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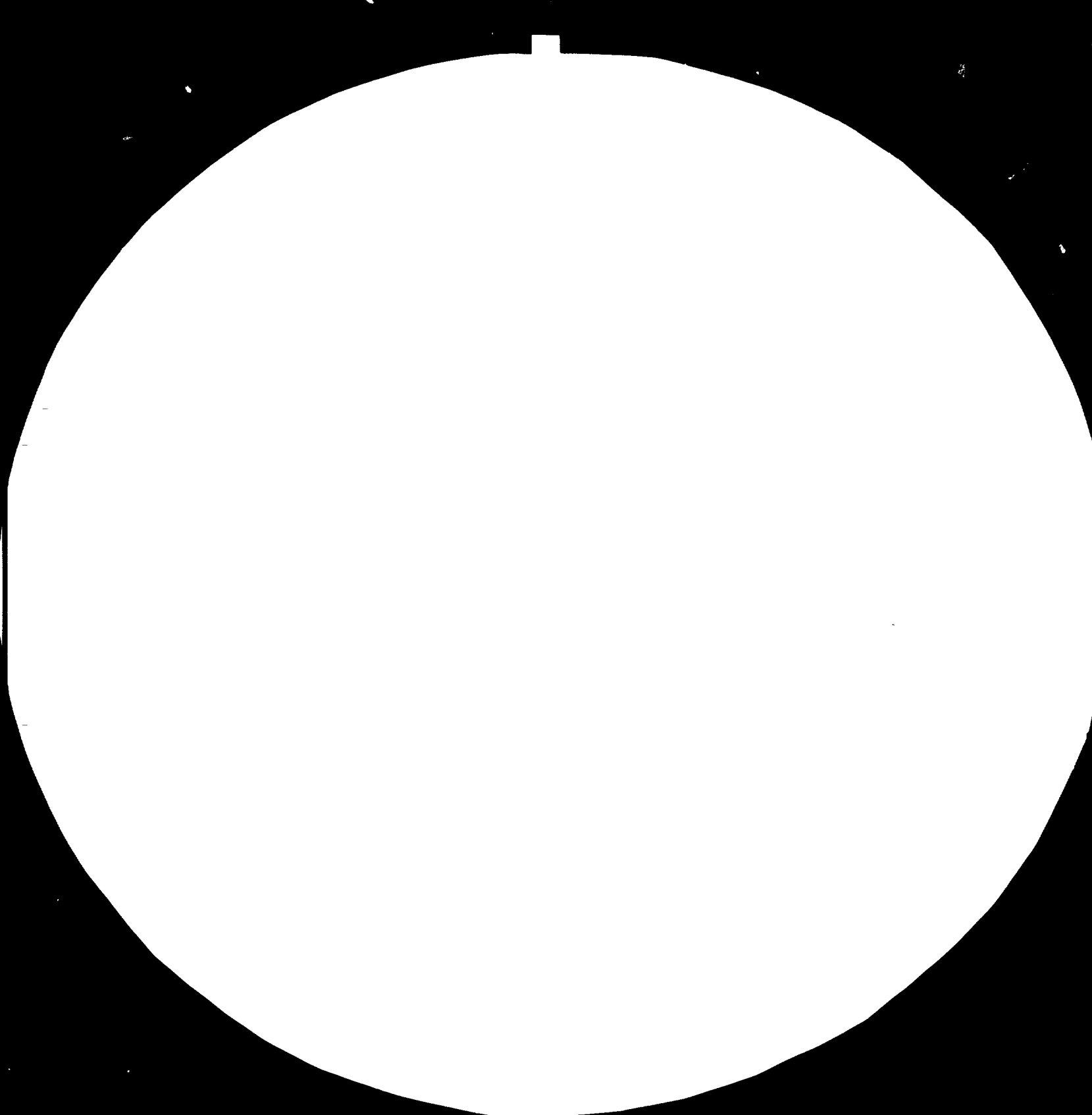

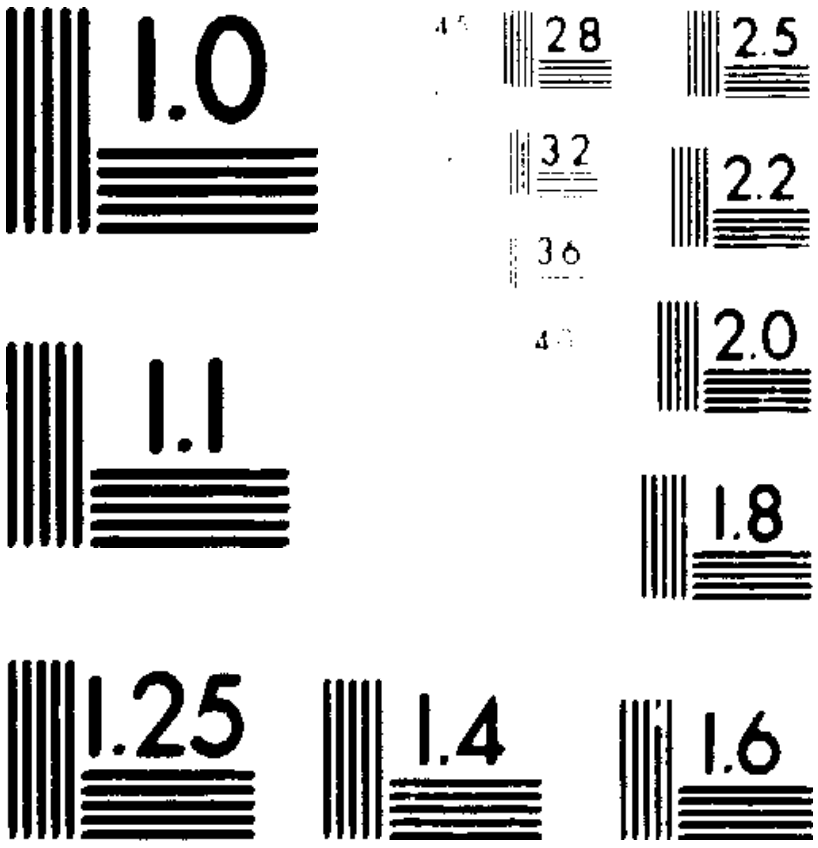

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THE PETROCHEMICAL INDUSTRY IN DEVELOPING ESCAP REGION

- PAST REVIEW AND FUTURE PROSPECTS -

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C O N T E N T S

Cont'd...2..

CONTENTS

Cont'd...3..

CONTENTS

LIST OF TABLES

LIST OF REFERENCES

- First World-wide Study on the Petrochemical Industry - 1975-2000, UNIDO/ICIS-83 12 December,1978.
- Second World-wide Study on the Petrochemical Industry : Process of Restructuring, ID/WG.336/3 19 May,1981.
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ABBREVIATIONS

- LDPE - Low Density Poly-Ethylene
- LLDPE - Linear Low Density Poly-Ethylene
- HDPE - High Density Poly-Ethylene
- PP - Poly Propylene
- PVC - Poly Vinyle Chloride
- PS - Poly Styrene
- VCM - Vinyl Chloride Monomor
- SBR - Styrene Butadiene Rubber
- DMT - Dimethyle-terephthalate
- TPA - Teraphthalic Acid
- EG - Ethylene Glycol
- EO - Ethylene Oxide
- LNG - Liquefied Natural Gas
- LPG - Liquefied Petroleum Gas
- Thermoplastics - (LDPE,HDPE,PP,PVC,PS)

1.0 OVERVIEW

1.1 General

Petrochemical products and their derivatives run into many hundreds ranging from fertilizers, solvents, plastics, fibres, rubbers to base material for detergents and pharmaceuticals. The petrochemical industry has been the most rapidly developing part of the chemical industry and now encompases much of the earlier established organic chemical sector. The industry is being dominated by the developed region of the world. However, in recent years the growth of developed region markets has slowed down. As compared, developing region market growth is still quite high owing to the low level of market penetration of materials produced by this industry. Another, development which has taken place in recent years is the increasing interest of developing countries to establish this industry, however, till todate only some developing countries,(e.g. Latin American countries,India,S.Korea, Turkey, Singapore etc) have operational basic petrochemical facilities. In the remaining developing region the petrochemical industry is limited to down-stream processing facilities. Many developing countries (specifically OPEC group) engaged in rapid industrialization have ranked establishment of petrochemical plans. The OPEC countries have started implementing their plans and facilities of Qatar are in operation and Saudi Arabia facilities which currently are under construction are expected to start operation some time during next year. OPEC countries have been

motivated to establish petrochemical industry primarily due to availability of gas resource with essentially a zero value (currently being wasted) which can be utilized for production of high value petrochemicals and the desire to possess sophisticated infra-structure based on oil/gas resource. These countries have limited market and as such the facilities being planned are export oriented. The plans for establishment of petrochemical industry in many non-OPEC developing countries have not been implemented due to constraints in availability of capital resources, raw material, technology and uncertainity about export prospects. The petrochemical industry in the years to come is expected to be highly price/cost competitive in view of excess production capacity available in industrialized countries and exports from new facilities of OPEC countries. The existing producers of developing countries such as South Korea are expected to loose their competitiveness for export purposes.

