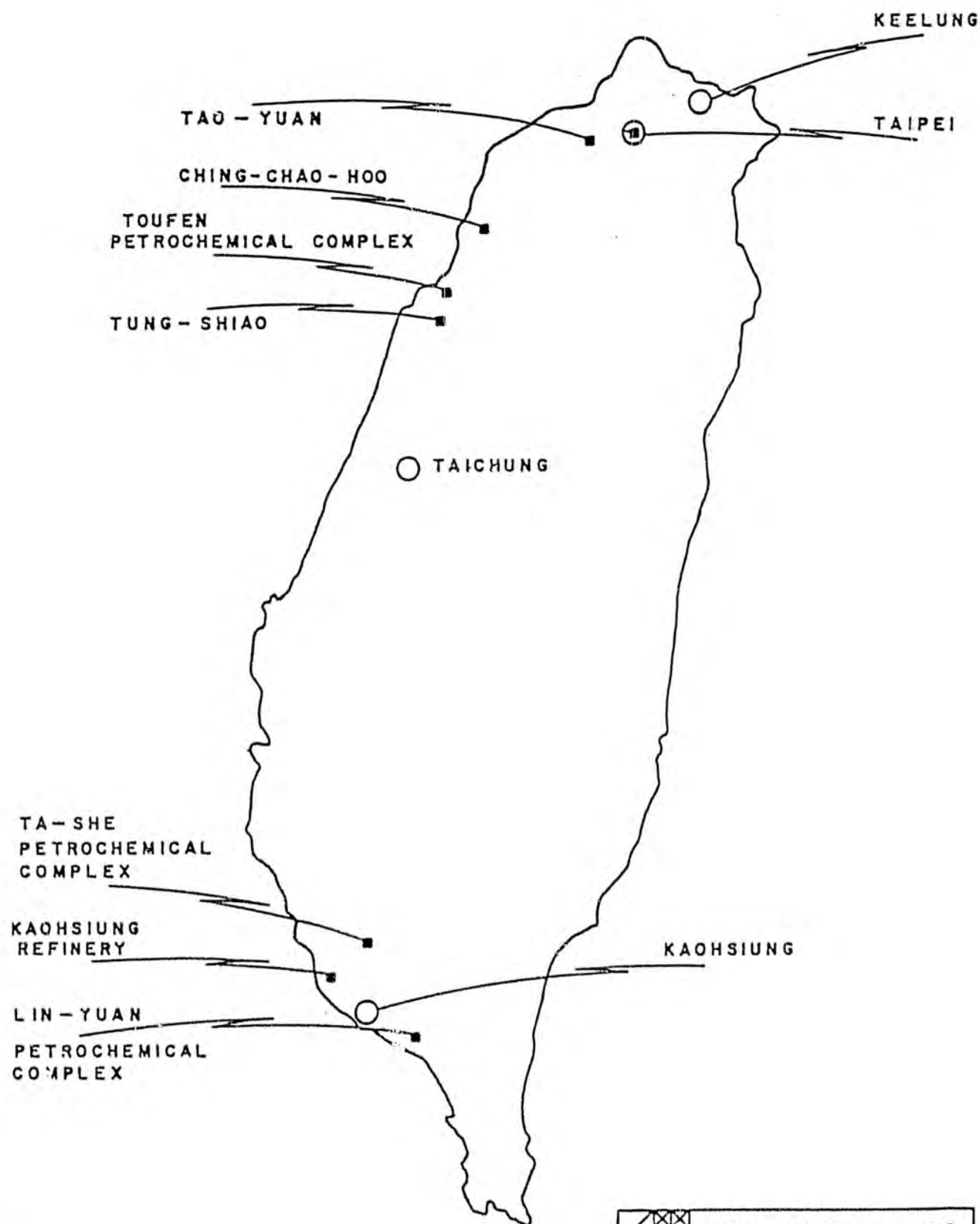


ALASKA LEGISLATURE SPECIAL COMMITTEE / SUBJECT FILES 8672

490 SCOM14: JOINT GAS PIPELINE COMM. (FINANCING) 1979-80

TAIWAN

4. Hong Kong

a. Background

Hong Kong is a British crown colony located off the Kwangtung coast of southern China, comprising the island of Hong Kong and adjacent islets, Kowloon peninsula and the leased New Territories on the mainland with surrounding islands. Hong Kong Island takes up only 28 square miles of the total 380 square mile area of the Colony.

Population is estimated to be over 5 million, nearly 99 percent of which is Chinese. The balance is mainly British. Due to its almost total dependence upon exports, the Hong Kong economy came to an abrupt halt in 1974 and 1975, with real GNP growth of 4 percent and 3 percent, respectively. After the double-digit growth of the previous decade, this was a serious reversal. Recovery began during 1975, however, and 1976 was a boom year with a 50 percent export increase and well over 10 percent real GNP growth. Confidence in Hong Kong's economic future remains high, and medium-term real growth rates of at least 5-6 percent per annum may be expected, provided the major Hong Kong markets of the United States and Western Europe avoid serious recessions.

Industrial Development and Infrastructure

Industry was introduced to Hong Kong on a small scale in the early 1930s under the stimulus of the Commonwealth Preference System. During that period and through the 1940s, Hong Kong's main role was as an entrepot, a center of trade and trans-shipment between China and the rest of the world. This activity was responsible for the development of excellent facilities for banking, shipping, warehousing and insurance.

The most significant changes in Hong Kong occurred in 1949 and 1950, and the events that took place were largely responsible for the industrial development which resulted. In 1949, the government of China changed and

over 1 million immigrants came to Hong Kong from Communist China. In 1950, the Korean War resulted in a United Nations embargo on trade with China. This severely reduced Hong Kong's entrepot trade, and it became necessary to quickly find an alternative source of income to survive.

This led to Hong Kong's industrial revolution. Local business people and the immigrants, who brought machinery, technical knowledge and capital, took advantage of a large pool of skilled and semi-skilled workers to establish a manufacturing base. Hong Kong has virtually no natural resources and depends for its survival upon the energy, skill and intelligence of its people, its deepwater harbor and its strategic geographical position.

Textiles was Hong Kong's first major industry, and it was based mainly on cotton. In the late 1960s, synthetics became significant. Even with the development of other industries, textiles and clothing in 1976 accounted for 56 percent of exports in dollar value. The second largest export industry is electronics, with plastic products (principally toys, dolls and flowers) the third most important business category.

As far as Hong Kong's future is concerned, changes are taking place within the Southeast Asia region which are shaping its long range structure. The developing nations, including South Korea, Taiwan, Thailand, Malaysia, etc., are emulating Hong Kong by developing textile and plastics operations of their own. They are able to compete with Hong Kong on the basis of lower cost labor. As a result, Hong Kong business has concluded that it is to its advantage to retain manufacturing facilities requiring more sophisticated techniques. Hong Kong's manufacturing base will thus be oriented more strongly to more sophisticated products with a higher unit value, made from combinations of materials requiring more complex assembly and processing.

There has been some speculation about the fact that the United Kingdom's lease on Hong Kong expires in 1998 and that the People's Republic of China (PRC) might not renew it, thus clouding Hong Kong's future. This is not considered a significant factor for a number of reasons:

- The PRC has never really recognized any agreements made by Nationalist China and could have taken it over any time it chose to.
- The U.K. does not dispute PRC's claim that Hong Kong is Chinese.
- Hong Kong serves a very useful purpose to the PRC. Over 50 percent of Hong Kong's food is obtained from the PRC and almost 20 percent of its total imports are from that source. Aside from its value as a source of foreign exchange, Hong Kong serves the PRC by providing an excellent channel for the flow of goods into and out of the country without any "cultural pollution".

It is anticipated that this relationship will continue to exist for the foreseeable future.

Government Programs

The Hong Kong government maintains a classic laissez-faire posture towards economic activity in the Colony. There is a minimum of regulation, and taxation of personal and corporate income is limited to 15 percent. The government also adheres to a philosophy of free trade. Duties are levied on tobacco, alcoholic beverages and automotive fuels for revenue purposes only. Most imports and exports are subject to a trade declaration charge at a nominal rate. Import and export licensing is kept to the minimum required for the fulfillment of the U.K.'s and Hong Kong's international obligations, monitoring of essential commodities and the protection of health and safety. Hong Kong has a constant trade deficit due to its dependence upon imports for all raw materials. This deficit is compensated for through the Colony's considerable invisible earnings (particularly from tourism and commerce) and a sizeable annual inflow of capital.

Regional Associations

Hong Kong is a free trade area with no association or commitments to other countries in the region.

b. Petrochemical Overview

There is no oil or gas production nor any refining industry in Hong Kong.

At present, Dow's polystyrene plant is the only petrochemical venture in Hong Kong. No additional facilities are planned, nor are any likely in the foreseeable future. A map showing the location of Dow's facility is presented as Figure III-B-5.

5. Philippines

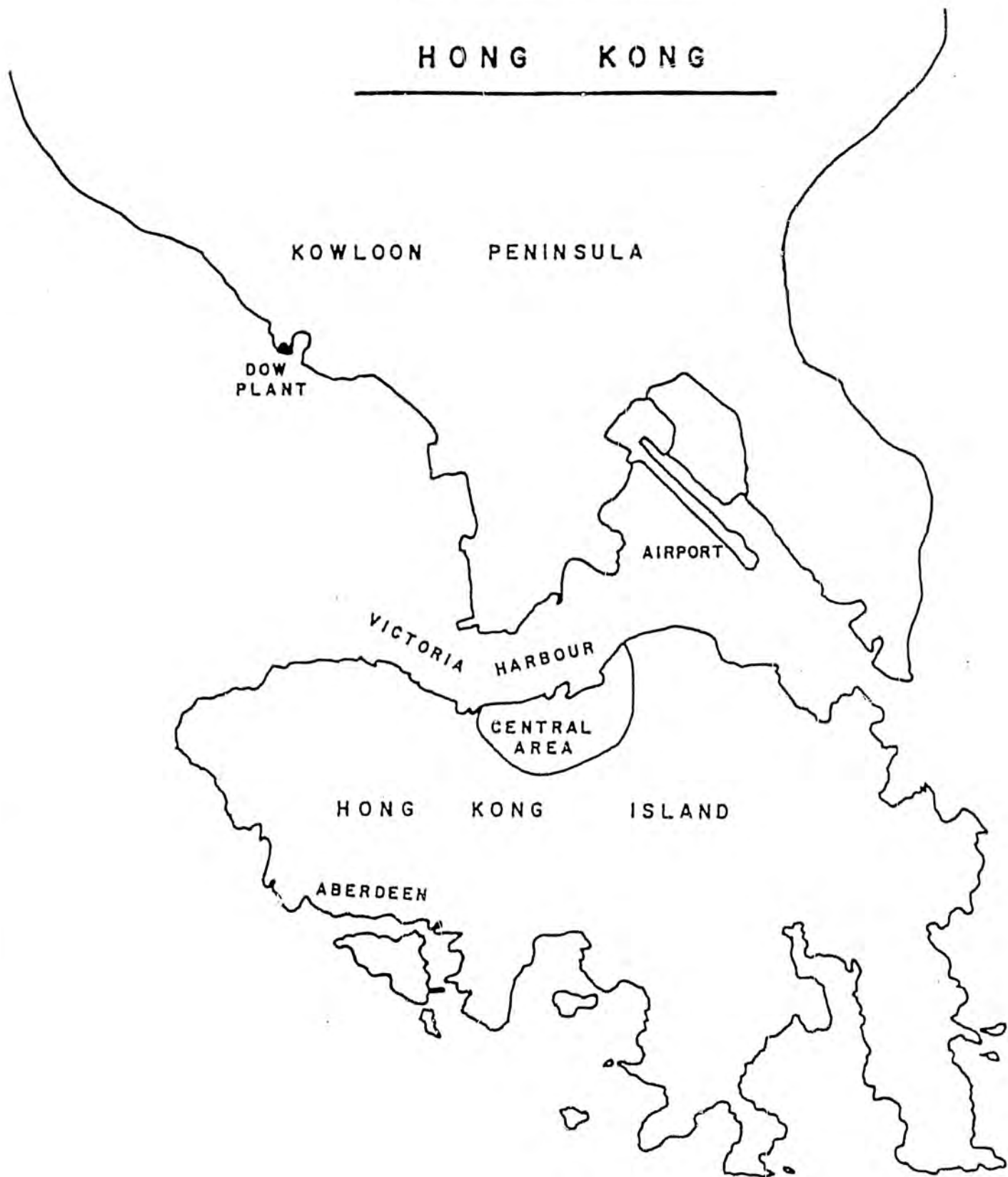
a. Background

The Philippines is an archipelago country of over 7,000 islands with a total land area of almost 114,000 square miles. Of this area, about 41 percent is cultivated, 40 percent is forested and the balance is unusable mountainous country. The principle economic and population center is the greater Manila area, where there are 4 to 5 million people. The total population is about 44 million, growing at 3 percent per annum. Efforts at planned population control have had very limited success. The labor force is around 14 million. A map of the Philippines is shown in Figure III-B-6.

