means that first of all the country will no longer be dependent on imports. The refining capacity of the refinery now contemplated is 6.5 million metric tons calculated as crude oil, which is sufficient to satisfy the present demand for oil products.

With respect to crude oil, the raw material, there are three alternatives: 1) use locally produced

crude oil, 2) use imported crude oil, 3) mix the two. In the case of 1), approximately 80% of the value of exports, $900 million-1,000 million, would be diverted for domestic consumption, and export revenue would decrease by that much; however, this would eliminate more than $1,000 million worth of imports (1996), significantly improving the trade balance. This would require expenditure of approximately $1,000 million for imported refinery equipment during the initial period of the construction, obviously affecting the trade balance substantially. In the case of alternative 2), exports would not change, but it would become necessary to import the equivalent amount of Middle East crude oil as in 1). This alternative would likely contribute $50 million to $100 million per year to the trade balance because of the difference in crude oil price, but as discussed later, we should take into account as well that the equipment cost in this case would be higher.

(2) Production plan (Product mix, equipment mix, crude oil used)

Any refinery project in Viet Nam must be based on both present and future demand for products. Forecasting future demand would require to assume a future industrial structure and develop a plan for energy supplies, but that issue will not be discussed here. What determines the products is the crude oil used and the equipment mix of the refinery. Product yields from primary equipment depend on the characteristics (specific gravity or API degree, sulfur content and residue) of the crude oil used. Therefore, the crude oil used and the equipment mix must be decided consistently with the quantities and varieties of the petroleum products needed.

As mentioned previously, the crude oil produced at Bach Ho, the main crude oil in Viet Nam, is light in specific gravity and low in sulfur content, and thus, it produces gasoline and middle distillates at high yields. (See Table 3.10) Therefore, in a case in which Bach Ho production is used for the total quantity, the equipment mix of the refinery could be relatively simple, and investment would be about $1,000 million (based on a refining scale of 100,000-150,000 b/d). In contrast, if a Middle East crude oil is used, various secondary facilities such as cracking equipment (FCC, etc.) and desulfurization equipment would be needed, and capital investment might be as high as more than $1,500 million (the same scale as above). (See Table 3.13)

Viet Nam should give due consideration to such equipment costs, as well as the economic effects on its trade balance due to the difference in the unit price of crude oil, when it tries to develop construction and production plans for an optimum refinery. Another thing to be considered carefully here is the outlook of reserves and production of local crude oil. The Bach Ho field is reported to have already peaked out, and moreover although there are plans for development and increase of production at other oil fields, the current outlook is that local production is likely to reach a peak by the year 2010. It must not be forgotten that once a refinery is built on the use of local crude for the entire production, it would require substantial further equipment investment to modify later the specifications to suit an imported crude.

(3) Distribution and foreign direct investment

As mentioned section(1), import and local sales of oil products in Viet Nam are controlled almost exclusively by Petrolimex and two other state-run enterprises. Once the refinery starts operations, these enterprises are expected to purchase oil products from the refinery and supply them to the distribution chains. PetroViet Nam itself, which will become the refining entity (or its parent company), plans to enter the distribution sector, and has created a subsidiary (PVPDC) for that purpose. However, time and funds are necessary to establish nationwide distribution channels, and therefore, Petro Viet Nam will probably need to work out an appropriate business segmentation with Petrolimex which is under the umbrella of the Ministry of Trade.

When Foreign direct Investment (FDI) to the refinery business is assumed, it is important to bear in mind that the foreign enterprise will demand to be allowed to enter the distribution field (especially retailing). Foreign enterprises likely request several things, such as a preferential tax system and improvement in infrastructure. Above all, the greatest incentive is entry in the retail market in Viet Nam whose population will reach 100 million in the near future. Compared with Malaysia (approximately 2,000 SS) and Thailand (approximately 7,000 SS), Viet Nam, with approximately 2,000 SS at present, has delayed in reorganizing the market. Conversely speaking, it is obvious that the country has considerable future potential.