1.2 Objective & Scope

The Lima Declaration mandate called for exploring the participation of each industrial sector with the objective of achieving atleast 25 percent share of developing countries in total world industrial production by the year 2000.[a] In this respect UNIDO studied and provided a forum for Consultantions of eleven industrial sectors including petrochemicals. In the petrochemical sector UNIDO prepared a first world-wide study on

(a) First World-wide Study on Petrochemical Industry 1975-2000, UNIDO/ICIS 83 12 December, 1978.

petrochemical industry which was discussed in First Consultation Meeting held in Mexico City from March 12-16, 1979. Subsequently, UNIDO prepared a second world-wide study on petrochemical industry and study of industrial uses of associated gases. These studies were discussed in Second Consultation Meeting held in Turkey from June 22-26, 1981. The Second Consultation Meeting on Petrochemical Industry emphasized the cooperation among developing countries for expansion and growth of petrochemical industry. To investigate the possibility of regional cooperation among developing countries, ESCAP and UNIDO decided to review and appraise industrial progress at regional level. In Phase-II of this project (prepared in Vienna during November 8-11,1982) selected sectorial studies had to be carried out. This study deals with petrochemical sector in the developing ESCAP region. The main objective of the study is to review and analyze the past developments in petrochemical industry of developing ESCAP region viz-a-viz global situation, identify future trends, proposects and problems of industry as well as potential projects of regional cooperation.

The study covers:

- Global review of petrochemical industry.
- Review of petrochemical industry in developing ESCAP region.
- Basic problems and issues of petrochemical industry.

- Future outlook of petrochemicals demand in world and developing ESCAP region.

- Supply/demand gap of petrochemicals in developing ESCAP region.

- Cooperation in the development and operation of petrochemical industry.

The study is basically a review report and is based on data available in UN/UNIDO and other published sources.

1.3 Summary of Study Report

Petrochemical products currently form an essential base for production of wide range of industrial and consumer products. Petrochemical industry is termed as one of the fast growing industrial sectors. Many developing countries have emphasized establishment of petrochemical industry with a view to accelerate the industrial development in their countries leading to achievement of developing countries target share of 25 percent in world industrial production. Petrochemical industry very well contributes to the objective of rapid progress and balanced expansion in industry. The industry also leads to development of small scale industries and their linkage with large and modern industries.

World production of basic as well as final petrochemical products showed a rapid growth till 1973 which considerably slowed down in subsequent years. Gases (e.g. natural, associated and refinery) as well as liquids like naphtha, gas oils from the main source of feedstock for all petrochemicals produced around the world.

World end-petrochemicals consumption showed a tendency of high growth during 1965-75 period, with relatively slow growth in later years. Developed region dominated the end-petrochemical consumption. Main end-petrochemcial consumed were plastics, fibres and synthetic rubber. The developing countries had a small share in world petrochemicals consumption however, developing countries growth in petrochemicals consumption specially duirng the last decade has been quite high as compared to countries of developed world.

Chemical and petroleum sector during the last decade has been a fast growing industrial sector of developing ESCAP region. The existing petrochemical industry of the region (primarily based on naphtha feed) is concentrated in India and South Korea. Singapore's facilities have recently started production. Iran's facilities are partially constructed and will be operational in late eightees. In remaining countries which include,Thailand, Malaysia, Philippines, Indonesia and Pakistan down-stream production facilities of thermoplastics and synthetic fibres are

available. The region also has sizeable processing facilities for plastic materials and synthetic fibres. The existing petrochemical production capacity of the region is not being fully utilized when at the same time region is importing major proportion of its requirements from facilities of developed world.

During the last two decades ESCAP region end petrochemicals consumption showed an impressive growth. The region's end-petrochemicals consumption has been dominated by Plastics (primarily thermoplastics) and Synthetic fibres (primarily polyester). Synthetic rubber consumption remained at nominal levels. Despite impressive growth in end-petrochemicals the per capita consumption remained significantly low as compared to developed countries, signifying the potential which exists for petrochemical industry in the region. Wide variations also existed in per capita consumption of countries part of the region.

Many countries of region have been actively persuing establishment of petrochemical industry. These countries till todate have not been able to implement their plans primarily due to international economic conditions, limitations of market size and uncertainity about export prospects. These countries include Indonesia, Phillipines, Thailand and Pakistan. The problems and issues which have been responsible for restricting the development of petrochemical industry in the region

are economic and technological in nature. Among economic problems and issues support of governments of respective countries, limitation of domestic market size, uncertainity of export prospects,size of facilities, constraints of capital resource are pronounced. Among technological issues, selection of various technoloies, technological innovation, non-availability of local machinery and equipment manufacturing capability and constraints in availability of skilled manpower are active.

The world petrochemical industry is not expected to show impressive growth in view of recessionary economic conditions, diversification of industry's base from consuming areas to oil rich countries and exhaustion of substitution opportunities in industrialized countries. The international market is expected to be highly price/cost competitive with oil producing region using to their advantage, availability of cheap and currently wasted raw material and developed countries taking the advantage of available technological infra-structure.

The developing ESCAP region is expected to still show high growth in petrochemicals compared to other regions of the world. However, the growth will be considerably lower then observed during the last decade. The demand growth can be high if all the countries planning to establish petrochemical industry are successful in implementing their plans. Thermoplastics and polyester

fibres will remain dominant among the end-petrochemicals market. By the end of current decade, ESCAP region petrochemical production capacity is expected to expand considerably as facilities of Singapore, Iran and Indonesia will be operational alongwith expansions in capacities of India and South Korea. The major expansion will be of ethylene and its deravitives. Despite the planned expansion region will have significant deficits of almost all the end-petrochemicals among which thermoplastics and polyester will be leading. Based on the projected deficits the region by 1990 will be requiring ethylene production capacity of about 1.2 million metric tons with polyester capacity of 1.00 million metric tons.

The region's existing producers of petrochemical i.e. India and South Korea and even Singapore are expected to loose competitiveness for export purposes. This will lead to non-implementation of industry's expansion plans in these countries and possibly low level of capacity utilization. This situation calls for highly activated regional cooperation whereby region's existing petrochemical producers are saved from high cost burdens (in view of expected low level of capacity utilization) and new entrants to petrochemical industry are provided necessary assistance in establishing and operating the petrochemical industry and finally assisting them in marketing their products.

1.4 Main Findings of the Study

The study has revealed that:

- Petrochemical industry has the required potential for accelerating the industrial development in developing countries.

- World petrochemical industry's growth in future will be slower as compared to high growth observed during the past. The developing countries petrochemicals consumption growth will be higher than developed countries.

- The petrochemical industry is going through the process of restructuring and rationalization calling for cooperation among developed and developing countries both at global and regional level.

- World petrochemical industry is going to be highly competitive with respect to price and technology.

- The current basic and intermediate petrochemical production of developing ESCAP region is limited to few countries.

- The problems and issues being faced by developing countries in establishment and successful operation of petrochemical industry can be overcome through cooperation among developing countries themselves.

- The developing ESCAP region has considerable potential for petrochemicals in view of low market penetration of these materials.

- The developing countries which have established or plan to establish petrochemical industry are expected to face problems in view of highly competitive situation to be prevalent in international market. This will be more pronounced for energy deficient countries such as South Korea.

- Despite planned expansion of petrochemical industry in developing ESCAP region considerable deficits in almost all end-petrochemicals will exist by the end of current decade.

- Based on projected petrochemicals deficits of ESCAP region by 1990, four sizeable petrochemical projects can be considered for implementation under regional cooperation arrangement.

- The expected situation of petrochemical industry in developing ESCAP region necessiates highly activated regional cooperation.

- The regional cooperation plans for establishment of petrochemical industry in developing ESCAP region (if implemented) will also be affected by international market forces. Through regional cooperation it would also be possible to introduce specialization in petrochemical production.

- The successful implementation of regional cooperation plans for development and successful operation of petrochemical industry would require considerable role on the part of governments of member countries. As in some cases member countries will have to provide tariff protection giving special treatment to imports originating from regional projects. Further the success of such arrangement would depend on degree of benefits to be gained by member countries in these arrangement.