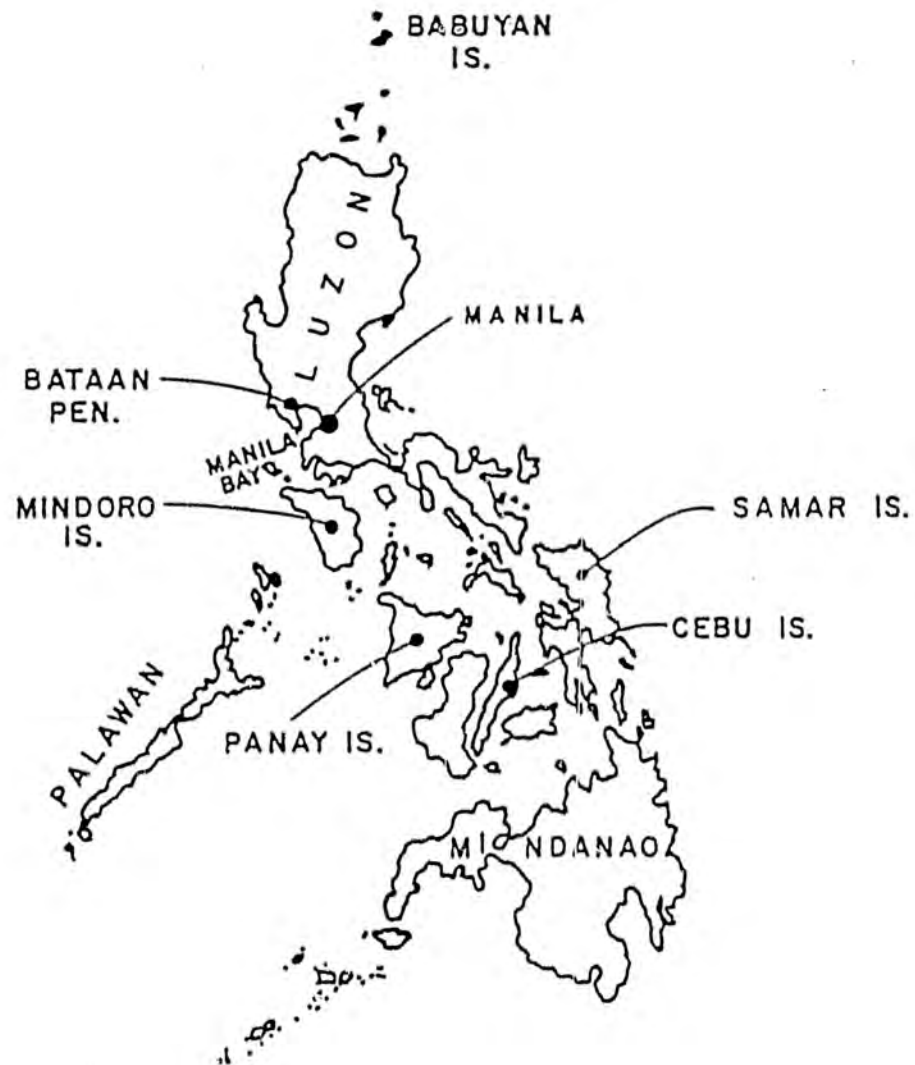
Although large areas of the country are very fertile, the country is in the middle of the Pacific typhoon belt and natural disasters can have major effects upon food production. The government is investing large sums in flood control dams, properly laid out irrigation systems and the removal of illegally built fish ponds, which impede the progress of flood water. The development of a viable agricultural sector is essential so that the government can reduce expenditures of foreign exchange for

FIGURE III - B - 5

HONG KONG



AGO 559587

PHILIPPINES

food. In addition, some of the Philippines' principal foreign exchange earners are agricultural products, including coconut products, sugar and timber.

The islands are also well endowed with minerals. The Philippines is the world's sixth largest producer of copper, and exploration activity for petroleum is now becoming an important activity. Some discoveries have already been made.

GNP growth was around 6 percent per annum in 1975 and 1976. Balance of payments problems are restricting long-term growth prospects, with only a 4-5 percent per annum growth anticipated.

Industrial Development and Infrastructure

The economy of the Philippines is still basically underdeveloped and agricultural. Industrial production has steadily expanded and diversified, but its growth has been relatively slow in recent years. The Government has now established a set of policies geared to the creation of a climate conducive to industrial growth, and prospects for continued industrial growth over the next years are good.

The government's industrial strategy places special emphasis on the processing of local raw materials, the growth of manufactured exports, employment generation, and regional dispersement and development of small and medium scale industries.

The government is spending large sums on road construction and rural electrification. There is a substantial program for rehabilitation of railroads, which are fairly well developed on Luzon and Panay Islands with about 750 miles of track. The total length of roads is nearly 40,000 miles. The Pan-Philippine highway, which is to span the length of the country from north to south, is more than 50 percent complete, and many feeder roads are being built to rural areas which will open new areas for markets and industry.

For many years, the electric generating capacity in the Philippines did not keep pace with the rest of the economy and blackouts are still commonplace. There is now a firm program developed for rural electrification and a number of fairly large-scale projects for hydro, geothermal, nuclear and coal power plants to supplement imported fuel oil. These facilities should be able to support the many new industries that the Bureau of Investment (BOI) is trying to attract into the country.

To relieve the port congestion problem, there is a large expansion under way in Manila which includes facilities for full container ships. In addition, there are plans to build a complete new deep-water port at Batanyas, south of Manila, where two of the country's oil refineries are located. Also under way are projects to increase the port facilities at Cebu City, which is the principal port and distribution center for the Visayas or central part of the country.

On Mindanao in the south, the port at Illigan is also being expanded, as this is the location of the integrated steel works, ferro-chemicals and the new investment by Kawasaki Steel of Japan in a sintering plant.

Government Programs

Due to its long association with the United States, the Philippines was once very much private enterprise-oriented. Since the advent of martial law in September 1972, however, the government has adopted a much more active role in the economy. The state is now involved in fertilizer production, all aspects of the petroleum industry and utilities. Also, the government has used the Bureau of Investment (BOI) as a vehicle to promote industrial development plans.

There is a wide range of incentives for new companies registered with and given BOI approval. These include tax relief, accelerated depreciation, tax-loss carry-forward, tax credits for import duties on machinery and equipment, the right to use expatriate management, protection from competitive imports, etc.

Basically, the BOI tries to promote "pioneer" industries. These are industries which do not exist in the country at present and which have local and/or export market potential. These would include many activities in the petrochemical and plastics fields.

Tariff protection is given where necessary to support local industries. In general, raw materials imported for processing and subsequent re-export are eligible for refund of tariffs when the finished products are exported. Current duties on basic petrochemical imports are in the 10 to 30 percent range.

Regional Associations

The Philippines is a member of ASEAN and, in common with the other members, has made nominal efforts towards regional cooperation. Early in 1977, tariff reductions between the Philippines and Singapore were agreed upon. In the long term, the Philippines could become a leading promoter of regional cooperation in ASEAN.

b. Petrochemical Overview

At present, there is only limited petrochemical production in the Philippines and petrochemical consumption is quite low. A major complex was planned by Herdis at Limay on the Bataan Peninsula with a government-owned core complex and with major participation by foreign companies in the downstream operations. The output from the facilities would have been sold locally and exported primarily to other ASEAN countries. This project has been changed and significantly reduced in scope. At present, a 90,000 metric ton per year low density polyethylene plant (with USI-Far East participation) and a 50,000 metric ton per year polypropylene plant (with Hercules participation) are planned. Both of these facilities would utilize imported feedstocks and primarily serve the local market.

6. Singapore

a. Background

Singapore is situated at the southern tip of the Malay Peninsula, with one main island and over 50 smaller islets comprising a total of 220 square miles. Major land reclamation schemes continue.

Just under 20 percent of the land area is cultivated, but food imports remain significant. Urban development covers over 35 percent of the total land area and continues to expand. Population is currently 2.3 million, growing at around 1.5 percent per annum. Zero population growth is the government objective, but this is proving difficult to achieve. About 75 percent of the population is Chinese, 15 percent Malays, 7 percent Indian and Pakistani and 3 percent European and others. The labor force is around 850,000. Singapore came through the 1974-1975 worldwide recession relatively well. Real GNP increased by 6.0 percent in 1974, 5.7 percent in 1975 and around 7 percent in 1976. This current growth is relatively poor compared to the 12-13 percent per annum rates achieved prior to 1973, and readjustment to this more modest growth has been slow to develop. Key factors responsible for double digit growth in the early 1970s are probably changed forever. Highly competitive labor-intensive production has been undermined by rapid labor cost increases; imported energy will no longer be cheap; the Southeast Asian oil boom, with Singapore as the regional headquarters, has collapsed - at least temporarily; and finally, the economy is now relatively mature, making rapid growth increasingly difficult. In the short/medium term, worldwide overcapacity and reduced demand expectations have badly hit the important oil refinery and shipbuilding industries. Shortage of suitable land will be a long-term constraint on major industrial development.

Projections are now for 7-8 percent per annum growth of the economy, to continue through the early 1980s. Singapore is generally regarded as

having a highly efficient, well-run economy and is likely to become the financial, industrial and services center for the ASEAN region.

Industrial Development and Infrastructure

Since its separation from Malaysia in 1965, Singapore has made maximum effort to attract and develop export-oriented industries. This campaign has been highly successful, and it prevented major disruption of the economy in 1971, when the British forces withdrew from their Singapore bases, which had previously contributed 20 percent of the gross domestic product and employed over 40,000 people.

Government bodies provided infrastructure, sites and buildings for new industries. There is a relatively skilled and experienced work force and constant efforts by the government to upgrade skills and training at all levels. Extensive investment incentive programs have been implemented. Most new companies and industries have been successful, and Singapore is now firmly established as the industrial center of the ASEAN region. The port of Singapore is one of the world's largest and the communications network is good.

The only real long-term infrastructure problem stems from the lack of available land for continued development. Although the government has become more selective regarding the type of industry to be encouraged in Singapore, petrochemicals has been selected as a favored industry for development.

Government Programs

Singapore was a pioneer in developing an organized program of incentives for attracting new industries. These include all forms of tax exemptions and accelerated depreciation provisions, plus complete freedom in remittance of foreign exchange. Singapore is basically a free port, with no tariffs or duties on most raw materials and fabricated products. Protective tariffs are imposed where necessary to support new local industries, and this would probably apply to any new petrochemical and plastics production.

The government is closely involved in industry, but the objective has been to assist and promote rather than to regulate. It has invested both on a wholly-owned and a joint venture basis in most basic industries, and government equity involvement in all petrochemical ventures is likely.

Regional Associations

Singapore is a member of ASEAN; it differs, however, from all other members of the group in being a producer of finished products rather than of raw materials.

As the fourth largest port in the world, Singapore trades and trans-ships a great deal of commerce for its ASEAN neighbors. Despite development of port and export facilities in other ASEAN countries, Singapore will undoubtedly remain the dominant port and trading center for the region.

The ASEAN group is still a very loose association. No common tariff policy has yet been promulgated. In the long term, attempts to divide up projects and industries between the member states will probably succeed. At present, however, each state tends to develop its own plans and projects. This is particularly true of Singapore, and the promotion of its petrochemical project has upset its ASEAN partners due to the lack of consultation and consensus. Since Singapore has so much to gain from the development of a strong, cohesive ASEAN group, with Singapore as the trading and manufacturing center, it is to be expected that strong long-term support will be given by Singapore to joint economic and industrial policies.

b. Petrochemical Overview

At the present time, Singapore's involvement in petrochemicals is limited to a 15,000 metric ton per year polyvinyl chloride plant based upon imported monomer and various resin converters. The imports of resins are largely for the converting industry, which, in turn, exports the bulk of its products.

Singapore has no oil or gas reserves. However, with 918,000 barrels per day of crude oil refining capacity in existence, Singapore has the potential to produce adequate naphtha for a world-scale ethylene facility. At the present time, the majority of this naphtha is exported - to Japan, Taiwan, the United States and Europe. A map of Singapore is presented as Figure III-B-7.

The Economic Development Board had been studying the feasibility of an integrated petrochemical project for many years and had developed a proposed joint-venture between Sumitomo and the Development Bank of Singapore. With the lessening of petrochemical growth rates, brought about by rising crude oil prices, Sumitomo delayed with proceeding. Since then, however, the Singapore project was made a Japanese national project with the involvement of over 20 firms which would take over part of Sumitomo's interest. Site preparation for the complex has been completed, but implementation continues to be slow.

The cracker will have a capacity of 300,000 metric tons per year of ethylene, and low density polyethylene, high density polyethylene, ethylene oxide/glycol and polypropylene facilities will be built to utilize the output of the core complex.

7. Malaysia

a. Background

The Federation of Malaysia has a total area of 125,780 square miles, of which Peninsular or West Malaysia takes up 51,450 square miles. The East Malaysian States of Sabah and Sarawak take up 28,880 and 46,740 square miles, respectively. A map of Malaysia is presented as Figure III-B-8.

The population, which is estimated at about 12.5 million and is increasing at a rate of about 3 percent per annum, is concentrated mainly along the lowlands of the western side of the peninsula. The large land areas east of the mountains on the peninsula and the two East Malaysian states are sparsely populated.

FIGURE III-B-7

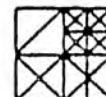
SINGAPORE

FIGURE III-B-8

MALAYSIA



67

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The racial make-up of Malaysia is roughly 50 percent Malay, 35 percent Chinese and 15 percent Indian, Pakistani and others. There has been friction in the past between the Chinese and the Malays because the Chinese dominate the commercial sector of the economy.

There have been substantial efforts at upgrading and projecting the racial Malays into the industrial and commercial sectors of the economy. This is succeeding to some extent as educational facilities are made available to a greater portion of the population. The labor force is around 4.4 million, with unemployment about 7 percent.

The more developed areas on the western side of the peninsula provide the main agricultural products, including rubber, palm oil, pineapples and food crops such as rice. The tin mines, which have been the source of much of Malaysia's wealth in the past, are also located mainly on the western side of the peninsula. With the population concentration and center on the western side, this area has also been the principal area of industrialization.

The oil and gas discoveries have largely been off-shore Sabah, Sarawak and the east coast states of Pinang and Trengannu. In the future, as oil and gas production reach commercial operation, it is likely that new industrial centers, based on petroleum and petrochemicals, will be located on the east coast of the peninsula and possibly in the East Malaysian states.

The economy survived the 1974-1975 recession fairly well. Recovery was largely due to improved export markets for rubber, tin and other commodities which form the mainstay of the economy. Over the next few years, growth is anticipated to average about 5-6 percent per annum. Manufacturing industry accounted for 11.9 percent of GNP in 1971, 17 percent in 1975 and is projected in the 20-year Perspective Plan to reach 35 percent by 1990.

Industrial Development and Infrastructure

The government is making efforts to improve land communications and develop the underpopulated areas. The East-West highway crossing the northern part of the peninsula provides access to large agricultural and timber areas. There has also been investment in the modernization and expansion of railroads. In East Malaysia, the road system has been gradually improved. However, much of these vast areas is remote and accessible only by air or river travel.

Most of the industrial development has occurred around the major population centers. The largest area is the 30 mile strip between the capital of Kuala Lumpur and the principal port, Port Klang. This area is rapidly filling in with planned industrial sites, which comprise electronic and textile industries for export and other import substitution industries. Other industrial sites are located on the outskirts of principal towns, including Johore Bahru in the south and Malacca, Ipoh and Penang in the north.

There are about 100,000 miles of roads in peninsular Malaysia, but only about 1,000 in Sarawak and less than 2,000 in Sabah. There are 1,200 miles of railways in the peninsula; these connect with Singapore in the south and Thailand in the north. Now that the new East-West highway is completed across the north of the peninsula, all the habitable areas have good access to the manufacturing and trading centers and ports. This allows manufacturers to move farther afield to tap sources of low-cost labor and at the same time allows more trade to develop in the rural areas. As income for manufacturing increases, it will help to smooth out the sharp peaks and dips in the Malaysian GNP which have occurred in the past due to reliance on export prices of commodities.

The National Electricity Board supplies most of the power to the country. About two-thirds of the 1,200 MW capacity is thermal and one-third is hydropower. There are other large new hydro projects under construction, and nuclear power is being considered as an alternative to

oil in the future. The NEB has been able to keep up with demand thus far and seems to be capable of meeting future requirements. Water is generally handled by the individual states and has not been a problem for developing industries.