However, if oil majors which have not only financial prowess but also advanced distribution technologies, come in all at once, the immature domestic market could well be disrupted. This is because entry of foreign oil majors owning parts of refineries into the distribution field will cause sudden changes in the makeup of market shares of Petrolimex and other state-run enterprises. A possible way to avoid such a situation would be to delay the influx of foreign capital for a certain period to allow the state-run enterprises time for preparation, or to impose quantitative control on retail sale percentages of equities or the like, and open the market gradually.

(4) Possibility for Export

As stated previous section, the product mix of a refinery is determined by the crude oil used and the equipment makeup. Table 3.15 shows an example of the petroleum products when 130,000 b/d of crude oil are refined at standard yields experienced in Japan. When the demand for petroleum products in Viet Nam in 1995 and forecast demand in 2000 are compared with the table, it is clear that even in comparison with 1995 when the total volume was only about 900,000 b/d, there is a shortage of diesel oil, while there will still be surpluses for gasoline and heavy oil.

When production results in an imbalance with domestic demand, export is one alternative to improve the profitability of refinery, but would this be possible? It will depend on the price competitiveness of the products from the newly built refinery.

At this point it is difficult to make a study by assuming the refining cost in Viet Nam; therefore, we will give an example of the refining costs (unit costs) in Singapore and South Korea estimated by the Institute of Energy Economics, Japan.

As Table 3.14 shows, the refining costs per kl of crude oil treated in South Korea and Singapore in 1993 were both at the ¥1,500 level, with no significant difference between the two. In 1996, however, the cost in Singapore was approximately ¥1,800/kl, while the cost in South Korea was ¥2,200/kl, about ¥400/kl higher. This was due mostly to an increase in depreciation, which resulted from equipment expansion (investment) implemented between 1993 and 1996. Singapore did not increase capacity, while South Korea expanded capacity by 400,000 b/d. The significant cost difference is due partly to the fact that in South Korea the diminishing-balance method (over 8 years) is used for depreciation, but at any rate, the study shows that refining costs of a new refinery would be too high to be competitive against international market prices represented by Singapore. Accordingly, if refining costs of a refinery in Viet Nam is to be reduced by disposing of (selling) surplus products outside the country, it will be necessary to establish sales routes, rather than try and compete in the international market. In the case of a refinery owned predominantly by a international oil company, for example, it would be possible to use its selling power. To reduce the risks of a state-run refinery business in Viet Nam, however, it is essential to give priority to the construction of a refinery which will not depend on exports.

Appendix

Table 3.1 Supply and demand for crude oil by region (Actual and Projected)

(millions B/D)

	1978	1985	1990	1995	2000e	2005e
Demand(Consumption)						
North/Central & South America	25.4	22.1	24.2	25.9	28.3	30.2
Europe/Mediterranean	25.4	23.5	24.1	21.0	22.2	23.8
Asia-Pacific	11.1	10.7	14.0	18.0	22.0	25.7
Middle East	1.7	2.9	3.3	4.1	4.5	4.9
Western/Southern Africa	0.7	0.9	0.9	1.1	1.3	1.5
Total	64.3	60.1	66.5	70.1	78.3	86.1
Production						
North/Central & South America	16.8	19.0	18.5	19.8	22.3	23.7
Europe/Mediterranean	17.5	19.6	19.8	17.6	19.3	20.2
Asia-Pacific	4.9	5.9	6.7	7.3	7.7	8.0
Middle East	21.4	10.7	17.8	20.6	23.2	27.6
Western/Southern Africa	2.3	2.3	2.9	3.5	4.4	5.1
Total	62.9	57.5	65.7	68.8	76.9	84.6
Balance						
North/Central & South America	-8.6	-3.1	-5.7	-6.1	-6.0	-6.5
Europe/Mediterranean	-7.9	-3.9	-4.3	-3.4	-2.9	-3.6
Asia-Pacific	-6.2	-4.8	-7.3	-10.7	-14.3	-17.7
Middle East	19.7	7.8	14.5	16.5	18.7	22.7
Western/Southern Africa	1.6	1.4	2.0	2.4	3.1	3.6
Total	-1.4	-2.6	-0.8	-1.3	-1.4	-1.5

Source IEA, BP, IEEJ

Table 3.2 Projected demand for petroleum in East Asia (including India)

(thousands B/D)