2.0 DEVELOPING ESCAP REGION: ECONOMIC PROFILE

The developing ESCAP region is situated in Southwest and East Asian continent. The fifteen countries which are part of developing ESCAP region are :

Afghanistan	Indonesia	Pakistan
Bangla Desh	Iran	Phillipines
Burma	South Korea	Singapore
Hong Kong	Malaysia	Sri Lanka
India	Nepal	Thailand

Developing ESCAP region is heavily populated area of the world and currently about 30% of world population is living in countries of the region. The region consists of diverse group of economies with differing economic structures. The economic profile of Developing ESCAP region is presented in Annexure I. The review of annexure indicates that leading contributors to region's GDP are India, Indonesia and South Korea. Traditionally, agriculture sector had the largest share of GDP of majority of region's countries. However, during the last two decades service sector has taken the lead followed by Industry and agriculture. In all most all the countries of the region a rapid drive towards industrialization was noticed. This drive was infact responsible for much of the economic growth and prosperity as well as structural changes seen in many economies of the region. During 1960-70 Gross Domestic product

of countries like Iran, Hong Kong, Singapore and South Korea showed an average annual growth of 8 to 11%. In remaining economies the growth rate varied between 2.00 - 7.0 percent per annum. In all most all the countries of the region, the growth in GDP during 1970-82 was slightly lower then recorded during the previous decade.

Industrial output in all developing ESCAP countries during 1960-82 continued to expand at faster rates then gross domestic product (GDP). South Korea's industrial sector showed a highest growth rate of 17% per annum during 1960-70 period, the sector's growth declined to 14% per annum during 1970-82 period. India's industrial sector showed a consistent growth of 4.0% per annum during 1960-82 period.

3.0 PETROCHEMICAL INDUSTRY : ITS IMPACT ON ECONOMIC PROGRESS

Among the developing ESCAP region by the end of last decade only two countries (S.Korea and India) had operational basic petrochemical industry.Singapore's petrochemical facilities have recently started operation. The region has a sizeable market of petrochemicals.. However, feedstock from oil and gas resources in the region is limited to Iran, Indonesia, Malaysia and Thailand. The remaining countries are deficient in this resource . The region is net importer of petrochemicals (even after the operation of Singapore facilities), this situation is not expected to change significantly by the end of current decade. Many countries of the region have ambitious plans to establish basic petrochemical industry. However, these plans have not been materialized in view of prevailing economic conditions, scarcity of capital resources, development of other priority sectors, low level of technical know-how and limitation of market size in individual countries.

The Petrochemical industry's economic benefits generally considered are:

- Rapid expansion of countries/region's manufacturing sector.

- Contribution to gross domestic product directly by value adding to the raw material source and indirectly through expansion of down-stream industries.

- Foreign Exchange Savings.

- Supply of raw material and support to other industries.

In paragraphs to follow the impact of petrochemical industry on overall economic development in relation to policy objectives laid down in International development strategy (which has been considered as guiding policy for industrial development in Developing ESCAP region countries) is discussed.[a]

The policy objectives are:

a) Strengthening of linkages between industry and agriculture.

b) Development of industry to satisfy the basic needs of the poor.

c) Development of small scale industries and their linkages with large and modern industries and

d) Dispersal and location of industries away from metropolition areas.

(a) Re-orientation of Industrial Policies studies undertaken by ADNOC Group of Ministry of Industry, ESCAP.

a) Strengthening of linkages between industry and Agriculture:

Most of the initial industrial development of the region has been in industries having strong backward linkage with agriculture. The example can be of Cotton Textile industry in Pakistan, here agriculture sector acts merely as supplier of inputs to industry. In recent past the forward linkage has been strengthened and industries like fertilizer, pesticides engineering goods have been developed. Petrochemical industry also provides help in establishing these linkages both directly and indirectly. The industry's backward linkages is limited as it's primary feed is based on oil/gas resource, the backward linkage is possible only in one case if petrochemical production is based on the non-conventional route of ethanol (as being done in Brazil and India). The ethnaol is manufactured from molasses recovered from sugarcane (an agriculture product) during sugar production. The industry's forward linkage is in the form of provision of base materials for insecticides and pesticides manufacture for irrigation facilities and control of water logging and slanity reducing the menance of land erosion.

b) Development of Industry to Satisfy the Basic needs of the Poor:

In many countries of the region, food production is inadequate, the establishment and expansion of petrochemical industry is expected to release land which currently is

deployed for production of wood, cotton etc. as petrochemical products will substitute these natural materials. As such region's food availability position will be considerably improved.

The industry is also instrumental in providing clothing, water supply, sanitation and numereous house hold items.

c) Development of Small-scale industries and their linkages with large and modern industries:

Petrochemical industry is an excellent example of this type of linkage. The industry leads to numerous types of small scale industries for example plastic processing textile weaving etc. This part of the industry is in continous contact with end-petrochemical producers who keep on dissimenating the required technical back-up, changes in product characteristics and product development.

d) Dispersal and location of Industries away from Metropolition Areas:

The manufacture of basic as well as end-petrochemicals is normally established near its feed source i.e. gas fields and refining facilities. The materilization of this objective is dependent on the location of the available feed source in a particular country. However, the processing facilities involved in manufacture of consumer goods are normally widely spread in a particular country/region.

4.0 PETROCHEMICAL INDUSTRY : GLOBAL REVIEW

4.1 General

The petrochemical products currently form an essential base for production of wide range of industrial and consumer products. The petrochemical sector has been the most rapidly developing part of the chemical industry and now encompasses much of the earlier established organic chemical sector which was based on by-products of coal carbonization. The present industry is based on petroleum/gas feedstock.

4.2 Production Trends in Basic and End-Petrochemicals

Broadly speaking, production of basic as well as final petrochemical products showed a tendency towards growth, which was rapid upto 1973. In the later period the industry's growth slowed down and gave way to recessionery conditions.

- Basic Products

The world basic petrochemicals production during the period 1965 to 1981 is presented as follows:

TABLE - 1

WORLD PETROCHEMICALS PRODUCTION

BASIC PRODUCTS

(MILLION METRIC TONS)

	1965 (a)	1970 (a)	1975 (b)	1979 (b)	1981 (c)&(d)
- Ethylene	8.000	18.500	24.400	37.630	35.253
- Propylene	4.400	9.530	12.590	19.720	18.445
- Butadiene	1.900	3.130	3.445	5.060	8.201
- Benzene	4.780	8.820	11.310	17.180	16.501
- Xylenes	N.A.	N.A.	3.770	6.110	9.512
- Methanol	N.A.	N.A.	7.540	11.720	N.A.

Source: a) First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December,1978.

b) Second World-wide Study on Petrochemicl Industry: Process of Restructuring ID/WG.336/3 19th May,1981 and Annex.Ref. ID/WG.336/3/Add.1 20th May,1981.

c) The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March 1983.

d) Hydrocarbon Processing, Gulf Publishing Co. USA, August 1983.

The regional break-up of world basic petrochemicals production 1975-81 is given in Annexure-II.

It can be observed from the above given figures that basic petrochemical production showed rapid growth during 1965-70 with maximum increase in ethyhlene production i.e. 2.3 times. During 1970-75 the growth in petrochemical production considerably slowed down resulting in annual compound growth of 6 percent as compared to growth rate of 18 percent per annum during 1965-70. During 1975-79 ethylene production recovered from earlier slow growth, as it achieved annual compound growth rate of 11 percent per annum. In 1981 World basic petrochemical production generally declined only exceptions were xylenes and butadiene. Ethylene production which stood at 37.630 million metric tons declined to 35.253 million metric tons.

- End-Petrochemicals

The end-petrochemicals are grouped into four categories i.e. Plastics, Synthetic Fibres , Synthetic

Rubbers and Detergents. The below given Table-2 shows the growth in production of these four main end-products.

T A B L E - 2

WORLD PETROCHEMICALS PRODUCTION
END-PRODUCTS

(MILLION METRIC TONS)

	1960 (a)	1970 (a)	1975 (a)	1979 (b)	1981 (c)
- Plastics	7.000	30.200	38.500	41.165	37.436
- Synthetic fibres	0.700	5.100	7.500	10.040	12.069
- Synthetic Rubbers	2.000	5.900	7.400	6.390	8.494
- Detergents	3.500	9.000	10.800	N.A.	N.A.