When large new facilities are planned for the east coast of the peninsula to utilize the off-shore hydrocarbons, considerable preplanning and infrastructural development will be required.

Government Programs

The Malaysian government has well-developed agencies and programs to plan and assist in the development of the country. Statutory bodies will participate in joint ventures with foreign companies, and MIDF (Malaysian Industrial Development Finance) will assist in medium- and long-term loans.

The prime objective of the above organizations is to assist the indigenous racial Malays to penetrate the commercial and industrial sectors of the economy. Since the Malays generally do not have the equity capital required to participate in various proposed joint ventures, there may in the future be a trend whereby the government in one form or another may take up equity in new manufacturing enterprises in order to ensure that a majority of the venture is available to Malays.

The government has taken steps to become more directly involved in commodity trading, including successful price stabilization schemes for the important rubber industry.

Petronas, the national petroleum company, was created in 1974 and is responsible for anything to do with the petroleum industry, from exploration to the final consumer and including products such as petrochemicals and fertilizers. Agreements are gradually being renegotiated between Petronas and the foreign oil companies, and production and exploration have restarted after the nationalization scares.

The government agency for assisting a potential new investor in Malaysia is the Federal Industrial Development Authority (FIDA). Since the creation of Petronas in October 1974, FIDA no longer has the authority over activities involving the petroleum or petroleum-derived chemical industry, as this responsibility now belongs to Petronas. Petronas will develop its own guidelines and incentives for potential investors in the petroleum-related industries.

The incentives FIDA offers other manufacturers are numerous. They include:

- Pioneer status, which grants an approved company exemption from income and development taxes for a period of 5 years.
- Investment tax credits are granted if the proposed industry will produce a "priority product", locate in a "development area" and utilize 50 percent or more of local raw materials.
- Export-oriented industries which export 90 percent or more of their production have extended tax holidays.
- Imported machinery and raw materials are exempt from duty, and additional export allowances are made for local content products.
- Deserving industries are given anti-dumping tariff protection.
- There is a bilateral Foreign Investment Guarantee agreement with the United States.
- Investors are freely permitted to remit capital and income from investments in Malaysia.
- Tariff protection is granted to a wide range of manufactured items.

It is the government's declared policy that tariff protection should be used as a tool to encourage local industries. Where protection from foreign dumping is required, each case is decided on its own merits, with efficiency and cost of production of the local item the main criterion.

Regional Associations

Malaysia is a member of ASEAN, and its balance of payments is very much governed by its exports of primary commodities: rubber, tin, palm oil, timber and, increasingly, oil and gas. Malaysia has been very vocal in pushing for regional producers of these commodities to act in a concerted effort to maintain levels.

As far as intra-ASEAN trade is concerned, Malaysia has not been active in promoting complementary industries or trade. The prime emphasis has been upon developing industries beneficial to Malaysia, without any great enthusiasm for joint ASEAN objectives.

Malaysia has 140,000 barrels per day of refining capacity in contrast to crude oil production of 160,000 barrels per day in 1978 and reserves estimated at 2.8 billion barrels. In addition, there are gas reserves estimated at 17 trillion cubic feet.

b. Petrochemical Overview

Malaysia's petrochemical industry can technically be said to date from 1967, when a 50,000 metric ton per year refinery hydrogen-based ammonia plant was built adjacent to the Esso refinery at Port Dickson. Effective October 1974, all future development was put in the hands of Petronas, the national petroleum company, as part of the law establishing the company as the Malaysian vehicle for controlling all activities in the petroleum and petroleum-derived industries. Although the principal interest has been to develop crude oil production, it is believed that there are substantial gas reserves off-shore Sabah, the other East Malaysian State.

At one time, it was assumed that a State Development Corporation would set up a 250,000 metric ton per year ethylene cracker. This project has never passed beyond the conceptual stage and is very unlikely to be built.

8. Thailand

a. Background

Thailand has an area of 195,000 square miles, of which nearly 40 percent is cultivated and another 55 percent is forested. The economy is mainly agricultural: agriculture employs over 75 percent of the population and produces nearly 30 percent of GDP and the dominant proportion of export revenue.

The population is about 43 million, increasing at 3 percent per annum. The population is mainly Thai, but there is also a 15 percent Chinese minority. The work force is estimated at 19 million, mostly outside the cash economy and involved in agriculture. Most industrial activity is in the Bangkok area, with its population of 4 million.

The Thai economy was not severely affected by the worldwide slump of 1974-1975, since its basically agricultural exports continued to be in demand. Real GNP has increased at about 6 percent per year since then, and over the next few years, GNP growth of around 5-6 percent is anticipated.

Thailand's international credit rating is excellent, based upon good economic conditions. However, the political climate is still a concern because of the threat of aggression by the Communists and actions by the Moslems in the south.

Industrial Development and Infrastructure

Thailand may be divided into the Greater Bangkok region and "up-country". The port of Bangkok, 30 miles up the Chao Phraya River, handles 90 percent of Thailand imports and 75 percent of its

exports. Congestion is a major problem and maximum vessel size is 10,000 DWT. Plans have been discussed for a new commercial port on the Gulf of Thailand at Sattahip, currently a military base. Development is in the future, however. There are two oil refineries located on the coast and the site allocated for the formerly planned petrochemical project is nearby. A map of Thailand is presented in Figure III-B-9.

The road network is fairly well developed, including 12,000 miles of national highways. There are nearly 2,500 miles of single-track railways, and the rivers are also used extensively for inland transportation.

Government Programs

In addition to owning the utilities, transport systems and communications, the Thai government has been heavily involved in manufacturing operations. There appears to be little enthusiasm for government joint ventures with foreign companies.

The government has taken steps to improve the investment climate after the recent political and labor troubles, and business confidence is likely to improve. There are no requirements concerning Thai ownership of any project. The economy is basically a free one.

The Thai Board of Investment appears to be a well-organized body whose role is to assist foreign investors interested in coming into Thailand. They claim their incentives are more attractive than those of other Southeast Asian countries. Their investment incentives cover all the standard points such as tax holiday, full remittance of foreign capital invested, royalties, interest on foreign loans, and guarantees against nationalization and competition from new state enterprises.

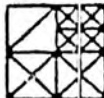
Tariff protection, subject to justification of needs, can include import bans on competitive products or the raising of import duties on foreign competitive products. If the project is export-oriented, there is exemption from import duties and business tax on raw materials and re-export items; exemption from business tax for domestic raw materials;

FIGURE III-B-9

THAILAND



AGO 559605

	CHEM SYSTEMS INC.
	PROJECT NO. 527 DATE

and exemption from duty and/or business tax for all imported and locally produced machinery and equipment. Imports duties on most petrochemicals are currently in the 10 to 30 percent range.

Regional Associations

Thailand belongs to ASEAN, and Bangkok is the seat of the UN Economic and Social Commission for Asia and the Pacific (ESCAP), SEATO and other regional organizations. As in the other ASEAN countries, there has been a lot of planning and conversation on regional cooperation for industrialization. In the case of petrochemical development, Thailand has operated on the principle that an adequate inland market exists for economically viable plants for most of the basic petrochemicals. However, no developments in this area are likely for several years. Thailand is evaluating the feasibility of a \$200 million soda ash project proposed by ASEAN to meet regional requirements. This would utilize high purity rock salt found in northeastern Thailand.

b. Petrochemical Overview

Thailand has 160,000 barrels per day of refining capacity. At present, the country has small oil reserves, estimated at 270,000 barrels, but has substantial gas reserves, estimated at 5 trillion cubic feet.

Major petrochemical complexes had been planned for Thailand in the early 1970s, but they died as a result of the oil crisis. At present, activities are primarily limited to polystyrene, PVC and fiber production. At present, a 90,000 metric ton per year low density polyethylene plant and a 50,000 metric ton per year high density polyethylene plant are planned, based upon imported ethylene. In addition, Exxon is reportedly evaluating a natural gas liquids based complex, which would ultimately provide feedstocks for these facilities.

9. Indonesia

a. Background

The archipelago Republic of Indonesia has over 13,000 islands spreading over nearly 3,000 miles. The total land area covers 750,000 square miles. The population is currently estimated to be around 140 million, growing at 2.5 percent per annum. A map of Indonesia is shown as Figure III-B-10.

The labor force is around 45 million, with a very high percentage unemployed or underemployed. The islands of Java and Madura occupy about 9 percent of the total land area, but contain 65 percent of the total population. The population density on these two islands is over 250 persons per square mile.

Although many of the islands are very mountainous, large areas of the country are suitable for agricultural development. These could support a much larger population than at present. Government efforts to relocate people have had very limited success due to the close family relationships of Malay society. About 10 percent of the land area is devoted to agriculture. The food crops are rice, corn, sugar and sweet potatoes, and the principal plantation crops are rubber, palm oil, coffee, tea and spices. Large areas of the country are covered with tropical hardwood forests; timber (as logs, but more increasingly as cut timber and plywood) constitutes the country's second largest export commodity.

Oil is the dominant factor in the Indonesian economy, generating over 50 percent of government revenues and over 70 percent of total export earnings.

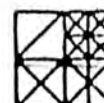
During 1976, new agreements were negotiated with the foreign oil companies active in Indonesia, resulting in terms far more favorable to the government. This, coupled with uncertainties about the effects of

FIGURE III - B - 10

INDONESIA



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PROJECT NO. 527 DATE

recent U.S. government tax rulings on the oil companies, has resulted in the lowest level of oil exploration activity in over three years.

Because Jakarta, the capital and largest city, and several other major cities are located on Java, the main market potential is on Java. However, the majority of the energy-related raw materials (oil, natural gas, hydro power and coal) are located on other islands or off-shore. As industrial development projects proceed, there will be a continuing struggle to shift the labor supply to the energy/feedstock source and political pressure to locate manufacturing operations in overpopulated, underemployed, land-scarce Java. The imbalance in location of population and raw materials for employment opportunities is one of the principal factors inhibiting the positive expansion of the Indonesian economy.

It is estimated that only about 15 percent of the population is in the money economy on a full-time basis, so the "have nots" represent a sizeable portion of the economy. The easy-going nature of the average Indonesian, his lack of education and training, lack of management ability and susceptibility to corruption at all levels, together with the high rate of population increase, have worked against positive economic growth.

During 1976, Indonesia made a significant recovery from the 1975 financial crisis in Pertamina, the state oil company. International reserves, nearly depleted as an immediate consequence of that crisis, have improved considerably. In the future, the government's ability to service its large debt and still maintain momentum in its development program depends largely upon whether Indonesia can maintain current oil production levels. Over the next several years, GNP growth in the 5-6 percent per year range is anticipated.

Industrial Development and Infrastructure

Infrastructure development and support facilities for industrial development in Indonesia are quite limited. The demands are so great and the capacity in funds, manpower and expertise so restricted that it is

unlikely the country will have a developed infrastructure by Western standards by the end of this century. In the greater Jakarta area and in some of the other cities in Java, an effort has been made to plan industrial sites and provide them with infrastructure such as road and/or rail access, water and power. Availability of unskilled labor is never a problem. As a result, most of the light to medium labor-intensive industries have clustered around Jakarta and other cities in Java. This has added to the already overcrowded situation in Tanjong Priok, the port for Jakarta. Priok handles about 60 percent of the total value of imports, but only about 4.5 percent of the exports. The difference is caused by the fact that most of Indonesia's exports are raw materials which are exported directly from the source.

If manufacturing growth in the Jakarta area continues to the point where exports become of sizeable volume, congestion will become worse. There is some talk about building a complete new port for Jakarta. Before this can ever be realized, however, the need for these additional facilities will be increased severalfold. To a greater or lesser extent, other ports in Indonesia are suffering from the same overload problems.

In remote areas, where mining and petroleum projects are located, the foreign companies are making their own investments in infrastructure and turning it over to the government or, as in the case of oil companies, infrastructure may be provided by Pertamina as part of the production sharing agreement.

Government Programs

The Indonesian government has state investments in many industries. The most prominent of these is through Pertamina, the national oil and gas company. Other state investments include mining, manufacturing and services. The Government also participates in joint ventures with private foreign companies.

The factor inhibiting private petrochemical investment is the limited amount of capital available from private sources for world-scale or even Indonesian-scale ventures.

It is government policy to encourage foreign capital and technology investment, and the following basic assurances and tax incentives are provided:

- Repatriation of current profits; expenses of foreign employees; depreciation of capital assets; compensation in case of nationalization.
- Exemption from corporate and dividend taxes for 6 years.
- Exemption of reinvested profits from corporate tax and dividend tax up to 5 years after date of reinvestment.
- Permission for accelerated depreciation of fixed assets.

b. Petrochemical Overview

Indonesia is a petroleum and natural gas exporting nation. In 1978, crude oil reserves were 10 billion barrels and production was 1.7 million barrels per day. In contrast, the country's refining capacity was 528,000 barrels per day. The country also has natural gas reserves estimated at 24 trillion cubic feet and is currently shipping LNG to Japan.

In addition to ammonia facilities, the only Indonesian petrochemical activity is the 20,000 metric ton per year polypropylene plant at Pladja, South Sumatra. Initial production began in early 1974. Two major petrochemical projects, an aromatics plant and an ethylene complex, were also planned, but the Pertamina collapse delayed their implementation by several years. At present, these projects are again being evaluated.

The collapse of Pertamina brought a change in government agencies responsible for petrochemical projects. As part of the program to rid Pertamina of ancillary activities, petrochemicals were assigned to the

Ministry of Industry. However, since the Ministry of Gas has responsibility of the disposition of natural gas liquids and the Ministry of Finance has responsibility for obtaining loans for all government agencies and corporations, these agencies must be in total agreement with a project before it can proceed.

10. People's Republic of China

a. Background

The People's Republic of China, frequently referred to as China, contains a quarter of the world's population. It is the world's third largest country in size. The People's Republic was proclaimed on October 1, 1949, by the Chinese Communist Party, which set for itself the awesome task of uniting and mobilizing a population impoverished and exhausted by 37 years of domestic chaos, war and foreign invasion in the construction of a modern industrial socialist society.

The territory governed by the Chinese People's Republic includes China Proper (the 18 historic provinces of imperial China), Inner Mongolia, Sinkiang, the Northeast (Manchuria) and Tibet. The country's vast area of 3.69 million square miles (excluding Taiwan) is slightly larger than that of the United States. China's immense land mass forms the greater part of central and eastern Asia.

China's demographic statistics are terribly inadequate. It has been estimated that in 1978 the population of China reached 863 million. It is also estimated that 40 percent of the population is under 15 years of age. This means that there is a much larger dependent population in China than in the economically advanced nations, presenting serious problems in education and employment. Because climate and soil limit agriculture to only one tenth of the land area, some 90 percent of people live on 40 percent of the land area.