	1995				2000(Projected)				2005(projected)			
	Production capacity	Trade Volume	Demend	Surplus or Shortage	Production capacity	Trade Volume	Demend	Surplus or Shortage	Production capacity	Trade Volume	Demend	Surplus or Shortage
China	3,398	2,718	2,891	-173	3,933	3,146	3,557	-411	4,283	3,426	4,155	-729
S.Korea	2,018	1,816	1,855	-39	2,538	2,284	2,332	-48	2,538	2,284	2,704	-420
Taiwan	651	573	643	-70	1,079	950	875	75	1,429	1,258	967	291
Hong Kong	0	0	211	-211	0	0	362	-362	0	0	458	-458
NIES Total	2,669	2,389	2,709	-320	3,617	3,234	3,569	-335	3,967	3,542	4,129	-587
Philippines	392	372	326	46	472	448	450	-2	472	448	584	-136
Indonesia	994	944	896	48	1,064	1,011	1,136	-125	1,364	1,296	1,303	-7
Malaysia	421	379	342	37	521	469	451	18	521	469	494	-25
Thailand	471	447	661	-214	806	766	793	-27	1,106	1,051	896	155
Viet Nam	9	8	89	-81	139	125	142	-17	239	215	181	34
Singapore	1,130	1,017	596	421	1,130	1,017	683	334	1,130	1,017	756	261
ASEAN Total	3,417	3,167	2,910	257	4,132	3,836	3,655	181	4,832	4,496	4,214	282
India	1,093	1,038	1,275	-237	1,453	1,380	1,554	-174	1,693	1,608	1,743	-135
Total	10,577	9,312	9,785	-473	13,135	11,596	12,335	-739	14,775	13,072	14,241	-1,169

Source The table was prepared with data from petroleum Association of Japan.

Table 3.3 Projected demand in Asia

(in thousands B/D)

		1995	%	2000	%	2005	%
Japan	Naphtha	765	15%	772	14%	792	14%
	Gasoline	887	17%	951	18%	1,012	18%
	Kerosene	663	13%	703	13%	778	14%
	Diesel Oil	1,271	25%	1,380	26%	1,498	27%
	Fuel oil	771	15%	694	13%	653	12%
	Others	792	15%	832	16%	889	16%
	Total	**5,149**	**100%**	**5,332**	**100%**	**5,622**	**100%**
Korea Taiwan	Naphtha	466	18%	686	20%	747	19%
	Gasoline	302	12%	462	14%	576	15%
	Kerosene	259	10%	384	11%	490	13%
	Diesel Oil	562	22%	741	22%	861	22%
	Fuel oil	682	27%	776	23%	855	22%
	Others	291	11%	336	10%	374	10%
	Total	**2,562**	**100%**	**3,385**	**100%**	**3,903**	**100%**
ASEAN	Naphtha	93	3%	220	6%	315	7%
	Gasoline	445	16%	612	17%	805	17%
	Kerosene	356	13%	457	12%	548	12%
	Diesel Oil	920	34%	1,275	35%	1,684	36%
	Fuel oil	733	27%	852	23%	951	21%
	Others	196	7%	252	7%	311	7%
	Total	**2,743**	**100%**	**3,668**	**100%**	**4,614**	**100%**
China Hong Kong	Naphtha	277	9%	351	8%	425	8%
	Gasoline	785	24%	1,161	27%	1,552	29%
	Kerosene	232	7%	283	7%	328	6%
	Diesel Oil	943	29%	1,313	31%	1,663	31%
	Fuel oil	730	23%	824	19%	887	17%
	Others	265	8%	364	8%	449	8%
	Total	**3,232**	**100%**	**4,296**	**100%**	**5,304**	**100%**
India	Naphtha	87	6%	153	7%	186	7%
	Gasoline	109	7%	152	7%	194	8%
	Kerosene	245	16%	305	15%	371	15%
	Diesel Oil	683	44%	931	45%	1,188	47%
	Fuel oil	202	13%	234	11%	258	10%
	Others	211	14%	280	14%	344	14%
	Total	**1,537**	**100%**	**2,055**	**100%**	**2,541**	**100%**
OCEANIA	Naphtha	4	0%	5	1%	6	1%
	Gasoline	361	44%	387	42%	403	41%
	Kerosene	93	11%	113	12%	132	13%
	Diesel Oil	227	28%	260	28%	289	29%
	Fuel oil	39	5%	36	4%	34	3%
	Others	100	12%	114	12%	128	13%
	Total	**824**	**100%**	**915**	**100%**	**992**	**100%**
Total	Naphtha	1,692	11%	2,187	11%	2,471	11%
	Gasoline	2,889	18%	3,725	19%	4,542	20%
	Kerosene	1,848	12%	2,245	11%	2,647	12%
	Diesel Oil	4,606	29%	5,900	30%	7,183	31%
	Fuel oil	3,157	20%	3,416	17%	3,638	16%
	Others	1,855	12%	2,178	11%	2,495	11%
	Total	**16,047**	**100%**	**19,651**	**100%**	**22,976**	**100%**