Source: a) First World-wide Study on Petrochemical Industry 1975-2000 UNIDO/ICIS 83 12 December, 1978. The individual product groups include all categories of products.

b) Annexes to Second World-wide Study on Petrochemical Industry: Process of Restructuring UNIDO ID/WG.336 3/Add.1 20 May 1981. The individual product group cover major products e.g. in case of plastics only thermoplastics are included.

c) The Development of Petrochemical Industries in the Developing Countries. Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March 1983. The individual product group cover major products e.g. in case of plastics only thermoplastics are include

The regional break-up of world end-petrochemcial production from 1975-81 is given in Annexure-III.

- Plastics

Plastics account for more then half of world's end-petrochemicals production followed by synthetic detergents and fibres. The plastics production during 1960-70 increased at annual compound growth rate of 16 percent. The growth in production of plastics during 1970-74 was @ 10 percent per annum which after taking into account the low level of production of 1975 dropped to 5 percent per annum. The five thermo-plastics production (LDPE, HDPE, PVC, PP, PS), which was estimated to be 24.43 million metric tons in 1975 increased to 41.165 million metric tons in 1979, showing a compound growth rate of 14.0 percent per annum. In 1981 thermo-plastics production declined to 37.436 million metric tons.

- Synthetic Fibres

Synthetic fibres production which took a start from a nominal level of less than 1 million metric tons in 1960 touched a level of more then 5.10 million metric tons in 1970. The growth in production recorded an unprecendently high rate of 22% per annum during 1960-70 period. The increase in production of this magnitude was due to the fact that most of synthetic fibres were developed during the intervening period. The synthetic fibres production grew at annual compound growth rate of 8% per annum during 1970-75 The three leading synthetic fibres production (Acrylic, Polyamide, Polyester) which in 1975 was around 7.300 million metric tons increased to 10.040 in 1979 and 12.069 in 1981. The increase in production during 1975-81

period was recorded at an annual compound growth rate of 9.0 percent per annum.

- Synthetic Rubber

  Synthetic rubber production increased at annual compound growth rate of 11 percent, the growth declined to 5 percent per annum during 1970-75 period. The two leading synthetic rubber which accounted for about 70% of total synthetic rubber production, grew @ 6% per annum during 1975-79. In 1981 the production of SBR and PBR was estimated to be around 8.50 million metric tons.

The world petrochemical industry is concentrated in developed region of the world with United States, Western Europe and Japan being the leading producing areas. The share of developing countries in world petrochemical production is nominal. In basic petrochemicals production, developing countries had a share of only 8 percent. In end petrochemicals production developing countries had a share about 12 percent. Among end-petrochemicals synthetic fibres is one product group in which developing countries had a highest share i.e. 18 percent. In fact synthetic fibres was the developing countries first venture in petrochemical industry, in view of relatively small plant sizes for economic production and the larger share represented by labour in total production cost.

The developing countries as a whole are relatively new comers in petrochemical industry. More recently the OPEC countries have made a break-through and huge capacities are being planned. These facilities are expected to be operational during mid eightees as such this decade will see significant diversification in world petrochemcial industry.

4.3 Feedstock Pattern

Since it's inception petrochemical industry has been based on hydrocarbon resources starting with coal, then shifting predominantly on petroleum based resources including natural gas. Petrochemical feedstocks in general are categorized as gas based feedstocks or liquid feedstock. Gas based feedstocks include methane, ethane, propane, all of which make-up the bulk of constituents of natural gas (including associated gas) and refinery gases as well as synthesis gas. Liquid feedstock, on the other hand, are mainly crude oil refining cuts, NGL and condensates. The most noted of these cuts are butane (in LPG), naphtha and gas oil. Synthesis fuel (namely coal), coking liquid as well as biomass ethanol are also classified as liquid feedstocks.

Natural gas and refinery gases as well as refinery liquids are the main source of feedstock for all petrochemicals around the world. However, different feedstocks pattern exists in different region.

- United States

  In United States of America, traditional feedstocks for ethylene production consisted of ethane and propane. Trends in recent years have been towards increasing the use of naphtha and middle distillates.

- Western Europe

  Western European petrochemical industry has been primarily naphtha based. However during seventies shift towards heavier middle distillates fractions such as gas oil, and LPG/ethane has been observed.

- Japan

  Japan is in a similar position to Western Europe and as such all olefins production of ethylene, propylene and butadiene is based on naphtha feedstock.

- Remaining World

  The information on feedstock pattern in USSR, Eastern Europe and other centrally planned economies is not available. However, the general feeling is that major chunk of petrochemical production is gas based and remaining is naphtha based. In developing countries naphtha followed by gas are the feedstocks for production of limited quantum of petrochemicals. A small quantum of biomass ethanol is also being utilized in countries like India and Brazil. The oil rich countries petrochemical industry is primarily based on associated, raw and refinery gases.

4.4 Consumption Trends in End-Petrochemicals

In view of the fact that consumption of end-petrochemical products is the key factor in determining the basic petrochemicals demand, the discussion on consumption trends has been concentrated on them. The consumption of main end end-petrochemicals in the past has followed the S shaped curve reflecting the extent of product and

technology substitut on. Typically, almost all end-petrochemicals initially started slowly followed by very rapid growth during the substitution phase and then falling off, once the substitution phase was completed the growth started coming in line with consuming sector's growth as well as economic activity in general.

The world end-petrochemical products consumption during 1965-81 is presented in the following table-3:

T A B L E - 3

WORLD PETROCHEMICALS CONSUMPTION
END-PRODUCTS

(MILLION METRIC TONS)

	1965 (a)	1970 (a)	1975 (a)	1979 (b)	1981 (c)
Plastics	13.501	26.275	38.460	41.000	36.862
Synthetic Fibres	2.140	4.616	7.400	10.030	12.069
Synthetic Rubber	3.720	6.860	7.370	6.380	8.427
Synthetic Detergents	6.110	7.920	10.850	N.A.	N.A.

Source:

a) First World-wide Study on Petrochemical Industry 1975-2000 UNIDO/ICIS 83. 12 December 1978. The individual product groups include all categories of products.

b) Annexes to Second World-wide Study on Petrochemical Industry: Process of Restructuring UNIDO/ID/WG 336/3/Add.1 20 May, 1981. The individual product group cover major products e.g. in case of plastics only thermoplastics are included

c) The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March 1983. The individual product group cover major products .e.g in case of plastics only thermoplastics are included.

The regional break-up of world end-petrochemicals consumption covering 1975-81 period is given in Annexure-IV.

- Plastics

Plastics is the leading end-petrochemical produce group and accounts for almost 60 percent of total tonnage of end petrochemicals. The past growth in plastics consumption has been fastest. During 1965-70 plastics consumption increased at compound growth rate of 14 percent per annum. The growth rate dropped to 8% per annum during 1970-75. The thermoplastics (i.e. LDPE, HDPE, PP, PVC and PS) consumption which in the year 1975 stood at 24.60 million tons increased to 38.00 million tons, showing an annual compound growth rate of 13.6 percent. The world thermo-plastics consumption declined to 36.862 million tons in 1981.

Plastics consumption during the period under study remained concentrated in developed region of the world. In 1979 developing countries had share of 16 percent in total World Consumption. Among the developed region North America and Western Europe were the leading consuming areas followed by Japan and centrally planned economies. Among developing countries Asia and Latin American were the main consumers. Throughout the period 1965-79 the developing countries consumption kept growing at a very fast pace with growth rates between 15-20 percent. Compared to this, the developed countries consumption growth remained in the range of 5 to 7 percent.

- Synthetic Fibres

The synthetic fibres consumption increased from a level of 2.0 million tons in 1965 to 10.0 million tons in 1979. The consumption during 1965-75 increased at an annual compound growth rate of 13 percent per annum. In 1975-79 period the growth was @ 9 percent per annum. Currently, leading synthetic fibres are polyesters, acrylic and nylon. During 1979-81 synthetic fibres consumption increased at an annual compound growth rate of around 10 percent.

Synthetic fibres consumption also remained concentrated in developed region of the World. The developing countries share in three leading synthetic fibres i.e. polyesters, acrylic and polyamide was around 25 percent in the year 1979. The developing countries fibres consumption growth was higher then developed countries owing to increased market penetration and higher population base. The developed countries growth in fibres consumption was lower due to the fact that their markets have already been saturated. In developed region North America was leading consumer and in developing region Asia was the main consuming area.

- Synthetic Rubber

Throughout 1965-75 period synthetic rubber consumption grew at an annual compound growth rate of 8 percent per annum. During 1975-79 period the growth rate was slightly lower then the growth achieved during 1965-75 period. Styrene Butadiene and Polybutadiene rubbers emerged as leading synthetic

rubbers, their consumption increased at an annual compound growth rate of 15.0 percent during 1979-81. The developed region's consumption of two leading synthetic rubbers accounted for about 90 percent of total world consumption.