Government Programs

After coming to power, the Communists placed overall long-range planning in the hands of the state planning commission, under the national people's congress of the state council. Short-range planning was given to the state economic commission. Other commissions were also formed. The general bureau for the supply of raw materials was formed in 1956 to control resources. Together with the state construction commission and the state technological commission, it helped the state planning commission to formulate five-year plans. Many changes in the commissions have taken place since then, but the general pattern has been the same. Although the central government makes plans, they are implemented by provincial authorities.

Trade

The United States officially recognized the People's Republic of China (PRC) on January 1, 1979. Although trade in 1978 exceeded \$1 billion, unresolved trade and commercial issues continue to hamper its growth. Neither country enjoys most-favored nation (MFN) tariff treatment and China does not have access to Export-Import Bank loans and guarantees or other financial programs of the U.S. Government, except for CCC (Commodity Credit Corporation) agricultural credits. The unresolved claims and assets issue inhibits or precludes direct banking relationships, direct shipping or airline connections in flag carriers and the exchange of trade exhibitions. It is the policy of the U.S. government to seek resolution of these and other barriers to the full development of trade and commercial relations.

China's leaders view international trade as an important factor in transforming China into a modern industrial state, as well as an instrument to foster the overall political and economic goals of making China a strong, unified nation capable of exercising leadership in Asia and the world. Import policy is directed at the acquisition of capital

goods that embody the modern technology needed to develop China's industry. Trade also is used to overcome serious shortcomings and bottlenecks in domestic production.

A prevailing theme in PRC foreign trade policy has been economic independence. Until recently, China has avoided long-term foreign credit, preferring to scale imports to the amount of foreign exchange available from export earnings. However, the goal to thoroughly modernize China by the year 2000 and the objectives of the Ten-Year Plan (1976-1985) are so ambitious that China has found it necessary to rely on some foreign financing. Until recently, the PRC had attempted to become self-sufficient through development of its own productive capacity; now it realizes that the industrialization program cannot be successfully completed in the desired time period without a major infusion of foreign plant, equipment and technology. Generally, the PRC seeks to avoid becoming too dependent on any one country as a source of trade.

Development of foreign trade and economic relations with most nations of the world is an important part of China's present policy to maximize the potential contribution of foreign trade to its economic development. China now has trading relations with more than 150 countries. To date, China has joined very few international economic or financial organizations, but Beijing's interest in arrangements that promote trade should increase as the country becomes more involved in international commerce.

b. Petrochemical Overview

Until recently, petrochemical production in the PRC was virtually nonexistent. At present, however, petrochemical production is growing rapidly through the importation of plants and technology. Fertilizer production increased sharply through the erection of a series of ammonia plants, which were given first priority. In addition, facilities for ethylene and derivatives manufacture, synthetic fibers and intermediates and plastics have been completed or under construction. In the petrochemical area, the strategy in the PRC is to import plants and

technology instead of products. As a result, product imports are anticipated to be relatively modest, and the PRC, despite large current local demand, has become a modest exporter in order to earn foreign exchange.

C. Factors Influencing Petrochemical Exports into
the Pacific Basin Region

The export of petrochemicals from a U.S. plant to the Pacific Basin regions will depend upon a number of factors such as local supply/demand considerations, pricing for products imported, governmental regulations, regional associations and local business practices. The situation which will influence petrochemical imports in each of the Pacific Basin countries is presented below.

Japan

Japan, as the free world's second largest petrochemical producer, is anticipated to have ample supply of virtually every petrochemical made in essentially world-scale facilities. However, for most petrochemicals, demand is very high in relationship to the output from a single plant, so that large imports from a West Coast plant would only amount to a small percentage of overall demand. Since domestic prices are relatively high and duties are nominal, the country could theoretically be a good export market.

Heretofore, Japanese business practices have precluded the potential for significant imports, except under special circumstances. The trading companies have strong ties to the domestic producers; thus they would not import material which would adversely affect domestic industry. In addition, the interrelationship between the Japanese manufacturers, the trading companies and the banks makes it difficult for a consumer to import materials outside established channels.

As a result of sharp crude oil and naphtha price increases since the 1973-1974 oil embargo, Japan has become a high-cost petrochemical producer. This has changed the long-term strategy for Japanese firms to one of emphasizing specialty instead of commodity chemicals for future growth and to importing those products in which Japanese firms are not

cost competitive from assured, low-cost sources of supply. As a result, Japan could be a significant market for chemicals for Alaska, and Japanese firms are potential investors in an Alaskan petrochemical project.

Korea and Taiwan

Korea and Taiwan both have developing petrochemical industries. A dual pricing structure for the products generally exists, such that material exported or processed into goods for export is valued at world market prices, while material intended for domestic consumption is generally valued at that price required for the producer to obtain a satisfactory return on his investment. Both countries have duties and other taxes which result in effective duties of about 30-50 percent for the commodity petrochemicals. This effectively precludes importation of material, except in duty drawback situations and situations when local supply is nonexistent or is insufficient to meet demand. In both countries, consumers have tended to use locally produced material whenever possible; as a result, significant petrochemical import opportunities exist only for those products where domestic supply is insufficient to meet demand.

Hong Kong

Hong Kong has no duties on imports and there is no protection for domestic industry. As a result, there are no impediments to exports from a U.S. facility.

ASEAN Countries

The ASEAN countries are attempting to develop (1) a trade zone coupled with preferential internal duties and (2) an apportionment of facilities among the countries. With respect to petrochemicals, the individual countries are promoting their projects, and rationalization of the situation on a logical basis appears unlikely within the next several years.

The Philippines, Indonesia, Thailand and Malaysia have significant protection for domestic industry. Petrochemical imports will thus be limited to products where local production is insufficient to meet demand and to duty drawback situations. However, it is anticipated that other countries within the ASEAN group will eventually have a preferable duty position. This will place a U.S. producer at a competitive disadvantage vis-a-vis an ASEAN country producer in those markets. As a result, over the longer term, the potential for imports will tend to be governed more by the supply shortfall within the group rather than on a country-by-country basis.

Singapore is a free port and, like Hong Kong, has no duties or restrictions on petrochemical importation. Since most petrochemical consumption is related to product exports, local production or production in other ASEAN countries would not affect the ability to export from the U.S. to Singapore.

People's Republic of China

The PRC purchases petrochemicals on a spot or short-term contract basis. The quantities purchased are relatively modest and can be quite variable depending upon price and the country's hard currency situation. As a result, the PRC cannot be considered a significant long-term market for petrochemicals from Alaska.

IV. PRODUCT ANALYSES

This section of the report presents market analyses for ethylene, propylene and their major derivatives in the Pacific Rim market.

A. Low Density Polyethylene1. West Coast Marketa. Demand

The 1978 market for LDPE resin in the West Coast areas of the United States and Canada was estimated at over 900 million pounds. An anticipated overall growth of 7.9 percent per year over the next 12 years will result in a market of over two billion pounds by 1990. Film will account for about 65 percent of the total demand for LDPE resin throughout the study period of 1978-1990, as shown in Table IV-A-1. The Canadian market constitutes about 5 percent of the total.

TABLE IV-A-1

WEST COAST LOW DENSITY POLYETHYLENE DEMAND, 1978-1990
(Million Pounds)

	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, %*</u> <u>(1978-1990)</u>
Western U.S.					
Film and sheet	580	700	1,060	1,500	8.2
Injection molding	125	145	200	260	6.3
Wire and cable	85	100	145	210	7.8
Extrusion coating	50	55	75	95	5.5
Other uses (including blow molding and pipe)	55	70	115	165	9.6
Total Western U.S.	895	1,070	1,595	2,230	7.9
Western Canada	40	45	65	90	7.0
Total	935	1,115	1,660	2,320	7.9

* Average annual growth rate.

Western U.S.Film and Sheet

Film is by far the largest market for LDPE on the West Coast, with 1978 consumption of about 580 million pounds. This market is anticipated to more than double by 1990.

Film is used in many forms of packaging and wrap, ranging from food to garbage bags. Shrink and stretch films are also used in packaging. Substantial quantities of film are also used in agricultural applications. Film thickness varies from 0.5 mil for dry cleaning and garment bag applications to 10 mils and higher for construction uses. Ethylene-vinyl acetate copolymer films containing low percentages of the comonomer to achieve improved impact strength and clarity are used for produce bags, shipping sacks and liquid packaging. Growth in film demand on the West Coast is expected to parallel that of the U.S. market. Considerable market potential is anticipated within the region for injected-in film for unitizing containers.

From time to time, the West Coast has felt the pressure of film and bag imports from the Far East. Currently, imports represent a relatively low percentage of overall demand. Increased imports are not anticipated to materially influence the growth of the West Coast industry.

About half of the resin market for film is in southern California. Northern California, Washington, Oregon and Idaho are other significant consuming areas. Major consuming firms are listed in Table IV-A-2.

Injection Molding

There are numerous molders of polyethylene; the major categories are lids for convenience and other foods, toys, housewares and food containers. Housewares account for about 40 percent of the total injection molding

TABLE IV-A-2MAJOR U.S. WEST COAST USERS OF LDPE RESIN FOR FILM PRODUCTION, 1978
(Million Pounds)

<u>Company</u>	<u>Location</u>
Arco	Long Beach, CA
Crown Zellerbach	San Leandro, CA
	Los Angeles, CA
	Portland, OR
Mobil	Woodland, CA
Shields Bag	Yakima, WA
Weyerhaeuser	two locations - WA
Potlatch	Lewiston, ID
Bemis Bag	Richmond, CA
CT Film (Dart)	Santa Ana, CA
Monsanto	Santa Ana, CA
Dow	Torrance, CA
Golden West	Tustin, CA
Ethyl Corporation	Glendora, CA
St. Regis	Union City, CA

market of 125 million pounds, with lids and toys accounting for another 40 percent. The West Coast injection molding market is anticipated to more than double by 1990.

Housewares are dominated by Fesco (Cities Service) of Tustin, California, and Dart Industries (Tupperware) with its Idaho plant. Processors of lid resins include Amoco, Triplas, Molded Container and Continental Can.

Wire and Cable

The wire and cable market for LDPE was about 85 million pounds in 1978 and is expected to reach 210 million pounds by 1990. The product finds use in telephone and coaxial cables. It is used as both an insulator and a dielectric. High-voltage cables also utilize polyethylene for insulation. The major user of polyethylene was Western Electric in Phoenix, AZ. The major LDPE consumers for wire and cable extrusion are shown in Table IV-A-3.

TABLE IV-A-3MAJOR U.S. WEST COAST USERS OF LDPE RESIN FOR WIRE AND CABLE

<u>Company</u>	<u>Location</u>
Western Electric	Phoenix, AZ
Kaiser Aluminum	Rockland, CA
Alcan Cable West	Rockland, CA
Reynolds	Longview, WA
Anaconda	Orange, CA
Pirelli	-
Arizona Wire	Phoenix, AZ
ITT Cable Hydrospace	San Diego, CA
Hatfield Wire	Phoenix, AZ

Extrusion Coating

The extrusion coating market for LDPE was about 50 million pounds in 1978 and is expected to almost double by 1990. The major application is in the coating of paperboard and other substrates. Ethylene-vinyl acetate copolymers are used by some converters to improve heat sealability. Companies such as Crown Zellerbach (San Francisco, CA), Guardian Packaging (Newark, CA) and Georgia Pacific (Portland, OR) are large producers of polyethylene-coated paperboard.

Other Uses

This category, including pipe, blow molding, and other uses, amounted to 55 million pounds in 1978. Growth is forecast at 9.6 percent per year, for a 1990 market of 165 million pounds.

Western Canada

The LDPE market in Western Canada was about 40 million pounds in 1978. Demand is forecast to increase at about 7 percent per year and reach 90 million pounds by 1990. Film is the major market within the area, but pipe and extrusion coated materials are also produced. Significant LDPE

consumers include Capital Plastics, Surrey, BC (film), Pacific Plastics, Vancouver (pipe), Seaforth Plastics, Vancouver (film) and Western Concord, Vancouver (film). There is no captive LDPE consumption in the West Canadian market.

b. Supply

There is only one producer of low pressure polyethylene on the U.S. West Coast, namely Union Carbide, with a capacity of 140 million pounds per year at Torrance, CA. This compares with a total U.S. capacity of about 8.5 billion pounds. The major part of the West Coast market is supplied from plants in Texas and Louisiana. The output from the Union Carbide facility is primarily consumed on the West Coast, but some is also shipped to other areas. This unit is small and relatively old, having been built in the 1950s.

Several of the U.S. producers of resin are significant suppliers to the West Coast. Union Carbide, Dow, USI, Exxon and Arco are the five largest suppliers, and they supply about two-thirds of the market.

There are no LDPE producers in British Columbia, but CIL has a 70 million pound per year unit at Edmonton, which supplies consumers in British Columbia. Other suppliers include Dow of Canada, DuPont Canada, Union Carbide Canada, Mitsubishi and some of the U.S. suppliers.

c. Captive Market

About 20 percent of the 895 million pound U.S. West Coast market for LDPE is captive. However, there are no captive consumers in Western Canada. Arco, Mobil, Dart and Cities Service (Fesco) are the major captive users. No significant changes in this percentage are foreseen over the study period.

d. Pricing

Low density polyethylene is sold on a delivered price basis in the U.S., with West Coast prices equivalent to those for the remainder of the U.S. In July 1979, LDPE prices were increased to 35.5 cents per pound for the liner grade. General-purpose grades are 36.5 cents per pound, while injection-molding grades are 38.5 cents per pound. Prices have increased by over one-third in the past year, due primarily to higher prices elsewhere in the world and increased domestic and export demand. Future prices will tend to reflect only increases in costs, since the supply/demand situation is anticipated to remain relatively good.

Liner-grade polyethylene in Canada sold for \$0.41 (Canadian) per pound delivered in hopper cars in September 1979. Bagged material is priced 6 cents per pound higher, while the general-purpose resin sells for 2.5 cents per pound more than the liner grade. Prices are anticipated to remain slightly above U.S. levels. The duty on LDPE is 10 percent ad valorem.

2. Pacific Basin Market

a. Japan

Demand

The domestic demand for low density polyethylene homopolymer and ethylene-vinyl acetate copolymer in Japan is forecast to increase from 894,000 metric tons in 1977 and 960,000 metric tons in 1978 to 1,770,000 metric tons in 1990, as is shown in Table IV-A-4. Exports were about 286,000 metric tons in 1977 and 231,000 metric tons in 1978, including copolymer. Exports are anticipated to decrease due to increased penetration of Far Eastern markets by U.S. producers, startup of new facilities in the region, and higher production costs in Japan.