Source Institute of Energy Economics, Japan

Table 3.4 Trend of state- owned oil companies in ASEAN countries

		Thailand	Indonesia	Malaysia	Viet Nam
State- owned oil companies (percentage held by government)		PTT (100%) (Petroleum Authority of Thailand)	PERTAMINA (100%) (Indonesian State Oil & Gas Company)	PETRONAS (100%) (Petroliam National Berhad)	PETROVIETNAM (100%) (Vietnam Oil and Gas Corporation)
Oil related business	(1) Crude Oil Development and production	System of contract for rights and interests by the Ministry of Industry. PTT is also involved through its subsidiary. Low rate of self-sufficiency.	The company develops and produces oil exclusively under the PSC system (forecast decreases or plateaus in production.)	Same as at left. (To preserve resources, mining development is stressed, with restraints on crude production)	Same as at left. The company, which has virtually no refinery capacity, exports all production
	(2) Refining	Investment is under way at three out of five domestic refineries (capacity totals 745,000 B/D). In addition to Esso, a Shell- Caltex refinery began operation in 1996.	The company, which owns five domestic refineries (total capacity 994,000 B/D), currently controls all refining as well. However, the entry of the private sector (foreign capital) is approved on a case-by-case basis.	Two (140,000 B/D) out of five domestic refineries (total capacity 366,000 B/D) are publicly owned. The private sector is allowed to enter the market freely (100% foreign-owned subsidiaries are also allowed).	Under review.
	(3) Distribution	Market share of petroleum product excluding heavy crude used for generation of electricity is 26% (1995). Free competition against foreign firms such as Shell and Esso.	Primary oil distribution, including importation, is controlled by the company. Some service stations may be owned and operated by individuals (ownership and consignment sales).	In addition to the state oil firm, five other foreign firms including Shell participate in primary oil distribution (under the license system). The company's retail share is on the order of 30%.	The company's subsidiary (PVPDC) is partially involved in sales (the biggest company is Petrolimex, which operates under the umbrella of the Ministry of Commerce, whose share is estimated at 60%-70%.)
	(4) Others	The petrochemical industry takes advantage of domestically produced natural gas under the subsidiary system.	The company has also entered the petrochemical business as well, which is not necessarily favorable.	A network of natural gas pipelines is under construction, and the petrochemical industry is being actively promoted.	Foreign firms are prohibited from supplying the fuel oil market.
Price of petroleum products		The price, which is formally unregulated, is however, virtually controlled by the government through a monitoring system.	Supplies are controlled by the company and the price fixed by the government.	Retail price and commission for distributors are under the government control (subject to adjustment through taxation).	The government sets a ceiling on prices.
Trends in capital investment		Two refinery construction projects (with a total capacity of 420,000 B/D) are planned, one of which is said to be authorized to export refined products.	Existing facilities will be expanded by 70,000 B/D by 1998). Outlook for export refineries following EXOR 2 (100,000 B/D) is unclear. Twelve projects are proposed by the private sector, but these are making no progress because they are unlikely to be profitable unless distribution is liberalized.	The company is constructing Malacca 2 (100,000 B/D) under a joint venture with Conoco and Statoil (expected to begin operation in 1998). Four projects are proposed by the private sector, but these are unlikely to be approved because imports from Singapore are more economical.	Refinery construction is planned in Dung Quat (130,000 B/D). The government is hoping to attract foreign investment.