- Synthetic Detergents

Synthetic detergents on volumetric basis come next to plastics. Their consumption during 1965-75 increased at a marginal growth rate of 6 percent per annum Alkylbnezene, sulfonates and non-ionic surfactants were the leading detergent materials in use. The developing countries together in the year 1975 consumed 20 percent of total world synthetic detergent consumption.

4.5 International Trade Pattern

Petrochemical products from an important share of international chemical trade. Among the petrochemicals the bulk of trade is taken up by end petrochemicals. The trade flows for basic petrochemicals is concentrated among developed region of the world in the form of inter trade in Europe. As such international trade in bulk petrochemicals has been very nominal. In general, biggest exporters of basic petrochemicals have been ECC countries and Japan. The basic petrochemicals trade have been in aromatics, propylene and methanol, in case of ethylene the quantum has been very small. World trade in intermediate petrochemicals has not been very significant and like basic petrochemicals has been concentrated heavily within developed regions. Inter-trade of intermediates (e.g. styrene)

among countries of the some developed regions has been more pronounced in the case of EEC. Exports of intermediates to developing countries has been very minimal in view of non-existant of further processing capacity. The bulk of trade in petrochemicals has been in end-products i.e. plastics, resins, synthetic fibres and synthetic rubber. The main world trade flow in end-petrochemicals has been from the developed region (where most exports were generated) to developing countries (where production facilities were non-existant or insuficient). Plastics had the highest trade volume. Western Europe dominated the world trade of plastics followed by Japan (whose concentration has been in South East Asia) and United States. Eastern European and other centrally planned economies have also been active in international trade of plastics more specifically in PVC. The share of the developing countries in world trade of chemicals petrochemicals has been low (i.e. about 5% in 1978).[a] In recent years some exports (mainly fertilizers and natural gas derivates and ammonia) have been undertaken.

Source: a) Second World-wide Study on Petrochemical Industry: Process of Restructuring UNIDO ID/WG/ 336/3 /Add.1 20 May,1981.

5.0 PETROCHEMICAL INDUSTRY IN DEVELOPING ESCAP REGION

5.1 General

As is the case for almost all the industries, similarly, petrochemical industry is also concentrated in developed region of the world. The developing countries in totallity have a notional share in petrochemicals production. As far as developing ESCAP region is concerned the chemical and petroleum sector during the last decade has been one of the fast growing industrial sectors. However, the share of chemical industry (without petroleum refineries and products) in total manufacturing value added has been in the range of 10-13 percent. (Annexure-V gives the country-wise data about chemical/ petrochemical industry's contribution to GDP, employment alongwith mean size of establishments).

The existing petrochemical industry is concentrated in countries like S.Korea, India and Iran the recent addition is facilities of Singapore. The region has a net deficits in almost all the petrochemical products. The deficits are met through imports from developed countries e.g.Japan, Western Europe and USA. Here it may be mentioned that although the region has net deficits in basic as well as end petrochemicals products but it has

sizeable petrochemical base consumer products manufacturing capacity. Typical example is of plastics products and synthetic wearing apparel industry. The products of these industries are exported to developed as well as developing countries of the world. The primary reason for existance of processing capability is the cheap manpower availability as in case of plastic fabrication, labour costs are quite significant.

5.2 Basic & End Petrochemicals Production

The developing ESCAP region capacity to produce basic as well as main end petrochemicals is presented in Table-4 given below :

TABLE - 4

BASIC AND MAIN END PETROCHEMICALS PRODUCTION CAPACITY IN DEVELOPING ESCAP REGION(a)

(Million Metric Tons)

	1977	1979	1980
Olefins (ethylene + Propylene+Butadiene)	0.508	0.710	1.253
Aromatics (Benzene + Xylenes)+Methanol	0.609	0.790	0.835
Plastics (5 thermoplastics)	0.641	1.193	1.570
Synthetic Fibres (Polyester, Polyamide & Acrylic)	0.625	0.848	0.901
Synthetic Rubber (SBR & Polybutadiene)	0.100	0.120	0.180

(a) Data sources specified in Annexure VI.

The country-wise break-up of Developing ESCAP region basic and main end petrochemicals production capacity is given in Annexure VI.

Due to the non-availability of relavent statistics the capacity figure have been given only for 1977-80. Most of the existing petrochemical production capacity has been installed during the last decade. As can be observed from the above table olefins capacity increased during three years i.e. 1977-80 by about 2.5 times. Among olefins major share is of ethylene followed by propylene. Aromatics and methanol production increased from 0.600 million tons in 1977 to 0.800 million tons in 1980.

Among end petrochemicals five leading thermoplastics capacity increased by 2.5 times. The synthetic fibres production capacity increased from 0.6 million metric tons to about 1.0 million metric tons. This increase has been primarily due to addition of basic polyester manufacturing plants. The synthetic rubber production capacity during the years 1977-80 increased from 100 thousand metric tons to 180 thousand metric tons.

The basic petrochemical production capacity of the region is restricted to South Korea and India with recent addition of Singapore. In the remaining region no significant production capability exists. India's petrochemical industry is the

oldest in the region. Korea is the new entrant however currently it enjoys a major share in region's industry. In fact the increase in region's production capacity (both basic and end petrochemicals) during 1977-80 is owed to the operation of Korea's yeoch-chon complex. Singapore petrochemical facilities which started operation early this year (1984) consists of central naphtha cracking complex (capable of producing ethylene, propylene, butadiene and aromatics) with down stream facilities of LDPE, HDPE, Polypropylene and ethylene glycol. Iran's basic and end petrochemical production facilities which are partially constructed, are expected to be operational some time during late eightees.

In case of main end petrochemicals production capability, plastics as a group is one product which is quite wide spread among the countries of the region. (In case of PVC 9 out of 15 countries in the region have production capability). Among, the plastics the leading materials are polyvinyle chloride (PVC) and polyethylene. The major proportion of capacity is still in Korea followed by India. It is interesting to note that large variations exists in capacities of various countries in the region for example in case of PVC Korea's capacity is around 300 thousand metric tons followed by India (130 thousand metric tons) as compared to capacity of 5 thousand metric tons in Pakistan.

The petrochemicals production from the facilities located in the region is presented in the Table-5 given below :

T A B L E - 5

ACTUAL PRODUCTION OF BASIC AND MAIN END PETRO-CHEMICALS IN DEVELOPING ESCAP REGION (1975-80)

(Million Metric Tons)

	1975	1977	1979	1980
Olefins (Ethylene + Propylene+Butadiene)	0.255	0.256	0.489	0.805
Aromatics (Benzene + Xylene + Methanol)	0.242	0.624	0.616	0.579
Plastics (a)	0.370	0.578	0.863	1.083
Synthetic Fibres (b)	0.354	0.575	0.687	0.753
Synthetic Rubber (c)	0.057	0.086	0.105	0.135

The country-wise actual production of basic and main end petrochemicals is given in Annexure-VII.

The capacity utilization in case of basic petrochemicals in 1980 was in the range of 60-70%. Among end petrochemicals highest capacity utilization rate around 80% was observed for synthetic fibres followed by synthetic rubber (75%) and plastics (70%). Here

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(a) includes major thermoplastics i.e. LDPE, HDPE, PVC and PP.

(b) includes major synthetic fibres i.e. polyester, polyamide and acrylic.

(c) includes major synthetic rubbers i.e. styrene butadiene rubber (SBR) and Polybutadiene rubber (PBR)

Data sources are specified in Annexure VII.

it may be stated the data about production of basic as well end petrochemicals is very scanty. The main reason of this is integerated nature of petrochemical industry. Most of the plants are composite having ethylene, polyethylene, aromatics as well as fibre intermediate production facilities. In all these plants separate statistics for production of basic as well as intermediate products is not kept accurately. In certain cases the PVC production facilities also have pipe/other products fabrication facilities. Normally these plants report PVC production which is available for sale and record about quantum of PVC utilized internally for production of pipes etc. is not available.

5.3 Consumption Trends in End Petrochemicals

Historically, end petrochemicals consumptions in developing ESCAP region has grown from a low level at which it existed during mid sixties. The low levels of consumption during mid sixtees as well as the increasing substitution process which took place during the intervening period resulted in an impressive growth during the last two decades.

The ESCAP developing region consumption figures of main end petrochemicals for the period 1965-80 are presented in Table-6 given below : -

TABLE - 6

END PETROCHEMICALS CONSUMPTION IN DEVELOPING ESCAP REGION [a] (1965-80)

(Million Metric Tons)

	1965	1970	1975	1980
Plastics	0.289	0.765	1.279	1.909
Synthetic Fibres	0.067	0.228	0.460	0.845
Synthetic Rubber	0.052	0.102	0.201	0.225

The country-wise consumption of end petrochemicals is given in Annexure - VIII.