TABLE IV-A-4
JAPANESE LOW DENSITY POLYETHYLENE DEMAND
 (Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, %</u> <u>(1978-1990)</u>
Film	515	555	625	800	975	4.8
Laminates	100	108	125	175	225	6.3
Wire and cable	62	66	73	92	115	4.7
Injection molding	75	80	95	130	170	6.5
Pipe	6	6	7	8	10	4.3
Blow molding	33	35	40	50	60	4.6
Others	103	110	125	165	215	5.7
Domestic demand	<u>894</u>	<u>960</u>	<u>1,090</u>	<u>1,420</u>	<u>1,770</u>	<u>5.2</u>
Exports	286	231	200	150	100	(7.2)
Total demand	<u>1,180</u>	<u>1,191</u>	<u>1,290</u>	<u>1,570</u>	<u>1,870</u>	<u>3.8</u>

Film is the largest segment of the LDPE market, representing nearly 50 percent of domestic demand. Historically, this has been a major demand growth area, but demand is expected to grow only at about 5 percent per year throughout the study period. This is due to increased imports from Korea and Taiwan, increased penetration of thin high density polyethylene film, which is capturing some traditional low density polyethylene markets, and conservation brought about by higher prices. Usage in lamination, injection-molded articles and blow-molded articles is also anticipated to show moderate growth. On the other hand, growth of wire and cable uses is expected to be relatively slow.

Supply

The current low density polyethylene capacity in Japan is 1,520,000 metric tons per year, as shown in Table IV-A-5. At present, no expansions are under way. However, it is felt that capacity will probably increase by 100,000 metric tons per year by the mid-1980s, since Mitsubishi Petrochemical has been considering a facility and some other firms have long-range plans to expand in LDPE.

TABLE IV-A-5

JAPANESE LOW DENSITY POLYETHYLENE PRODUCERS, 1978
(Thousand Metric Tons per Year)

<u>Company</u>	<u>Capacity</u>
Mitsubishi Petrochemical	250
Sumitomo Chemical	242
Mitsui Polychemical	160
Nippon Unicar	165
Ube Kosan	140
Asahi Dow Chemical	124
Toyo Soda	158
Mitsubishi Chemical	97
Nippon Petrochemical	64
Showa Petrochemical	120
Total	1,520

Supply/Demand Situation

The potential supply/demand balance for LDPE in Japan is presented in Table IV-A-6. Basically, Japan is anticipated to have sufficient LDPE capacity to be self-sufficient until the mid-1980s. However, the higher cost of production could result in displacement of Japanese production with imported material. By the mid-1980s, Japan could be importing 100,000-200,000 metric tons per year.

TABLE IV-A-6

POTENTIAL SUPPLY/DEMAND BALANCE FOR LOW DENSITY POLYETHYLENE IN JAPAN
(Thousand Metric Tons)

	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Potential supply*	1,520	1,520	1,620	1,620
Forecast demand	1,191	1,290	1,570	1,870
Surplus/(deficit)	331	230	50	(250)
Operating rate, %	78	85	97	

* 100 percent of nameplate capacity.

Pricing

LDPE prices in Japan are higher than world prices. Delivered prices were 215 yen per kilo (44.4 cents per pound) in late June 1979 for film-grade resin. Prices for other grades are somewhat higher. LDPE imports are subject to a duty of 28 yen per kilo.

b. KoreaDemand

The Korean demand for low density polyethylene was 135,000 metric tons in 1977 and 160,000 metric tons in 1978. Demand is forecast to increase to 205,000, 305,000 and 420,000 metric tons by 1980, 1985 and 1990, respectively. This represents an average annual growth of 8.4 percent over the period. Film and bags for fertilizer, agricultural and general packaging use represent about 80 percent of the market. Only about 10 percent of the converted product production is exported, but considerably larger quantities are exported in the form of packaged goods.

There are about 400 processors of low density polyethylene in Korea. The major consumers are listed in Table IV-A-7. These firms represent about half of Korean consumption.

TABLE IV-A-7MAJOR KOREAN CONSUMERS OF LDPE

Ajin
Hyon Dae Chemical
Il Shin Chemical
Sam Yung Chemical
Hwa Sung Vinyl
Daihan
Sun-A Plastic
Lucky Ltd.
Chin Yang
National Plastic

Supply

Korea Pacific Chemical, a Dow Chemical affiliate, is the sole producer of low density polyethylene in Korea; its plant at Ulsan is rated at 70,000 metric tons per year. The firm is building a 100,000 metric ton per year unit at Yeosu, which is scheduled to be on stream in 1979. Union Carbide has also entered into a joint venture with Lucky Petrochemical to build a 150,000 metric ton per year LDPE plant at the new Yeosu complex. Start-up is expected in 1982-1983, but could be subject to delay.

Production at the Korea-Pacific plant in 1978 was 63,000 metric tons of material. Imports were 98,000 metric tons, which were handled by Korea-Pacific for the industry association.

Supply/Demand Situation

The supply/demand situation for low density polyethylene in Korea is shown in Table IV-A-8. Korea is anticipated to be a net importer in the early 1980s, but will be self-sufficient when the third unit comes on stream. Based upon projections and current philosophy, it is unlikely that Korea would build a fourth unit until the end of the 1980s, and thus they would again be an importer in the late 1980s.

TABLE IV-A-8

POTENTIAL SUPPLY/DEMAND BALANCE FOR LOW DENSITY POLYETHYLENE IN KOREA
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Potential supply	70	70	170	320	420*
Forecast demand	135	160	205	305	420
Surplus/(deficit)	(65)	(90)	(35)	15	0
Actual production	55	63			

* Anticipated new unit.

Pricing

LDPE pricing from domestic units is set by the government at levels sufficient to yield a reasonable return in the facilities, and it tends to be from 20 to 30 percent above world prices. Imports are normally made on a monthly tender basis at very attractive prices; however, with the resin shortages in recent months, Korea has had to pay premium prices for imported material. Imports are subject to import duties, a handling charge, defense tax and a commodity tax. However, duty drawback is obtained on material converted for export.

c. Taiwan

Demand

In 1977 and 1978, the total demand for low density polyethylene in Taiwan was 89,000 and 93,000 metric tons, respectively. This included resin utilized in domestic markets, produced for export, and imported for conversion into products for export. The domestic market accounts for about three-quarters of domestic demand. Film and bags constitute about 80 percent of this market.

Approximately 20-25 percent of the total resin demand is processed into goods for export. Taiwan is facing increased competition from other countries, such as Singapore, in film and bag markets. In addition, the U.S. film and bag producers are not about to let imported products acquire more than a small percentage of the market. As a result, the processing for export market is anticipated to grow only at about 5 percent per year for the next few years and then begin to level off. This is less than the growth in polyethylene consumption.

The domestic demand for low density polyethylene is forecast to increase from 70,000 and 75,000 metric tons in 1977 and 1978 to 85,000, 115,000 and 150,000 metric tons in 1980, 1985, and 1990, respectively. This represents an average annual growth rate (from a 1978 base) of 5.8

percent. Exports are expected to increase significantly in the early 1980s due to the desire to utilize the increased capacity available. A breakdown of consumption is presented in Table IV-A-9.

TABLE IV-A-9
TAIWAN DEMAND FOR LOW DENSITY POLYETHYLENE
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, %</u> <u>(1978-1990)</u>
Total domestic demand	70	75	85	115	150	6.0
Exports	19	18	50	50	50	-
Total demand	89	93	135	165	200	6.6

Supply

The current Taiwanese capacity for low density polyethylene is 90,000 metric tons. Announced expansions should increase capacity to 215,000 metric tons by the end of 1979, as is shown in Table IV-A-10. Actual potential supply is estimated to be approximately 90 percent of nameplate capacity.

TABLE IV-A-10
TAIWAN LOW DENSITY POLYETHYLENE PRODUCERS, 1978
(Thousand Metric Tons)

<u>Company</u>	<u>Location</u>	<u>Capacity</u>	<u>Expansions</u>
Asia Polymer	Kachsiung		75 (1979)
USI Far East	Kaohsiung	90	50 (1979)
		90	125

USI Far East was once completely owned by National Distillers and Chemical Corp., but it is now 50 percent owned by local Chinese interests. The firm produces for the local market and exports throughout Southeast Asia. The plant, which reached its current size in a few stages, is in the process of expansion by 50,000 metric tons. This expansion will be completed in 1979.

Asia Polymer is owned by China Gulf Plastics (an affiliate of Gulf Oil Corp.), Chinese Petrochemical Development Corp. (government-owned), and a

number of plastics fabricators. The firm has completed a 75,000 metric ton per year unit.

Supply/Demand Situation

The supply/demand balance for LDPE is shown in Table IV-A-11. After the current expansions are completed, there will be sufficient capacity in Taiwan to meet demand growth throughout the study period. As a result, there will be little opportunity for sales to Taiwanese firms except under special situations, such as imports for processing into products which will be exported.

TABLE IV-A-11

POTENTIAL SUPPLY/DEMAND BALANCE FOR LOW DENSITY POLYETHYLENE IN TAIWAN
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Potential supply*	81	81	194	194	194
Forecast demand	89	93	135	165	200
Surplus/(deficit)	(8)	(12)	59	29	(6)

* 90 percent of nameplate capacity.

Pricing

The domestic prices in Taiwan are normally substantially above Southeast Asian market prices. However, resin sold to processors for conversion to fabricated articles for export are sold at Southeast Asian market prices. LDPE imports are subject to high duties and taxes, but duty drawback can be obtained on processing for export situations.

d. Hong Kong

Hong Kong has no domestic low density polyethylene production, and it is very unlikely that this product would ever be produced in the colony. However, Hong Kong is a major consumer of the product (use in 1978 is estimated at 90,000 metric tons). Film is the major outlet for low

density polyethylene in Hong Kong, representing about 65-70 percent of overall consumption.

Consumption is expected to reach 100,000, 115,000 and 135,000 metric tons in 1980, 1985 and 1990, respectively. Domestic use for the product is expected to grow strongly for the next few years, reflecting economic growth in the colony. However, processing of low density polyethylene for export, which constitutes about 60 percent of the market, is anticipated to remain about constant. This is due to the nature of Hong Kong's economy: it specializes in the development of techniques to produce fabricated articles rather than in producing larger quantities of a given product.

There are over one thousand polyethylene consumers, most of whom order only a few bags at a time. In 1978, Japan, with exports of 50,000 metric tons to Hong Kong, had over 50 percent of the market. Other suppliers were U.S., Italian, French and German firms. There is no duty on LDPE imports to Hong Kong, and the material is normally sold at the Southeast Asian market price.

e. ASEAN Countries

LDPE demand in the ASEAN countries is anticipated to increase from 155,600 and 172,000 metric tons in 1977 and 1978, respectively, to 421,000 metric tons in 1990, as shown in Table IV-A-12. Film and bags represent most of the demand for the product.

TABLE IV-A-12

ASEAN COUNTRY LOW DENSITY POLYETHYLENE DEMAND
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, % (1978-1990)</u>
Philippines	35	41	60	85	105	9.6
Singapore	24	25	28	36	46	5.2
Malaysia	23.6	25	28	37	50	6.0
Thailand	28	30	35	50	70	7.3
Indonesia	45	51	65	100	150	9.4
	<u>155.6</u>	<u>172</u>	<u>188</u>	<u>308</u>	<u>421</u>	<u>7.7</u>

At present, there are no producers of LDPE in the ASEAN region. A 100,000 metric ton per year plant, in which Sumitomo would have a dominant interest, is planned as part of a petrochemical complex in Singapore. The facility is scheduled to be onstream in late 1982. A 90,000 metric ton per year plant is planned for the Philippines, in which USI Far East would be the foreign partner. A facility of similar size is planned for Thailand by Chinese interests. These latter two projects are based on imported ethylene and are not firm at present.

f. People's Republic of China

In the past three years, the People's Republic of China has begun to install LDPE plants. At present, capacity totals about 200,000 metric tons; as a result, imports have fallen to relatively low levels, and the PRC has exported small quantities to Hong Kong. In future years, only modest imports are foreseen, so this market cannot be viewed as a significant secure market for an Alaskan facility.

3. Conclusions

Opportunities for an Alaskan Plant

The supply and demand for LDPE on the West Coast and in the Pacific Basin are summarized in Table IV-A-13.

TABLE IV-A-13

LOW DENSITY POLYETHYLENE

	Demand			AAGR, %	Capacity, per year	
	<u>1978</u>	<u>1985</u>	<u>1990</u>		<u>1978</u>	<u>Future</u>
	(Million Pounds)					
West Coast	935	1,660	2,320	7.9	140	0
	(Thousand Metric Tons)					
Japan	960	1,420	1,770	5.2	1,520	1,620
Korea	160	305	420	8.4	70	320
Taiwan	75	115	150	6.0	90	215
Hong Kong	90	115	135	3.4	0	0
ASEAN Countries	172	308	421	7.7	0	100*

* Singapore project. Other projects possible.

During the 1980s, it is expected that new grass-roots low density polyethylene facilities will have to have a capacity of at least 500 million pounds per year in order to be competitive.

Due to the established position of numerous suppliers, it is anticipated that a firm with Alaskan production could reasonably expect to capture only 15-20 percent of the merchant market on the West Coast. This would equate to 210-280 million pounds of the 1,400 million pound merchant market forecast within the region for 1985. By 1990, with the anticipated demand increase, sales should grow to 300-400 million pounds.

LDPE imports into Hong Kong and the ASEAN countries will total about 700 million pounds by 1985. About 40 percent of this demand should be met by exports from Japan and Taiwan. However, an Alaskan facility would be in a good position to capture a share of the remaining market. In addition, Japan, while it possesses sufficient LDPE capacity at present, is a relatively high cost producer. As a result, it could be advantageous to supplant domestic production with imports. Levels of about 200 million pounds per year would not be unreasonable. From a standpoint of market size and trends, production of LDPE in Alaska is viable.

B. High Density Polyethylene

1. West Coast Market

a. Demand

During 1978, consumption of HDPE within the West Coast region was estimated at 500 million pounds. California alone is estimated to have consumed more than 350 million pounds. Growth over the next 12 years is forecast at 10.3 percent per year, for a 1.6 billion pound market in 1990.

Blow molding accounts for about 35 percent of total HDPE demand in the West Coast region. This percentage is expected to be maintained over the entire study period. The consumption of HDPE, by application, from 1978 through 1990 is indicated in Table IV-B-1.