Table 3.5 Restrictions on foreign investment in the oil industry of neighboring countries

		Thailand		Indonesia		Malaysia		Singapore		Viet Nam	
Crude oil production		PTTEP (subsidiary in which the government has a 70% stake) is involved in development.		PERTAMINA monopoly (PSC system)		PETRONAS monopoly (PSC system)		—		PETROVIETNAM monopoly (PSC system)	
Refining	Existing	○	Foreign investors already participating	×	PERTAMINA monopoly	○	100% foreign ownership is allowed	○	Government approval is required	×	—
	Newly established	○	Subject to merger with PTT for domestic market	○	Government approval is required	○	Same as above	○	Same as above	○	Government approval is required for 100% foreign ownership
Distribution	Wholesale	○	100% foreign ownership is allowed	×	PERTAMINA monopoly	○	100% foreign capital is allowed	○	Government approval is required	×	State- owned enterprise operating under the umbrella of the Ministry of Commerce
	Retail (service stations)	○	Foreign capital investment less than 49%	△	Private ownership of service stations is allowed	○	Foreign capital investment less than 30%	○		×	Dominant firm
Price		Controlled for practical purposes by the government through PTT		Price set by the government		Price set by the government		Prices are unregulated		Price ceiling is set by the government	
Export and import		Liberalized		PERTAMINA monopoly		Import volume approval system (largely free)		Liberalized		Imports are dominated by state- owned enterprises operating under the umbrella of the Ministry of Commerce (limited to importers)	

Entry of foreign capital: ○= permitted, ×= not permitted

Table 3.6 Balance of supply and demand in crude oil production, refining and petroleum products

	Refining capacity (Number of facilities) 1995	Crude oil (Upper rows:1994 Lower rows:1995)				Petroleum products (Figures in parentheses indicate the year; Upper rows:Demand (Consumption) Lower rows:Production)						Same as at left (Upper rows :Exports Rower rows :Imports)
		Production	Imports	Exports	Amount of crude oil refined	Gasoline	Kerosene	Light oil	Heavy oil	Other	Total	
Thailand	471	55	net356	-	415	(95) 111	59	270	221		661	-
	(3)					(〃) 111	62	182	150		505	net156
Indonesia	994	1,530	160	888	767	(94) 130	169	313	90	32	734	173
	(7)	1,520	190	830	820	(〃) 126	157	213	70	202	768	104
Malaysia	366	660	25	438	227	(〃) 95	23	115	73	36	342	60
	(3)	685				(〃) 54	25	95	51	27	252	145
Philippine	392	1	242			(95) 49	12	106	125	52	344	12
	(3)		326	-	372							42
Singapore	1,130	(93) -	1,060	-	1,057	(94) 50	32	20	155	25	282	972
	(4)	(94)			1,095	(〃) 207	177	293	366	52	1,095	499
Viet Nam	9	135		135		(95) 23	10	38	16	1	88	-
	(1)	150		150								89
China	3,398	2,930	245	NA	2,610	(96) 893	98	804	699	247	2,740	
	(60)	2,990				(〃) 923	95	701	527	253	2,610	net130
South Korea	2,018		1,570			(95) 523	172	445	446	268	1855	336
	(5)		1,712		2000							615

Source Statistics by countries and SAI

Table 3.7 Breakdown of refinery facilities and products

		Thailand	Indonesia	Malaysia	Singapore	Japan
Breakdown of facilities (in thousands B/D)	TP	471	994	421	1130	5270
	Vacuum distillation	92	264	37	275	1769
	Reformer	89	124	75	114	823
	FCC	39				882
	RFCC				57	113
	Other cracking	33	192	25	283	130
	Desulfurization & others	77	115	12	248	1411
Percentage of secondary equipment		48.6%	43.4%	26.6%	62.1%	63.7%
Breakdown of products (%)	Gasoline	22	16	18	19	28
	Kerosene	12	21	10	16	14
	Light oil	36	28	38	27	18
	Heavy oil	30	35	20	33	32
	Other			14	5	8

Notes
1) Breakdown of facilities is taken from Petroleum of Japan. This data may differ from those of other sources.
2) Data on the breakdown of products is from 1994, except for Thailand (1995)
3) In Japan, the breakdown of facilities is as of September 1996, and the breakdown of products is from 1994
Source Data from Petroleum Association of Japan, Monthly reports of petroleum materials, and domestic and foreign petroleum