The review of above presented figures reveal that plastics as a group is the major tonnage item among the end petrochemicals. This pattern is in line with the world consumption pattern. The regions plastics consumption during 1965-75 increased at an annual compound growth rate of 16% which is considerably higher then the growth in world's consumption (11 percent per annum) for the corresponding period. In view of non-availability of plastics (all types) consumption data, the 1980 figures pertain to five leading thermoplastics. The consumption of these thermoplastics increased @ 20% per annum during 1975-80 which is unprecedently

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(a) The consumption data (1965-75 of individual product groups include all categories of products. The data for 1980 covers major products e.g. in case plastics only thermoplastics are included.

high growth. It may be mentioned that current as well as past plastics consumption has been dominated by these thermoplastics. Among the thermoplastics polyethylene enjoyed leading share followed by polyvinyle chloride.

Synthetic fibres consumption growth during the period under consideration was also quite high, this was as stated earlier, primarily due to polyester which was introduced during 1960's. Synthetic fibres consumption of the region during 1970-75 increased at an annual compound growth rate of 13%. The three leading fibres which dominate the total consumption achieved a growth rate of around 10% per annum during 1975-79.

Synthetic Rubbers consumption increased @ 12% per annum during 1965-75. The growth in consumption of two leading synthetic rubbers was around 11% per annum.

It is interesting to note that although in almost all the end-petrochemicals the growth in consumption has been quite impressive and has not been affected by events of 1970's. The per capita consumption of the region is still lowest in the world. For example the developed region average per capita consumption of five leading thermo-plastics ranged between 20-45 kg in 1980, as compared, developing ESCAP region had an average per capita

thermoplastics consumption of 2.0 kg. Among the countries of the region, wide variations in per capita petrochemicals consumption was noticed. For example the two countries i.e. S.Korea and India which in case of petrochemical industry are considered to be leaders of the region had per capita thermoplastics consumption of 15.4 Kg and 0.4 Kg, respectively. The low level of per capita consumption in countries of the region itself speaks of the petrochemical industry's potential.

6.0 DISCUSSION ON PETROCHEMICALS INDUSTRY IN SELECTED COUNTRIES OF DEVELOPING ESCAP REGION

6.1 General

The discussion on past developments of petrochemical industry in selected countries of developing ESCAP region is presented in the following paragraphs. The discussion pertains to Pakistan, India, South Korea, Iran, Indonesia and Thailand. For each country topics like economic profile and progress, development of petrochemical industry and petrochemicals market and available basic and downstream facilities have been dealt with.

6.2 Pakistan

Agriculture is the largest single sector of Pakistan's economy accounting for 31 percent of the GDP. It employs 55 percent of the labour force and it's share in export earnings amounts to about 40 percent. The share of agriculture in GDP has declined over the years, owing to expansion in industrial and services sectors.(a)

Industrial sector, including large and small scale manufacturing is currently contributing around 25 percent of GDP with an industrial labour force estimated to be 3.50 million. Industrial sector's growth since, 1947 has been highly impressive starting with virtually a complete absence of any worthwhile industry in territories forming present Pakistan by the end of sixties the country had developed a substantial industrial base. Despite severe set backs, the industrial base has continued to expand. Pakistan's economic profile is presented in Annexure-IX. Industrial sector during 1960's

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(a) The Sixth Five Year Plan 1983-88, Planning Commission, Government of Pakistan.

recorded an annual growth rate of 10 percent, which declined to about 6 percent per annum during 1970-82. The manufacturing value added was estimated to be 2500 million US dollars in 1981. The major share of manufacturing value added was taken by food and agriculture followed by chemicals & other manufacturing and textiles. The major large scale industries are textile, food processing, steel, fertilizer, paper and board, general chemicals and petroleum refining. The sector's growth has been primarily due to expansion in large scale industries. Small scale sector comprises of industries like cloth making, sports, carpets and surgical instrument. Pakistan's exports (estimated to be US$ 2403 million in 1982) were dominated by primary commodities i.e. agriculture and textiles. The import bill in 1982 was estimated to be US$ 5400 million with major share taken up by fuels, machinery and transport equipment and other manufactures.

- Chemical Industry

  Pakistan's chemical industry (excluding fertilizer) is still in a developing stage. The production capacity of chemical industry is able to meet only 10 percent of country's requirement. The fertilizer industry has shown an unprecendented expansion, (specifically in nitrogeneous fertilizer) with the result that currently the country has surplus of urea fertilizer which is being exported.

Chemical industry which currently is in existance consists of basic chemicals, pharmaceuticals and synthetic fibres.

- Existing Petrochemical Production Facilities

There exists no production facilities for building block petrochemicals e.g. ethylene. Bulk of petrochemical requirements of the country are being met through import involving considerable amount of foreign exchange when at the same time the country has required feedstocks i.e. Naphtha, Associated Gases, Mollasses. The posibility for setting-up basic petrochemical production facilities have been studied from time to time by various agencies. Recently, State Petroleum Refining & Petrochemical Corporation (PERAC) initiated a phased study programme which is currently under implementation. In the Sixth Five Year Plan (1983-88) an allocation of about US$ 5.00 million has been made for implementation of the programme of studying the feasibility of setting-up petrochemical production facilities utilizing one of the locally available feedstock. Depending upon the techno-economic feasibility the project can be implemented during the next plan period.[a] In the following paragraphas a brief sketch of existing petrochemical and assoicated industry is given:

(a) The Sixth Five Year Plan (1983-88), Planning Commission, Government of Pakistan.

- Plastic Materials

Currently, one small plant capable of producing about 5,000 metric tons of polyvinyle chloride, known as Pakistan PVC Ltd: is in operation. The PVC resin production of the plant is based on acetylene and HCL, the acetylene being obtained from calcium carbide. PVC resin production of the plant during last five years has been in the range of 2-4,000 metric tons per annum. Major proportion of plant's resin production has been utilized internally for production of PVC pipes.

Another plant (Synthetic Chemicals Ltd.) having the manufacturing capability of LDPE (5,000 metric tons) fromaldehyde resins and Hexamine (7,000 metric tons) and methanol (3,000 metric tons)was operational till mid 1970's. The plant was based on utilization of mollasses and natural gas as feedstock. The plant was closed down due to un-favourable economics of mollasses - alchohol-ethylene process and heavy financial brudens.

- Plastics Processing Industry

Despite the constraints in import of raw material and processing equipment, Pakistan's plastic processing industry has managed to develop over the years. Currently, the industry is capable of producing various types of plastic products ranging from sophisticated items like pipes, wire and cables, to household items, footwear and

packing materials. The country's annual processing capacity consisting of more than 2,000 processors is estimated to be around 80,000 metric tons with major share of extrusion process followed by injection moulding.

- Synthetic Fibres

The local production of synthetic fibres is limited to polyamides and polyester fibres and yarn.

- Polyamide (Nylon)

In all there are three plants for manufacture of polyamide fibre and yarn with a total capacity of about 3,000 metric tons. All these plants are based on imported caprolactum the production of these plants during recent years has been in the vicinity of 2,000 metric tons per annum.

- Polyester

Till 1980, there existed no facilities for manufacture of polyester fibre and yarn and the requirement was being met through imports. In 1982 two plants of polyester fibre/yarn namely National Fibres Limited (a public sector project) and ICI (a multi-national) started their commercial production. These two plants have capacity to produce 24,000 metric tons of fibre and 3,000 metric tons of yarn. These plants are utilizing imported DMT/TPA and ethylene glycol as basic feedstock. Additionally, eight polyester yarn manufacturing plants based on imported polyester

chips are in operation, the total capacity of these plants is estimated to be 10,000 metric tons per annum.

- Aromatics (BTX)

National Refinery Limited in 1979 established the production facilities of BTX. The facilities are capable of producing 25,500 metric tons of BTX, out of which Benzene is 5,000 metric tons, Toulene 9,000 metric tons and Xylenes 11,500 metric tons. The plants is catering to local and export markets. In the initial years of operation the unit's production remained in the range of 10-13,000 metric tons. Recently, the production has declined considerably in view of limited domestic market and non-availability of export markets.

e Petrochemical End-Product Market

Petrochemical end-product market in Pakistan has expanded during the past despite the constraints availability (as bulk of petrochemicals are imported) higher rate of duties and taxes on imports and restrictive import policies. For example, in case of plastic material duty/tax rate is about 200 percent of C&F value. The petrochemical products being consumed include plastic materials, synthetic fibres, synthetic rubber and detergents.