TABLE IV-B-1

WEST COAST HIGH DENSITY POLYETHYLENE DEMAND, 1978-1990
(Million Pounds)

	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, % (1978-1990)</u>
Western U.S.					
Film and sheet	40	65	160	250	16.5
Injection molding	110	135	210	325	9.4
Wire and cable	25	28	40	65	8.2
Blow molding	175	220	355	520	9.5
Pipe and conduit	60	80	135	215	11.2
Other uses (including roto molding)	70	87	130	175	7.9
Total Western U.S.	<u>480</u>	<u>615</u>	<u>1,030</u>	<u>1,550</u>	<u>10.3</u>
Western Canada	20	25	35	60	9.5
	<u>500</u>	<u>635</u>	<u>1,065</u>	<u>1,610</u>	<u>10.3</u>

Western U.S.

Film and Sheet

This category accounted for an estimated 40 million pounds in 1978, about 7 percent of the total U.S. West Coast market. HDPE film is used in

various applications such as merchandise bags, shipping sacks, coextruded food packaging and tissues. In essence, much of HDPE film's use is as a replacement for paper in, for example, bread wrap and fruit wrapping. In addition to typical plastics processors - Guardian Packaging (Newark, CA), Richmond Division of Pak-Well (Redlands, CA), Alchem (La Miranda, CA), Lustro (Valencia, CA), and LTD Packaging (Santa Fe Springs, CA) - companies that have traditionally made paper products, such as Crown Zellerbach, are also involved in the production of HDPE film. Film consumption alone on the West Coast area is estimated at 30 million pounds.

Sheet usage in the region is estimated at approximately 10 million pounds. The major application is in thermoforming for such diverse products as large containers, tote bags, toys and childrens' swimming pools. Gage Industries (Lake Oswego, OR) is the major sheet fabricator, but Lustro and Alchem are also manufacturers.

Injection Molding

About 25 percent of the U.S. West Coast HDPE resin consumption is used in injection molding for food containers, nursery tubs, toys, shipping drums and containers. Food containers and packaging injection molded products constitute about a third of this market. Production is primarily accounted for by about eight companies, with Crown Zellerbach, Molded Container, Gregg Foods and Owen-Illinois among the largest.

Nursery tubs and flower pots constitute about a quarter of the market. Anaheim Plastics and J.S. McConky are major producers.

Wire and Cable

Usage of HDPE resin in this category was estimated at 25 million pounds during 1978. About ten companies in the U.S. West Coast region use HDPE for wire insulation. They include Pacific Electricord (Gardena, CA), National Wire and Cable (Los Angeles, CA) and Raychem (Menlo Park, CA). However, the largest consumer is Western Electric of Phoenix, AZ, with an estimated annual usage of at least 15 million pounds.

A growth rate of 8.2 percent per year over the 1978-1990 period is forecast for the wire and cable extrusion market in the West Coast region.

Blow Molding

This is the major HDPE market in the West Coast, accounting for 175 million pounds of resin in 1978. Growth in this category is forecast at 9.5 percent per year, resulting in an anticipated market of 520 million pounds in 1990. About 50 firms blow mold HDPE in this region, with perhaps 20 of these accounting for 70 percent of total blow molding resin consumption. Many of the blow molders process resin for captive operations, such as Altadena Dairies, Carnation Dairies, Purex and Revlon. In addition, many of the major national packaging companies are involved, including American Can, Continental Can, Georgia Pacific, Monsanto and Owens-Illinois. Among the other processors are the following high volume companies - Born Free Plastics, Polytainer, Molded Container, Spokane Presto Log and Plastic Industries. Large (up to 55 gallon) drums are being blow molded by several companies. This market accounts for about 15 million pounds of the total consumption of blow molding resin. Born-Free, Applied Chemical Technology and Ziffco are the major producers of large drums.

Pipe and Conduit

Usage of HDPE resin in this application was estimated at 60 million pounds in 1978. This market is forecast to grow to 215 million pounds by 1990, an average annual growth rate of 11.2 percent over the period. The products are used in potable water and gas lines and in the production of 12" corrugated pipe. During 1973, corrugated pipe accounted for about half of the market, with gas and water distribution and oil patch pipe utilizing the rest.

Potable water pipe producers are Phillips Products (Watsonville, CA), AB&I Plastics (Newark, CA), Kerona Inc. (Santa Ana, CA), Pacific Plastic

Pipe Co. (Beaverton, OR), Portco Corp. (Vancouver, CA), Superlon Pipe Corp. (Tacoma, WA), Swanson Co. (Phoenix, AZ), Wes Flex Mfg. (Richmond, CA) and Western Plastics (Tacoma, WA and Denver, CO).

Other Uses

These include rotational molding for recreational vehicles, golf bags, crock pot covers and decoys. Companies involved in roto molding are Hollowform (Woodland Hills, CA), Rotoform (Santa Cruz, CA) and Peco (Portland, OR). There is also some extrusion coating and foam usage of HDPE. By 1990, the total "other" category is expected to reach 175 million pounds from the current level of 70 million pounds.

Western Canada

The HDPE market in Western Canada was 20 million pounds in 1978. Demand is forecast to increase at about 9.5 percent per year and reach 60 million pounds by 1990. Pipe, large containers, bottles and molded articles are produced within the area. Significant HDPE consumers include Capilano Plastics (large containers), Columbia Plastics (custom molder) and Pacific Plastics (pipe), all located in Vancouver.

b. Supply

There are no producers of HDPE resin on the U.S. West Coast, but there are 13 producers in the United States with a capacity totalling over 5 billion pounds. Announced expansions total about another 1 billion pounds.

Several of the U.S. producers of resin are significant suppliers to the U.S. West Coast. Among these, Phillips, Soltex, Chemplex, Arco and Allied Chemical account for about 70 percent of the total market.

There are no HDPE producers in Western Canada. The Canadian HDPE producers - Dow Chemical of Canada, DuPont Canada and Union Carbide Canada - supply the Western Region. In addition, firms such as Mitsui, Soltex, Phillips and Hoechst are also active in the region.

c. Captive Markets

The captive market for HDPE on the West Coast was about 50-60 million pounds in 1978, or approximately 10-13 percent of the overall market. The major captive user was Phillips through its pipe operation and through the Sealright container operation. Owens-Illinois, a 50 percent owner of National Petrochemical, is a significant factor in the blow molding market, and Amoco is also a producer of foamed food containers. No appreciable change in the captive share of the market for HDPE in the region is foreseen.

There is no captive HDPE consumption in British Columbia, but Phillips has an extruded pipe operation in Calgary.

d. Pricing

In July 1979, the U.S. prices for blow-molding, injection-molding and general-purpose extrusion grades of HDPE were 36.25 cents per pound, delivered. The same prices prevail on the U.S. West Coast as in the remainder of the United States. Prices increased about 25 percent since mid-1978. Further price increases should be related primarily to cost increases.

In Canada, the commodity grades of HDPE sold for \$0.455-0.491 (Canadian) per pound delivered in bags in September 1979. Prices are anticipated to remain slightly above U.S. levels. The duty on LDPE is 10 percent ad valorem.

2. Pacific Basin Market

a. Japan

Demand

The domestic demand for high density polyethylene in Japan is forecast to increase from 320,000 metric tons in 1977 and 438,000 metric tons in 1978 to 550,000 metric tons in 1980, 780,000 in 1985 and 990,000 by 1990. Japan has been a substantial HDPE exporter, with exports totaling 176,000 metric tons in 1978. However, they are anticipated to decrease somewhat over the study period. As a result, total HDPE demand should increase from 614,000 metric tons in 1978 to 1,060,000 metric tons in 1990. This represents an average annual growth of 4.6 percent. The Japanese demand by end-use for this product is presented in Table IV-B-2.

TABLE IV-B-2

JAPANESE HIGH DENSITY POLYETHYLENE DEMAND
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, % (1978-1990)</u>
<u>Demand</u>						
Injection molding	90	120	150	200	250	6.3
Blow molding	70	86	100	140	185	6.6
Film	50	95	130	210	280	6.4
Tape	10	14	17	25	30	6.6
Slit film yarn	29	34	45	55	65	5.5
Fiber	25	32	39	15	65	6.1
Pipe	7	9	11	15	20	6.9
Miscellaneous	39	48	58	80	95	5.9
Total domestic demand	<u>320</u>	<u>438</u>	<u>550</u>	<u>780</u>	<u>990</u>	<u>7.0</u>
Exports	<u>182</u>	<u>176</u>	<u>130</u>	<u>100</u>	<u>70</u>	<u>(8.0)</u>
Total demand	<u>502</u>	<u>614</u>	<u>680</u>	<u>880</u>	<u>1,060</u>	<u>4.6</u>

Injection molding applications are the largest segment of the HDPE market, with the major application being in the production of

containers. Demand is anticipated to increase about 12 percent per year in the 1978-1980 period, from 120,000 to 150,000 metric tons. Demand is expected to reach about 200,000 metric tons by 1985 and 250,000 metric tons by 1990, which represents a growth rate of 6.3 percent per year over the 1978 to 1990 period.

Blow molding is a relatively mature market, with demand growing an average of 6.6 percent over the study period.

Thin HDPE film has made substantial inroads in Japan in applications such as bags. Most of this market has been at the expense of LDPE. Overall HDPE film demand was about 95,000 metric tons in 1978, an increase of 90 percent over 1977. HDPE film is anticipated to increase to nearly 280,000 metric tons by 1990. Mitsui Petrochemical, Showa, Nissan, Asahi and Mitsubishi Chemical are among the producers of resins for this application. Package tape is currently a 14,000 metric ton per year market, which is anticipated to grow slightly above GNP.

Slit film yarn is used as a jute replacement. It also finds use as carpet backing, an application which is the province of polypropylene in the U.S. HDPE film yarn demand is anticipated to increase from 34,000 to 65,000 metric tons over the 1978-1990 period. Similar growth is anticipated for HDPE fiber. This product finds primary use in rope and fishnets. HDPE pipe is a small market in Japan, with consumption estimated at only 9,000 metric tons in 1978. Growth of about 7 percent per year is forecast.

Supply

The current high density polyethylene capacity in Japan is 882,000 metric tons. A list of Japanese HDPE producers is presented in Table IV-B-3.

At present, there are no expansions in progress. However, it appears likely that capacity increases will be made since, with the growth of thin HDPE film, the effective capacity is substantially reduced and the

TABLE IV-B-3

JAPANESE HIGH DENSITY POLYETHYLENE PRODUCERS, 1978
(Thousand Metric Tons per Year)

<u>Company</u>	<u>Location</u>	<u>Capacity</u>
Mitsui Petrochemical	Chiba/Iwakuni	209
Showa Petrochemical	Kawasaki	176
Asahi Chemical	Mizushima	90
Mitsubishi Chemical	Mizushima	88
Nisseki Resin Chemical	Kawasaki	87
Chubu Chemical	Yokkaichi	63
Idemitsu Petrochemical	Chiba	60
Nissan Chemical	Chiba	49
Chisso	Chiba	40
Mitsubishi Petrochemical	Yokkaichi	20
		<u>882</u>

producers are currently operating at about capacity. By 1985, it is anticipated that capacity will be expanded by at least 100,000 metric tons per year.

Supply/Demand Situation

The potential supply/demand balance for HDPE in Japan is presented in Table IV-B-4. Basically, Japan is anticipated to be in a relatively tight situation on HDPE.

TABLE IV-B-4

POTENTIAL SUPPLY/DEMAND BALANCE FOR HIGH DENSITY POLYETHYLENE IN JAPAN
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Potential supply*	750	750	750	835	835
Forecast demand	<u>502</u>	<u>614</u>	<u>680</u>	<u>880</u>	<u>1,060</u>
Surplus/(deficit)	248	136	70	(45)	(225)
Actual production	496	647			
Operating rate, %	56	73			

* 85 percent of nameplate capacity.

Pricing

The prices for HDPE were 210 yen per kilo (43.4 cents per pound) in late June 1979. Additional increases are anticipated in view of rising costs. The import duty on HDPE is 28 yen per kilo.

b. Korea

Demand

The demand for high density polyethylene in Korea is anticipated to increase from 36,000 metric tons in 1977 and 60,000 metric tons in 1978 to 85,000, 140,000 and 205,000 metric tons in 1980, 1985 and 1990, respectively. Rope, fishnets and flat yarn are the major products produced, but production of film and blow molded articles will grow rapidly over the study period.

Supply

Korea Petrochemical Industry Company (50 percent Korean interests/50 percent Chisso, Marubeni), the sole producer of high density polyethylene in Korea, has a nominal capacity of 35,000 metric tons per year in a facility at Ulsan. Amoco technology is used. In 1978, production from the unit was about 33,000 metric tons. Completion of the Korea Oil ethylene expansion in 1978 has allowed the facility to operate at near capacity levels. A 70,000 metric ton per year facility is being constructed by Honan Ethylene (Korean government) and Mitsui; this should be on-stream in 1980. The unit is part of the Yeosu project.

Supply/Demand Situation

The supply/demand situation for HDPE is presented in Table IV-B-5. With completion of the Yeosu plant, Korea is anticipated to have ample supply for this product only during the early 1980s, at which time it will probably again become an importer.

TABLE IV-B-5

POTENTIAL SUPPLY/DEMAND BALANCE FOR HIGH DENSITY POLYETHYLENE IN KOREA
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Potential supply	35	35	105	105	105
Forecast demand	36	60	85	140	205
Surplus/(deficit)	<u>(1)</u>	<u>(25)</u>	<u>20</u>	<u>(35)</u>	<u>(100)</u>

c. TaiwanDemand

The demand for high density polyethylene in Taiwan is anticipated to increase from 35,000 metric tons in 1977 and 45,000 metric tons in 1978 to 58,000, 80,000 and 115,000 metric tons in 1980, 1985 and 1990, respectively. Rope and yarn, blow molding and film are the major markets.

Supply

The sole HDPE producer in Taiwan is United Polymer, a joint venture of USI, Solvay and China Development. The firm operates a single 50,000 metric ton per year plant at Toufen. This plant was expanded by 14,000 metric tons in 1978 and it is unlikely to be further expanded due to ethylene limitations at the site.

Formosa Plastics will build a 120,000 metric ton per year HDPE plant as part of Taiwan's fourth petrochemical complex planned at Lin Yuan. Start-up is expected in 1982.

Supply/Demand Situation

The supply/demand situation for HDPE in Taiwan is presented in Table IV-B-6. Taiwan will be an importer of HDPE for the next few years, but the new plant will meet growing demand.

TABLE IV-B-6

POTENTIAL SUPPLY/DEMAND BALANCE FOR HIGH DENSITY POLYETHYLENE IN TAIWAN
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Potential supply*	32	45	45	153	153
Forecast demand	35	45	58	80	115
Surplus/(deficit)	(3)	0	(13)	73	38
Actual production	29	34			

* Production at 90 percent of nameplate capacity.

d. Hong Kong

The demand for high density polyethylene in Hong Kong is forecast to increase from 30,000 to 63,000 metric tons over the 1978-1990 period as is shown in Table IV-B-7. The product is utilized mainly in the production of injection and blow molding articles, which are both used domestically and exported. However, part of the growth is anticipated to result from thin film applications. In 1978, Japan and the U.S. were the major sources of HDPE resin for Hong Kong.