Table 3.8 Composition of refinery equipment in ASEAN countries

	By country	Thailand					Indonesia	Malaysia	
	Refinery	Thai-oil	BCP	ESSO	Rayon	Star	EXORI	Malacca	Malacca II
Breakdown of facilities (in thousands B/D)	TP	210	120	145	145	130	125	120	100
	Vacuum distillation	64.5		40	62	49.3			25
	Reformer	52	15	30	30	15		20	26
	FCC			25					
	RFCC					37	83		
	Other cracking	33.3			60				49
	Desulfurization & others	10.4			63		58		
Percentage of secondary equipment		45.6%	12.5%	37.9%	105.5%	40.0%	112.8%	16.7%	75.0%
Breakdown of products (%)	Gasoline	26	16	25					
	Kerosene	14	9	12					
	Light oil	40	33	35					
	Heavy oil	15	39	20					
	Other	5	3	8					

Source PTIF FOCUS and PAJ

Table 3.9 Export of crude oil import of petroleum products (million US dollar)

		1985	1990	1991	1992	1993	1994	1995
Viet Nam	Oil export	n.a.	390.0	581.4	805.7	843.9	866.8	1,033.1
	Product import	n.a.	423.4	501.9	576.8	694.6	719.2	867.1
Indonesia	Oil export	8,251.3	6,219.9	5,695.7	5,397.7	4,778.4	5,071.6	n.a.
	Product import	347.6	672.3	1,066.8	977.8	1,163.7	1,290.5	n.a.
Malaysia	Oil export	3,611.7	3,947.2	3,712.6	3,640.4	3,166.1	2,541.5	n.a.
	Product import	981.8	1,158.3	1,225.7	1,320.8	1,252.2	1,149.3	n.a.

Source Data from Viet Nam is taken from the Government Internal survey. Other data is based on United Nations statistics.

Table 3.10 Characteristics of main crude oils

	Api degree	Specific gravity	Sulfur content	Yield (vol. %)		
				Gasoline	Kerosene & Diesel oil	Heavy oil
Murban (United Arab Emirates)	41.2	0.828	0.76	25	48	25
Arabian Light(Saudi Arabia)	33.5	0.852	1.97	19	46	34
Arabian Heavy (Saudi Arabia)	28.0	0.887	2.98	16	36	46
Sumatra Light (Indonesia)	35.3	0.850	0.07	11	35	53
Maya (Mexico)	22.1	0.923	3.38	16	24	59
Daqing (China)	32.1	0.859	0.10	8	31	61
Tapis (Malaysia)	46.8	0.794	0.03	28	57	12
Bach Ho (Viet Nam)	40.5	0.823	0.03	15	48	35
Dubai (United Arab Emirates)	31.7	0.867	1.93	18	43	37