- Plastics

The plastic market consists of resins, sheets and finished products. The plastic resin market (i.e. thermo-plastics) in 1983 was estimated to be in

vicinity of 65,000 metric tons. PVC was the leading material with estimated quantum of 30,000 metric tons. Polyethylene (LDPE & HDPE) was next with estimated tonnage of 26,000. Poly-propylene requirement were estimated to be around 9,000 metric tons.

- Synthetic Fibres

Synthetic fibres market comprises of polyester, nylon, viscose and acrylic. Polyester fibre and yarn have dominating share of about 70% in total synthetic fibres market. Polyester fibre/yarn requirements for the year 1983 were estimated to be around 75,000 metric tons, with major share of texturized/filement yarn (i.e. 70%).

- Synthetic Rubber

The market size of synthetic rubber is comparatively very small in view of small size of local tyre and rubber product industry. Leading synthetic rubber is styrene butadiene rubber (SBR). The present consumption of SBR is estimated to be 5,000 metric tons per annum.

- Synthetic Detergents

The detergents market has consistently expanded with increase in standard of living and higher rate of urbanization. The current market size of synthetic detergents use for cleaning and washing purposes in household sector and bleaching purpose is in the vicinity of 20,000 metric tons.

- Thermo-plastics Resin Prices

Bulk of Pakistan's thermo-plastics resin requirements are imported. The imports originate from a number of countries such as U.S.A., Western Europe, UK, Japan, China and Qatar. PVC imports are mainly from China, Korea and East European countries owing to relatively lower prices. The import prices of petrochemicals are linked with international market prices. Annexure-X gives historical import prices of major thermo-plastics resins i.e. LDPE, HDPE, PVC and PP. It can be seen that considerable fluctuations took place during 1977-84 period. For example LDPE import price increased from US$ 600 per metric tons in 1977 to about US$ 1200 per metric tons in 1979, the price dropped to US$ 750 per metric tons in 1982, during 1983-84 an upward trend in prices was observed. Similar fluctuations were seen for other resins. Variations in prices also existed as to grades and origin of imports. The local prices of resins are determined by adding a mark-up on C&F price plus import duty, surcharge and other related charges. The imports of thermo-plastics resins in Pakistan is subjected to import duty and surcharge and sales tax. Currently, import duty is levied at the rate of Rs.13/Kg. equivalent to one US$, import surcharge is levied at the rate of 5 percent. The variation in local prices is attributed to fluctuations in

C&F prices as well as variations in import duty and taxes being levied. The lcoal prices of major thermo-plastics during 1977-84 period are also given in Annexure-X. It may be noted that local prices remained almost double of import prices during 1977-80 period. In subsequent years due to upward revision of duty ratesand rupee to US$ exchange rate the local price have in some cases almost 400 percent higher then import prices. However,in dollar terms the local market prices showed a declining trend owing to higher rupee to dollar exchange rate.

6.3 India

India is the most populous country of developing ESCAP region with a predominantly agragian economy. Agriculture sector, currently contributes to the extent of 33 percent in (1982) to country's GDP (as compared to 50 percent in 1960). India posseses a fairly developed and diversified industrial base. In 1982 industry's share in GDP was estiamted to be 26 percent while manufacturing sector's contribution to GDP was around 18 percent. India's economic profile is given in Annexure-II.

India's industrial sector showed an annual growth of 5.40 percent during 1960-70, the growth declined to 4.30 percent during 1970-82 period. The manufacturing value added increased from US$ 10232 million in 1970 to US$ 16190 million in 1981. Leading sectors contributing to country's manufacturing value added were machinery and transport equipment, textiles, chemicals and other manufacturing. The exports in 1982 were estimated to be US$ 8446 million, consisting of primary commodities, textiles and other manufactures. The import bill for the year 1982 was around US$ 14088 million. Fuel sector had a dominating share in imports followed by other manufactures and machinery items.

e Petrochemical Industry

Among ESCAP developing countries India is one of the leading producer of petrochemicals specifically and chemicals in general. Till late fiftees India had limited number of plants producing petrochemicals and general chemicals. India's petrochemical industry

at that time was primarily based on supply of ethylene and butadiene manufactured from ethyl alcohol derived from coke-oven operations.

The first olefin plants based on naphtha steam cracking were installed in 1960's. These plants were established by Union Carbide India Limited and National Organic Chemical Industries. During the late 1970's additional petrochemicals capacity became available when plant of Indian Petrochemcial Corporation came on-stream.

The existing production capacity of various basic and end-petrochemicals products is presented as follows:

Primary Products	PRODUCTION CAPACITY (1982) '000 METRIC TONS/YR
- Ehtylene	243
- Propylene	120
- Butadiene	50
- Xylenes	40
- Benzene	150
- Methanol	33
Intermediate Products	
- DMT/TPA	60
- Styrene	35
- Ethylene Glycol & Oxide	58
- Acetone	25
- Styrene	35

End-Products

- Thermo-plastics	328
- Synthetic Fibres	116
- Synthetic Rubber	50

India's petrochemical industry is based on naphtha, available after processing imported as well as local crude oil. Imported curde oil constitutes about 60 percent of crude oil processed. Apart from naphtha, ethyl alcohol (from locally available molasses) and coke oven (for aromatics production) are being utilized for production of petrochemicals. About one-third of ethyl alcohol produced was utilized for petrochemical production. Similary, about 20 percent of benzene production was coal based.

The country is nearly self-sufficient in most of the petrochemicals. The capacity utilization specifically in case of basic petrochemicals is lower probably due to time lag between start-up of down-stream facilities as well as development of market. Indian petrochemical/chemical industry (inclusive of petroleum refineries) made a contribution to GDP of around US$ 2.6 billion in 1978. The plastics product's contribution was around US$ 740 million. The industry directly employed 632,000 personnel. The mean size of establishment in case of refineries was 300 and in case of chemicals and plastics was 100. The industry consists of public and private enterprises. The public enterprises are active in petroleum refining and production

of basic petrochemicals. The down-stream production of chemicals/petrochemicals in most of the cases is in domain of private enterprises.

The planned petrochemical facilities include proposed project of Assam and Haldia at West Bengal. Recently, Indian government approved the construction of petrochemical complex at Nagothane in the Konkan region of Mahrashtra. The complex will use ethane and propane fractions from Bombay High and South Bassein offshore oil and gas fields. The complex will produce 300,000/year ethylene. Down-stream facilities will consist of LDPE(80,000 tons/year), HDPE (135,000 tons/year) PP (60,000 tons/year) ethyle glycol (50,000 tons/year). The complex is expected to be commissioned before the end of 1989.

e Petrochemical End-products Market

The end-petrochemical products i.e. plastics, synthetic fibres and synthetic rubber consumption of India has constaintly increased during the last two decades. The thermo-plastics consumption which was about 55,000 metric tons in 1965 has increased to about 252,000 metric tons in 1980. Synthetic fibres consumption was at very small level during 1970's. The current synthetic fibres consumption is estimated to be 88 thousand metric tons with poleyster as the leading fibre. Styrene Butadiene rubber consumption has gradually increased, in 1980 SBR consumption was estimated to be50,000 metric tons. Despite the growth in consumption and local production of almost all the basic and end-petrochemicals, India's per capita consumption is one of the lowest

in ESCAP developing region. For example in case of thermo-plastics India's per capita consumption in 1981 was less than half kilograms as compared to the world average of 9 kilograms. The low per capita consumption is primarily due to low standard of living of major propotion of country's population and the fact that consumer product market is restricted to urban areas of the country.

e Import and Exports of Petrochemicals

India's petrochemical industry is primarily geared to domestic market, however exports of various products in the past have been undertaken. Since exclusive data about import and export of basic and end-petrochemicals is not available, import and export data of chemical/petrochemical industry during 1970-79 period is given in Annexure-XII. India's chemical and petrochemical industry's imports for the year 1979 were estimated to be US$ 2.0 billion as compared to export of US$ 23.6 million. The export of plastic resins and articles were around US$ 1.5 million, bulk of which were exported to developing ESCAP countries.