TABLE IV-B-7

HONG KONG HIGH DENSITY POLYETHYLENE DEMAND
(Metric Tons)

1977	25,000
1978	30,000
1980	36,000
1985	48,000
1990	63,000
AAGR, % (Base 1978)	6.4

There are no high density polyethylene facilities in Hong Kong and none are expected over the study period.

e. ASEAN Countries

The HDPE demand in the ASEAN countries is anticipated to increase from 102,800 and 114,800 metric tons in 1977 and 1978 to 297,000 metric tons

in 1990, as shown in Table IV-B-8. The use pattern for HDPE varies from country to country. Injection and blow molding are the major uses in Malaysia, Thailand and Indonesia, film predominates in Singapore, and rope and fishnets are important in the Philippines.

At present, there are no production facilities within the region, but by 1985, capacity will be 80,000 metric tons per year when the facility in Singapore is brought on stream. In addition, a 50,000 metric ton per year facility based on imported ethylene, in which USI Far East would have an interest, is planned for Thailand. However, during the 1980s a deficit situation will persist.

TABLE IV-B-8

ASEAN COUNTRY HIGH DENSITY POLYETHYLENE DEMAND
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, %</u> <u>(Base 1978)</u>
Philippines	22	25	30	45	65	9.4
Singapore	6.8	8.8	10	13	17	5.6
Malaysia	16	18	23	34	45	7.9
Thailand	16	17	22	38	60	11.1
Indonesia	42	46	54	78	110	7.5
	<u>102.8</u>	<u>114.8</u>	<u>139</u>	<u>208</u>	<u>297</u>	<u>8.2</u>

f. People's Republic of China

At present, the PRC has HDPE facilities with a capacity of about 120,000 metric tons per year. It is anticipated that imports will remain relatively modest.

3. Conclusions

Opportunities for an Alaskan Plant

The supply and demand for HDPE on the West Coast and in the Pacific Basin are summarized in Table IV-B-9.

TABLE IV-B-9
HIGH DENSITY POLYETHYLENE

	<u>1978</u>	<u>Demand</u> <u>1985</u> <u>(Million Pounds)</u>	<u>1990</u>	<u>AAGR, %</u>	<u>Capacity, per year</u> <u>1978</u>	<u>Future</u>
West Coast	500	1,065	1,610	10.3	0	0
(Thousand Metric Tons)						
Japan	438	780	970	7.0	882	982*
Korea	60	140	205	10.1	35	105
Taiwan	45	80	115	8.1	50	170
Hong Kong	30	48	63	6.4	0	0
ASEAN Countries	115	208	297	8.2	0	80**

* Future projects not certain.

** Additional facilities possible.

It is anticipated that during the 1980s new grass-roots high density facilities will have to be at least 250 million pounds per year in size in order to be competitive. Due to the significant position of at least six firms, it is anticipated that a firm with Alaskan production could reasonably expect to capture only about 20-25 percent of the merchant market on the West Coast. This would equate to 180-225 million pounds. By 1990, with normal demand increases, sales should grow to over 300 million pounds. Any anticipated captive consumption within the region must be added to these figures.

In the mid-1980s, Korea, Hong Kong and the ASEAN countries will be major importers, with current demand totaling 450-500 million pounds. At best, about half of this current demand could be met by facilities in Japan and Taiwan since, with the trend to increased film and large container consumption, the effective capacity of HDPE units is reduced. An Alaskan facility would be well located to capture part of this current demand. In addition, Japanese producers could opt to place new HDPE capacity offshore in lieu of modernizing older plants and erecting new ones. Imports in the 200 million pound per year range would not be unreasonable.

Production of HDPE in Alaska is viable from a standpoint of market size and trends. Facilities in the 250-400 million pound per year range could be justified.

C. Polystyrene1. West Coast Marketa. Demand

In 1978, the U.S. West Coast demand for polystyrene, including expandable beads, was estimated at 540 million pounds, or 15 percent of the total U.S. market of about 3.6 billion pounds. This 540 million pound Western U.S. market is made up of 480 million pounds of general-purpose and impact polystyrene and 60 million pounds of expandable beads. By 1990, total polystyrene demand is expected to reach 1,030 million pounds, an average annual growth rate of 5.5 percent over the 1978-1990 period, as shown in Table IV-C-1. Western Canadian consumption of about 15 million pounds in 1978 is expected to double over the period. Molding accounts for 45 percent of total polystyrene consumption. Nearly every molder in the West Coast region uses some polystyrene for proprietary products, housewares, electrical goods, toys or sporting equipment. Extrusion of polystyrene, including foamed sheet and regular film and sheet, accounted for somewhat over 30 percent of the polystyrene consumed during 1978. Foam and foamable materials, primarily expandable beads, accounted for about 20 percent.

TABLE IV-C-1

WEST COAST POLYSTYRENE DEMAND, 1978-1990
(Million Pounds)

	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, % (1978-1990)</u>
Western U.S.					
Molding	235	250	300	350	3.4
Extrusion	170	195	285	390	7.2
Foam and foamable materials	105	120	170	220	6.3
All other uses	30	35	50	70	7.3
Total Western U.S.	540	600	805	1,030	5.5
Western Canada	15	20	25	30	5.9
Total	555	620	830	1,060	5.5

Molding accounted for nearly 45 percent of the U.S. West Coast polystyrene consumption in 1978. Major markets were packaging, housewares, electrical and electronic applications, cassettes, toys, nursery tubs and containers. Typical of the molders is Amoco in La Mirada, CA. Amoco is a major producer of cups. High-impact polystyrene is molded by toymakers such as Mattel, Revell and Cox. In addition, Adams Brothers Plastic molds for Sears, Ideal and Tomy, a Japanese toy company. In housewares, Triplastics is a major molder of polystyrene. Another significant market for polystyrene is tape cassettes, which are produced by M.U. Engineering and UPM.

Extrusion of solid polystyrene sheet, shapes and profiles is widespread, accounting for about 30 percent of total polystyrene use. A prominent extruder is Gage Industries of Oregon, which produces sheet for thermoforming and also carries out thermoforming and vacuum forming of polystyrene. Most of Gage's output is used for packaging. Container Corporation and American Can thermoform high-impact polystyrene for hot drink cups.

About 20 percent of the polystyrene market is comprised of foamed material either from expandable polystyrene beads (EPS) or foamed general-purpose material. There are about 20 significant processors of EPS beads in the West Coast region, including Dew Foam, Handi-Kup, W.D. Adam, K&B Mfg. and Thompson Industries, a subsidiary of Dart Industries located in Phoenix, AZ.

There are about ten producers of extruded foam sheet and molded board for insulation and other uses. A substantial portion of the total market is devoted to egg cartons by Dolco, Keyes and Packaging Corporation of America. Dow also makes foamed sheet in Torrance, CA.

Approximately 5 percent of the total polystyrene consumption is in the "other" category. This includes material for signs and material used in paper coating.

The polystyrene market in Western Canada was about 15 million pounds in 1978 and is anticipated to grow at nearly 6 percent per year and reach 30 million pounds by 1990. Foam products and molded articles are significant in the area. Significant polystyrene consumers include Gulf Plastics in Langley (foam packaging), Scott Plastics in Victoria (custom molding) and Plasti-Fab in Vancouver (foam insulation).

b. Supply

There are six producers of polystyrene on the U.S. West Coast, with a total capacity of 480 million pounds per year, as shown in Table IV-C-2. Two expansions, which will increase capacity by 70 million pounds per year, have been announced. Dow, Monsanto, Amoco and Cosden are among the major suppliers to the West Coast market.

TABLE IV-C-2

U.S. WEST COAST POLYSTYRENE PRODUCERS, 1978
(Million Pounds per Year)

<u>Company</u>	<u>Location</u>	<u>Capacity</u>	<u>Expansions</u>
A&E Plastik Pak	City of Industry, CA	45	
Amoco Chemical	Torrance, CA	65	
Cosden	Orange, CA	75	
Mobil	Santa Ana, CA	30	50
Dow Chemical	Torrance, CA	215	
Monsanto	Long Beach, CA	50	
Plastic Products	Los Angeles, CA		20
Total		480	70

There are no polystyrene producers in Western Canada. However, BASF, Dow, Monsanto and Polysar supply product from Eastern Canada. In addition, there are imports from U.S. producers.

c. Captive Market

About 20 percent, or 110 million pounds, of the polystyrene market is captive. Dow, A&E Plastik, Amoco and Mobil have captive operations within the region.

There is no captive consumption in Western Canada.

d. Pricing

Polystyrene is sold on a delivered basis in the Western U.S., with prices for the general-purpose and high-impact grades being 41 and 42 cents per pound, respectively, as of October 1, 1979. Prices have risen recently due to the styrene price increases caused by a tight benzene situation worldwide.

In Canada, general purpose polystyrene was priced at \$0.526 (Canadian) per pound for general-purpose grade, with the high-impact grade moving for about 1 cent per pound more. Canadian prices should remain about the same or slightly above U.S. prices. Imports of polystyrene into Canada are subject to a 10 percent ad valorem duty.

2. Pacific Basin Market

a. Japan

Demand

Domestic demand for polystyrene in Japan is anticipated to increase from 530,000 to 1,030,000 metric tons during the 1978-1990 period. This represents a growth of 5.1 percent per year over the study period. Net polystyrene exports are currently about 60,000 metric tons, and they are anticipated to increase somewhat over the study period. The Japanese polystyrene demand by end-use is presented in Table IV-C-3.

TABLE IV-C-3

JAPANESE POLYSTYRENE DEMAND
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, %</u> <u>(1978-1990)</u>
General-purpose and high-impact						
Electrical appliances	110	115	130	175	230	6.0
Mechanical appliances	12	13	15	20	25	5.6
Industrial goods	16	18	20	25	30	4.4
Packaging	145	160	175	215	260	4.1
Consumer items	100	110	125	170	220	5.9
Foam	<u>147</u>	<u>154</u>	<u>175</u>	<u>220</u>	<u>265</u>	<u>4.6</u>
Domestic demand	530	570	640	825	1,030	5.1
Exports	<u>60</u>	<u>60</u>	<u>65</u>	<u>75</u>	<u>80</u>	
	590	630	705	900	1,110	4.8

Electrical and electronics applications are anticipated to be a fast growing area for polystyrene, with demand increasing at about 6.0 percent per year over the study period. This figure reflects a slowing down of growth due to export of some consumer electronics activities to other countries and increasing difficulties in obtaining a larger share of the U.S. market. In 1977 and 1978, Japanese television manufacturers voluntarily curtailed shipments to the U.S., reducing polystyrene demand in that application. Use in nonelectric appliances and industrial goods is expected to remain small. Demand growth in the packaging, consumer items and foam (also largely packaging and consumer) categories is anticipated to rise at somewhat slower rates due to conservation efforts.

Supply

The current capacity of Japanese polystyrene producers is 739,000 metric tons, as shown in Table IV-C-4. At present, no expansions are in

progress. However, it is anticipated that additional expansions will be made in the early 1980s, primarily by firms such as Asahi-Dow, Shin Nippon Steel Chemical, Toyo Polystyrene and Mitsubishi Monsanto, which are either basic in styrene or have strong positions in the industry, coupled with styrene supplies through related companies.

TABLE IV-C-4

JAPANESE POLYSTYRENE PRODUCERS, 1978
(Thousand Metric Tons per Year)

<u>Company</u>	<u>Location</u>	<u>Capacity</u>
Asahi-Dow	Kawasaki	59
	Mizushima	135
	Chiba	50
Denki Kagaku	Chiba	70
Dainippon Ink	Chiba	14
	Yokkaichi	30
Idemitsu	Tokuyama	60
Mitsubishi Monsanto	Yokkaichi	91
	Kashima	24
	Kawasaki	52
Nippon Polystyrene	Tobata	60
Shin Nippon Steel Chemical	Kawasaki	60
Toyo Polystyrene	Sakai	34
		<u>739</u>

Supply/Demand Situation

The potential supply/demand situation for polystyrene in Japan is presented in Table IV-C-5. Basically, the existing Japanese polystyrene capacity is insufficient to meet demand beyond the early 1980s. However, it is anticipated that demand growth will be met by new facilities in Japan, and it is highly unlikely that significant polystyrene imports can be made from the U.S. except under extraordinary circumstances. For exports to Japan, a U.S. producer would be competing against other regional producers, such as Dow in Hong Kong, which have the advantage of not having to pay a tariff since Hong Kong is a "developing nation".

TABLE IV-C-5

POTENTIAL SUPPLY/DEMAND BALANCE FOR POLYSTYRENE IN JAPAN
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Potential supply*	739	739	739	739	739
Forecast demand	590	630	705	900	1,110
Surplus/(deficit)	149	109	34	(161)	(371)

* 100 percent of nameplate capacity.

Pricing

In June 1979, the Japanese price for general-purpose polystyrene was 40 yen per kilo (43.4 cents per pound). The duty on polystyrene resin is 14 percent, with the exception of the foam resin, which has a duty of 8 percent.

b. Korea

Demand for polystyrene in Korea is anticipated to increase from 48,000 metric tons in 1977 and 70,000 metric tons in 1978 to 85,000, 125,000 and 165,000 metric tons in 1980, 1985 and 1990, respectively. This represents an average annual growth of 7.4 percent from 1978. Consumption is primarily in general-purpose injection-molding grades. Demand for high-impact material for refrigerator door liners and other more demanding applications was met through imports.

Han Nam Chemical, a joint venture of Asahi-Dow and Korean interests, is the sole Korean producer with a 50,000 metric ton per year unit at Ulsan. Polystyrene imports were 17,000 metric tons in 1978. An additional 68,000 metric tons of capacity should come on stream in 1982-1983 as part of the new petrochemical complex at Yochon. It is expected that Korea will try to remain basically self-sufficient in the product, importing only those specialized grades not produced domestically.

c. Taiwan

Demand for polystyrene in Taiwan was increased from about 42,000 metric tons in 1977 to about 58,000 metric tons in 1978. Consumption exists primarily in the general-purpose injection-molding grades, although high-impact and expandable polystyrene are also utilized. Consumption is anticipated to reach 80,000 metric tons by 1980, due in part to growth in electronics and appliance sectors. By 1985 and 1990, demand is estimated to reach 110,000 and 135,000 metric tons, respectively. This represents an average annual growth of 7.3 percent over the 1978 to 1990 study period.