Source Statistics from Idemitsu Petrochemical Co., Ltd. and others

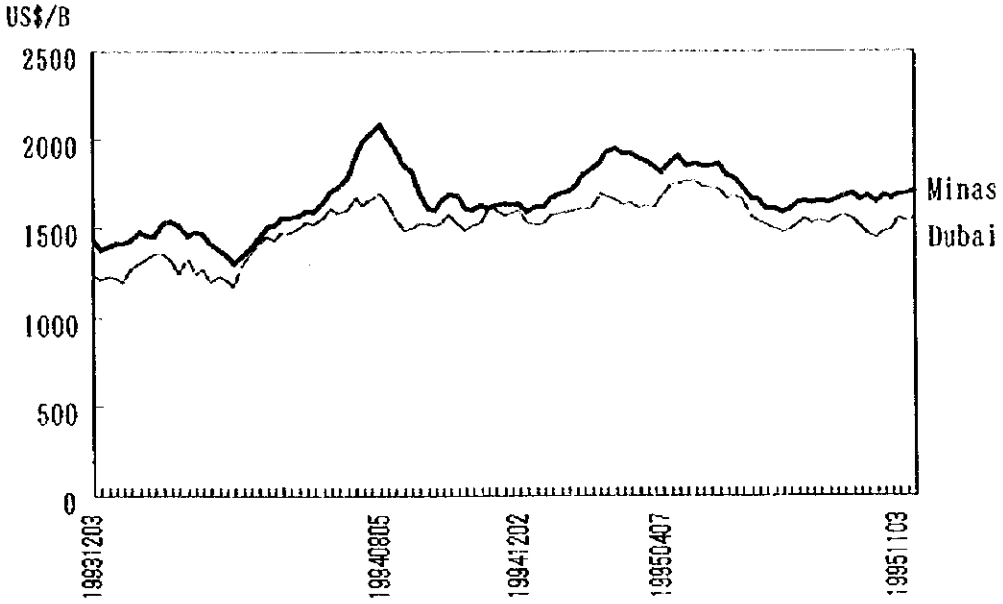


Figure 3.2 Difference in crude oil prices (two-years average is $1.49/B)

Table 3.11 Import and consumption of oil refining products (thousand tons)

	Import			Consumption		
	1993	1994	1995	1993	1994	1995
Gasoline	910	1,052	1,200	880	1,003	1,096
Kerosene	376	476	520	363	417	486
Diesel oil	2,003	2,193	2,450	1,960	2,208	1,853
Fuel oil	804	809	960	767	866	855
Others	165	192	290	120	150	460
Total	4,258	4,722	5,420	4,090	4,644	4,750

Notes Kerosene includes Jet Oil
Source Report of VEA (Viet Nam Economic Association)

Table 3.12 Import of products by state owned enterprises (1996)

	Quantity		Value		Remarks
	1,000 tons	%	million US$	$/t	
Petrolimex	3,868.7	66.7	725.10	187	under MOC
Saigon Petro	903.1	15.6	153.50	170	under H. C. M. City
Petex	730.2	12.6	131.30	180	under MOC
VN Airline Petro	88.3	1.5	20.64	233	for Air Plane
Petexim	62.9	1.1	10.72	170	Subsidiary of Petro VN
Transportation import-export	61.5	1.1	12.57	204	
Others	83.2	1.4	23.62	284	
Toral	5,797.9	100.0	1,077.5	1,428	

Source Report of VEA and others

Table 3.13 Construction costs of major equipment in refineries (projected in the case of TP-100,000B/D) (million US dollar)

Unit	Scale	Cost
Atmospheric distillation	100,000 B/D	100-150
Vacuum distillation	40,000 B/D	50-100
Catalytic reforming	15,000 B/D	100-150
Residue catalytic cracking	30,000 B/D	about 200
Vacuum residue hydrogenolysis	30,000 B/D	about 400
(Sulfur recovery unit)	120,000 B/D	50
(Hydrogen producting unit)	12 mil Nm/D	100
Total		1,000-1,200

Notes
1) In hydrogenolysis units, sulfur recovery and hydrogen prd unit are required.
2) Auxiliary facilities add and additional 50%-100% to the overall cost of the facility.

Table 3.14 Study of refining cost (yen/kl)

	South Korea			Singapore		
	1993	1996	Change	1993	1996	Change
Fuel costs	300	300		240	260	
Labor costs	190	260	+70	130	130	
Cost of repair	120	260	+140	320	410	+90
Depreciation	590	1,100	+520	580	590	
Other	310	300		290	390	+100
Total	1,510	2,220	+710	1,560	1,780	+220
Refining capacity in thousands B/D	(1,675)	(2,104)	(+429)	(1,155)	(1,155)	(+70)

Notes
Cost of refinery construction
¥120billion (estimated) for a facility with a capacity of 130,000 B/D
Depreciation ¥ = 1,590/kl (given a life of 10 years)

Table 3.15 Trail calculation of the breakdown of petroleum products (thousands B/D)

	Average yield in Japan	Trial calculation (A) Petroleum products	Demand for VN (1995)	A-B	Projected VN demand (C)	A-C
Gasoline	28	36.4	23.0	13.4	38.0	−1.6
Kerosene	14	18.2	10.0	8.2	16.0	2.2
Light oil	18	23.4	38.0	−14.6	60.0	−36.6
Heavy oil	32	41.6	16.0	25.6	26.0	15.6
Others	8	10.4	1.6	8.8	2.2	8.2
Total	100	130.0	88.6	41.4	142.2	−12.2