Taiwan has several small polystyrene producers; they have a total capacity of 69,800 metric tons per year, as shown in Table IV-C-6. In 1978, Taiwan was a net importer of about 6,000 metric tons of resin. It is anticipated that Taiwan will basically remain a small net importer of polystyrene over the study period.

TABLE IV-C-6

TAIWANESE POLYSTYRENE PRODUCERS, 1978
(Thousand Metric Tons per Year)

Company

Poly	31.2
Taita	19.2
Shing-chi	2.4
Kao-fu	9.6
Others	7.4
	<u>69.8</u>

d. Hong Kong

The demand for polystyrene in Hong Kong in 1978 was roughly 100,000 metric tons. About 60-65 percent of this market consists of general-purpose resins. This market is anticipated to have reasonable growth due to expansion of the electronics industry, which utilizes

polystyrene components. Demand is anticipated to reach 120,000, 170,000 and 220,000 metric tons in 1980, 1985 and 1990, respectively. This represents an average annual growth of 6.8 percent.

Dow is the sole Hong Kong polystyrene producer with a 65,000 metric tons per year plant which came on stream in 1976. This plant supplies both local and export markets. Dow is planning to increase the capacity of this facility to 125,000 metric tons per year.

Since there is no tariff protection in Hong Kong, considerable polystyrene imports will continue throughout the study period. Imports were 75,000 metric tons in 1978. Due to the Dow plant expansion, they are expected to decrease in the early 1980s, but then increase to about 80,000 metric tons by 1985.

e. ASEAN Countries

Unlike the polyolefins, which are utilized in overwrap, bags and relatively unsophisticated applications, polystyrene finds use in electronics, appliances and more sophisticated packaging applications. As a result, it is generally the last of the major thermoplastic resins to achieve significant usage, and for this reason consumption in the ASEAN countries was only 53,000 metric tons in 1978, which is half of the consumption in Hong Kong, which only has 2 percent of the population of the ASEAN countries.

Polystyrene demand in the ASEAN countries is anticipated to increase from 42,200 and 53,600 metric tons in 1977 and 1978 to 70,000, 110,000 and 162,000 metric tons in 1980, 1985 and 1990, respectively, as shown in Table IV-C-7. Imports to the region were about 24,000 and 22,000 metric tons in 1977 and 1978. In spite of the increased production at the new Dow plant, imports are expected to increase to 45,000 metric tons by 1985 if no new capacity is introduced.

TABLE IV-C-7
ASEAN COUNTRY POLYSTYRENE DEMAND
 (Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, %</u> <u>(1978 Basis)</u>
Philippines	9	13	15	20	29	6.9
Singapore	12.8	15.1	22.6	33	46	9.7
Malaysia	3.4	4	6	10	15	11.6
Thailand	7.7	9	11	22	34	11.7
Indonesia	9.3	12.5	15.4	25	38	9.7
	<u>42.2</u>	<u>53.6</u>	<u>70.0</u>	<u>110</u>	<u>212</u>	<u>12.1</u>

f. People's Republic of China

Polystyrene production in the PRC is quite small, with production capacity reported at only 5,000 metric tons per year. Various polystyrene grades are imported, but significant growth in polystyrene consumption will be slow in developing for the next few years, and at that time the PRC should be in a position to manufacture most of its needs domestically.

3. Conclusions

Opportunities for an Alaskan Plant

The supply and demand for polystyrene on the U.S. West Coast and in the Pacific Basin are summarized in Table IV-C-8.

During the 1980s, it is anticipated that a new grass-roots polystyrene facility, producing both general-purpose and high-impact material, will have to be about 200 million pounds per year. A new polystyrene producer could expect to capture only about 15 percent of the U.S. West Coast merchant market, or about 100 million pounds in 1985.

TABLE IV-C-8

POLYSTYRENE

	<u>1978</u>	<u>Demand</u>		<u>AAGR, %</u>	<u>Capacity, per year</u>	
		<u>1985</u>	<u>1990</u>		<u>1978</u>	<u>Future</u>
		(Million Pounds)				
West Coast	555	830	1,060	5.5	480	550*

(Thousand Metric Tons)

Japan	570	825	1,030	5.1	739	739*
Korea	70	125	165	7.4	50	118*
Taiwan	58	110	135	7.3	70	70*
Hong Kong	100	170	220	6.8	65	125
ASEAN Countries	54	110	212	10.6	39	47*

* Additional expansions likely.

Most Pacific Basin countries are anticipated to be virtually self-sufficient in polystyrene. Due to the entrenched positions of Dow and the affiliates of Japanese companies in the Pacific Basin, polystyrene imports from facilities outside of the region are estimated at only 100-200 million pounds in 1985. As a result, shipments from a new Alaskan producer to the region probably would not exceed 20-30 million pounds per year. Basically, production of polystyrene in Alaska by a new producer does not look too attractive from a market standpoint, since it would generally be preferable to produce the polystyrene resin close to the point of consumption.

D. Polyvinyl Chloride

1. West Coast Market

a. Demand

The U.S. West Coast region consumed an estimated 680 million pounds of polyvinyl chloride resin in 1978. This accounted for about 12 percent of the U.S. domestic consumption of 5.5 billion pounds of PVC. By 1990, West Coast demand is expected to reach 1.9 billion pounds, representing an average annual growth rate of 8.7 percent over the period. The Western Canadian market was about 15 million pounds in 1978 and it is expected to reach 40 million pounds by 1990. The demand for PVC on the West Coast is shown in Table IV-D-1.

Over 70 percent of the regional demand in 1978 was used in extrusion, particularly pipe. Molding and calendering were the other significant markets for PVC, accounting for 12 and 9 percent of the market, respectively.

Calendering markets are traditionally divided into flooring, textile and others, which includes film and sheet. There is little textile-oriented manufacture in the U.S. West Coast region, so PVC consumption in this market is negligible. However, there is considerable activity in flooring, with the major product being vinyl asbestos tile. Five of the national flooring companies are active in the West Coast area: Armstrong, Nafer (National Flooring), Flintkote, Kentile and American Biltrite. Flooring is expected to show growth significantly higher than overall U.S. growth due to new construction in the region.

Consumption of PVC resin in film and sheet was about 30 million pounds in 1978. Growth of the market is forecast at 7-9 percent per year over the 1978-1990 period. This use area is somewhat small, since there is no

TABLE IV-D-1
WEST COAST POLYVINYL CHLORIDE DEMAND
(Million Pounds)

<u>Western U.S.</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, % (1978-1990)</u>
Calendering					
Flooring	30	35	-	-	-
Textile	*	*	-	-	-
Other, including film and sheet	30	35	-	-	-
Subtotal	<u>60</u>	<u>70</u>	<u>105</u>	<u>150</u>	<u>8.0</u>
Coating					
Flooring	*	*	-	-	-
Textile and paper	*	*	-	-	-
Protective coatings	10	10	-	-	-
Adhesives and other	5	10	-	-	-
Subtotal	<u>15</u>	<u>20</u>	<u>30</u>	<u>40</u>	<u>8.5</u>
Extrusion					
Wire and cable	25	30	-	-	-
Film and sheet	15	20	-	-	-
Rigid pipe and tube	430	545	-	-	-
All other extrusion	20	25	-	-	-
Subtotal	<u>490</u>	<u>620</u>	<u>960</u>	<u>1,370</u>	<u>9.0</u>
Molding					
Bottles	5	10	-	-	-
Sound records	35	40	-	-	-
Fittings for pipe	25	30	-	-	-
Other molding	15	20	-	-	-
Subtotal	<u>80</u>	<u>100</u>	<u>150</u>	<u>220</u>	<u>8.8</u>
All other uses	35	40	55	70	6.0
Total Western U.S.	<u>680</u>	<u>850</u>	<u>1,300</u>	<u>1,850</u>	<u>8.7</u>
<u>Western Canada</u>	<u>15</u>	<u>20</u>	<u>30</u>	<u>40</u>	<u>8.5</u>
Total	<u>695</u>	<u>870</u>	<u>1,330</u>	<u>1,890</u>	<u>8.7</u>

* Small.

production for the auto industry. The 6 calenders in the West Coast region are operated by Columbus Coated Fabrics (Borden), Ellay Plastics (W.R. Grace) and MacIn.

Coating applications for PVC on the U.S. West Coast are small, accounting for only 15 million of the 500 million pound U.S. market in 1978. No significant usage in the flooring, textile and paper areas was found.

This is because the textile industry is small in the region and paper coating is a relatively small consumer of resin. In the protective coatings area, some PVC is used for solution vinyl. Adhesives uses were also small, consuming about 5 million pounds per year. The total coating category is expected to grow to 40 million pounds by 1990.

Extrusion applications constitute the largest market for PVC resins in the U.S. West Coast region, accounting for over 70 percent of resin consumption. Of the total market of 490 million pounds of PVC in 1978, 430 million pounds were consumed in rigid pipe and tubing, mainly for irrigation and land reclamation purposes. There are about ten major producers of pipe, including Certain-Teed, Johns-Manville, Robintech, Portco, Carlon, Simpson Timber, Apache Kerone, EPPCO, Celanese, Rainbird, Richdale and Thompson. There are a number of extruders of PVC film and sheet in the Western region, including Atlas Plastics, Raum Chemical and Lustro. The products are used mainly in packaging. Wire and cable extrusion in the West involves a number of companies, including Anaconda, Carol Cable, Coaxco, Icore International, National Wire and Cable, Pacific Electricord and Whitmore. The overall market for PVC in extrusion applications is expected to reach 1,370 million pounds by 1990. This represents growth of 9 percent per year.

Other uses, including fire retardant applications, foamed PVC, roto and slush molding are estimated at 35 million pounds in 1978. Growth to 1990 is expected to average 6.0 percent per year.

Western Canada

The polyvinyl chloride market in Western Canada was about 15 million pounds in 1978 and is anticipated to grow 8-9 percent per year and reach 40 million pounds by 1990. Pipe is the largest segment of the market, with Pacific Plastics (Vancouver) and Flex-Lox (Abbotsford), being significant consumers.

b. Supply

There are three producers of polyvinyl chloride in the Western U.S. - B.F. Goodrich, Keysor Century and Stauffer. Stauffer is the only company basic in vinyl chloride monomer. Total capacity is estimated at 370 million pounds, as is shown in Table IV-D-2.

TABLE IV-D-2

U.S. WEST COAST POLYVINYL CHLORIDE PRODUCERS
(Million Pounds per Year)

<u>Company</u>	<u>Location</u>	<u>Capacity</u>
B.F. Goodrich Chemical	Long Beach, CA	150
Keysor Century	Saugus, CA	50
Stauffer Chemical*	Carson, CA	170
Total		370

* Has VCM production at same site.

The supply within the region is not sufficient to meet demand. Significant marketers in the region, besides the producers, are Conoco, Diamond Shamrock, Union Carbide, Borden, Tenneco, Pantasote, Ethyl and Firestone.

There are no PVC producers in Western Canada. Esso Chemical Canada and B.F. Goodrich Canada supply material from the East, and some of the U.S. producers also serve the region. It is anticipated that the Diamond Shamrock Alberta Gas Chemical joint venture will become a significant supplier in the near future when their 220 million pound per year facilities at Ft. Saskatchewan, Alberta, are completed.

c. Captive Market

Borden, which produces film, is the sole captive consumer on the U.S. West Coast. It is estimated that its consumption is about 2-3 percent of

the total demand, and no significant change in this percentage over the study period is foreseen. There are no captive consumers in Western Canada.

2. Pacific Basin Market

a. Japan

The Japanese domestic demand for polyvinyl chloride resin is forecast to increase from 1,180,000 metric tons in 1978 to 2,060,000 metric tons in 1990 (Table IV-D-3), an average annual growth of 4.6 percent. In addition, Japan has in the past been a significant net exporter of these resins, with net exports totaling 80,00 metric tons in 1977. In 1978, net exports dropped to 20,000 metric tons. This was due to the yen's appreciation, which priced Japanese PVC out of competition on world markets. Although exports are expected to again reach the 1977 level during the 1980s, they are forecast to decline as other countries in the Asian region attain greater self-sufficiency.

Rigid PVC constitutes nearly 60 percent of the Japanese market. Demand for rigid sheet, which is used in packaging applications, is anticipated to grow 6.4 percent per year. Pipe is a relatively mature product in Japan. After a sharp rise in 1978, it is expected to level off at 5 percent per year. Plasticized PVC constitutes about 30 percent of the domestic market, of which film and sheet applications constitute about half. The principal use for film is as a moisture barrier, but it is being replaced in this use by polyethylene and polypropylene. Sheet applications, such as shower curtains, are similar to these applications in the U.S. As a result, film and sheet demand is expected to grow at only about 2-3 percent per year. Use in wire and cable insulation is anticipated to follow the growth of that industry at about 4-5 percent per year. The flooring market is primarily for commercial use, since tatami and carpeting are used in residences. PVC fiber is made by Teijin for flame resistant applications and is expected to remain a specialty fiber.

TABLE IV-D-3

JAPANESE POLYVINYL CHLORIDE DEMAND
(Thousand Metric Tons)

	<u>1977</u>	<u>1978</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>	<u>AAGR, % (1978-1990)</u>
Rigid PVC						
Sheet	155	190	215	295	400	6.4
Pipe	270	355	410	530	650	5.1
Joints	30	40	45	55	65	4.1
Rain pipe	25	30	35	45	60	5.9
Others	45	50	55	75	95	5.5
Subtotal	<u>525</u>	<u>665</u>	<u>760</u>	<u>1,000</u>	<u>1,270</u>	<u>5.5</u>
Plasticized PVC						
Film and sheet	140	165	175	200	225	2.6
Artificial leather	50	65	70	85	100	3.6
Extrusions	60	70	75	85	95	2.6
Other	55	75	80	100	130	4.6
Subtotal	<u>305</u>	<u>375</u>	<u>400</u>	<u>470</u>	<u>550</u>	<u>3.2</u>
Miscellaneous						
Wire and cable	90	103	110	135	170	4.3
Flooring	15	20	25	30	35	4.7
Fiber	7	8	10	10	10	1.9
Others	8	9	10	15	25	8.8
Subtotal	<u>120</u>	<u>140</u>	<u>155</u>	<u>190</u>	<u>240</u>	<u>4.6</u>
Total domestic demand	950	1,180	1,315	1,660	2,060	4.8
Net exports	80	20	85	70	40	-
Total demand	<u>1,030</u>	<u>1,200</u>	<u>1,400</u>	<u>1,730</u>	<u>2,100</u>	<u>4.8</u>

Supply

In Japan, the 19 producers of PVC resin have a total capacity of 1,921 metric tons, with no announced expansions at present. A number of these facilities are small and may not be able to meet more stringent environmental standards. A list of the Japanese PVC resin producers is presented in Table IV-D-4.