6.4 Republic of Korea

The Republic of Korea which is referred in the report as South Korea had a population of about 39.30 million with GDP per capita of US$ 1741 in 1982. Korean economy (considered to be a model developing economy) has grown rapidly in recent years first through the development of an export oriented textile industry and later through ship building, construction and other heavy industries The economy during the last two decades has considerably shifted from agriculture base to industrial base. In 1960's agriculture sector's share in total GDP was around 37 percent which declined to 16 percent in 1982. As compared, industrial sector's share increased from 20 percent (1960) to 39 percent in 1982. South Korean Economic Profile is given in Annexure-XIII. Korea's industrial sector's growth during 1960-70 was around 17 percent per annum which was the highest among ESCAP region. The sector's growth declined to about 14 percent per annum during 1970-82. The manufacturing value added increased from US$ 2346 million in 1970 to US$ 10542 million in 1981. The main contributers to manufacturing value added were textiles, machinery items, chemicals and other manufactures. The exports which in 1982 were estimated to be US$ 21853 million increased at an average annual growth rate of 35 percent (1960-70) and 20 percent during 1970-82 period. The exports were dominated by textiles, machinery items chemicals and other manufactures. The chemical industry's export in 1980 were estimated to be US$ 673 million, about 30 percent of chemical exports weredirected to developing ESCAP region. In 1982, the country's total imports were of the order of US$ 24251 million. Fuels, machinery and transport equipment items and other manufactures were prominent among the imported goods.

e Petrochemical Industry

Korea has no hydrocarbon reserves at present, although there is offshore exploration planned. At present, there are six refineries in Korea with crude oil thru-put capacity of 607 thousand b/d. The crude oil requirements of the country is being met by imports from OPEC countries.

The Korean petrochemical industry is based on naphtha. The industry consists of a number of amonia and methanol plants and two petrochemical complexes, i.e. Ulsan and Yeoch-chon. The Ulsan complex which is in operation since 1973, consists of a naphtha cracking ethylene plant (with a capacity of 155,000 metric tons per year) and 20 down-stream plants. The complex jointly owned by Korea Oil, Government Bank, Korea Public Company and Gulf Oil. The Yeoch-chon complex was completed in 1979. The complex houses a naphtha cracker (capable of producing 350,000 metric tons of ethylene a year) and 16 down-stream plants. Dow Chemical and Mitsui were involved in down-stream facilities of complex.

The data about Korean petrochemical production capacity is given below:

Primary Products	PRODUCTION CAPACITY (1982) '000 METRIC TONS/YR
- Ethylene	505
- Propylene	268
- Butadiene	25
- Xylene	50
- Benzene	155
- Methanol	390
- Toulene	116
Intermediate Products	
- DMT/TPA	160
- Styrene	80
- Ethylene Glycol	80
- Caprolactom	80
- Acrylonitrile	77
End-Products	
- Thermo-plastics	892
- Synthetic Fibres	445
- Synthetic Rubber	130

The Korean petrochemical industry is currently meeting bulk of country's requirements. The industry's capacity utilization during early Eightees was around 65 percent. The thermo-plastids processed products production was in the vicinity of 800 thousand metric tons

with dominant share of polystyrene followed by HDPE and PVC. The leading processes employed for production of plastic products were injection compression and extrusion moulding.

The petrochemical industry is supported by government policies with respect to feedstock price and maintenance of product prices for material used domestically at levels such that material destined for export markets can be priced competitively.

- Petrochemicals Market

The petrochemical end-product market has expanded with continued expansion in country's industrial base, specifically, industry utilizing petrochemical end-products. The demand for petrochemical products in Korea during 1973-79 period, showed an average of 20 percent annual growth, which was twice as much as the GDP growth rate during the same period. The demand experienced slow down in 1979 and suffered a serious set back in 1980 recording an unprecedent negative growth. During 1981-82, the demand started showing positive growth.

During 1973-82 period synthetic resins demand showed highest increase of about 4 times. The resins demand was dominated by major thermoplastics. Synthetic fibres consumption increased by about 3 times. The leading fibres being consumed are polyster, polyamide and acryrilics. The synthetic rubber consumption is 127 thousand metric tons with dominant share of styrene butadiene rubber. The growth

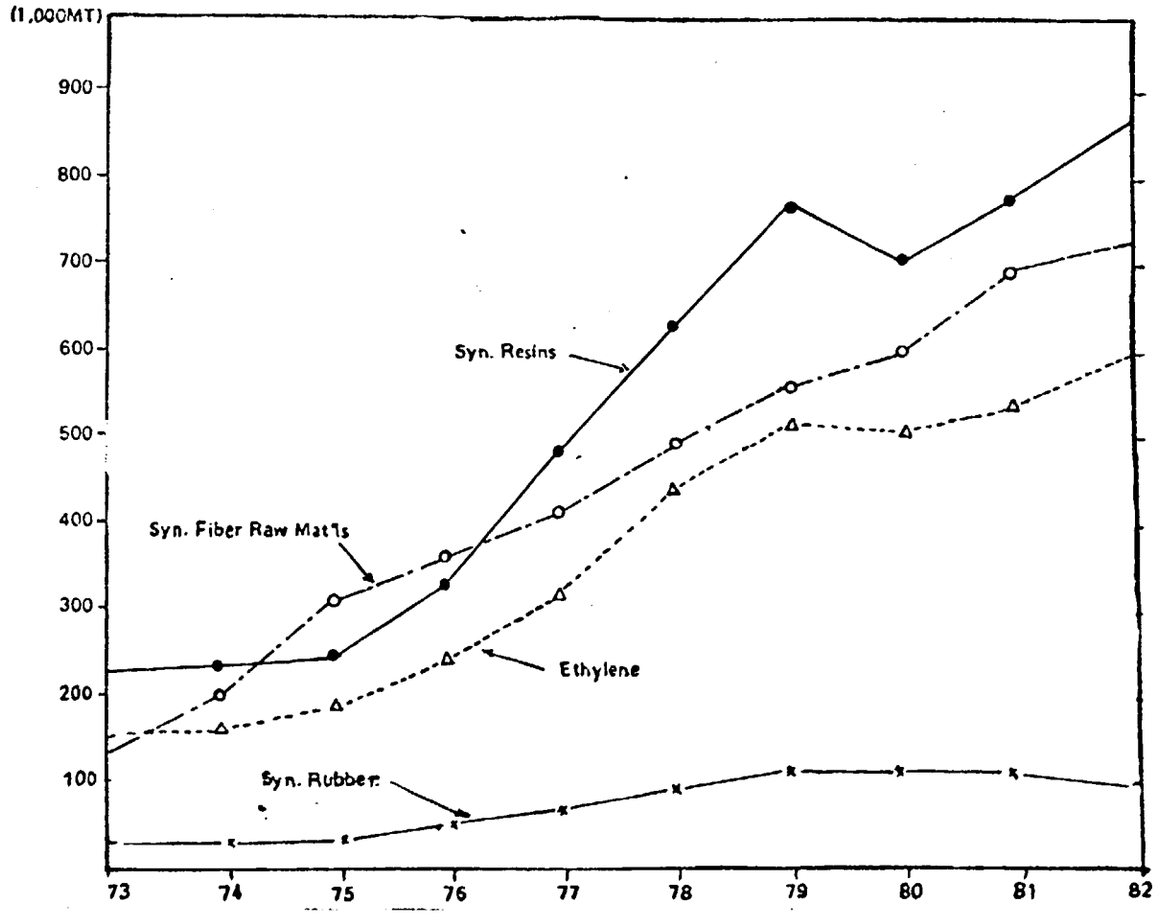
in Korea's petrochemical industry during the last decade is shown in the Figure-1.

- Import & Exports of Petrochemicals

  S.Korea's import and export of chemical/petrochemical industry during 1970-80 period is given in Annexure-XIV. The country during 1980 imported chemicals/petrochemicals worth US$ 2.5 billion as compared to exports of about US$ 1.0 billion. Among the petrochemical exports significant were thermo-plastics resins and plastic articles.

FIGURE-I

GROWTH IN PETROCHEMICAL INDUSTRY OF KOREA



6.5 Iran

Iranian economy is predominantly an oil economy as approximately 50 percent of GDP is contributed by oil sector. The country's economic growth in the past has been unprecedently high primarily due to frequent oil price increases. The country's GDP increased consistently at 26 percent per annum during 1973-78. In 1979, the country emerged as a republic as a result of an Islamic revolution. The data for post revolution era (1979-82) is not available. The state has played a major role in industrial development and is involved in petrochemicals, oil, iron and steel and automotive industries.

Iran's proven reserves of oil are estimated to be around 60 billion bbls. (1980) with 547 producing wells. The proven reserves of gas are estimated to be 485,000 billion cubic feet. The oil production during 1980 was 128 billion b/d. There are six refineries having crude oil thru-put of 1.21 million b/d.

e Petrochemical Industry

The development of petrochemical industry in Iran dates back to 1961 when first petrochemical plant, a fertilizer complex was established at Shiraz. In 1965 the state owned National Petrochemical Company (NPC) was set-up to plan and develop the country's petrochemical industry. Since it's incor-

poration's NPC has been actively involved in setting up various projects. The existing petrochemical industry consists of:(a)

- Abadan Petrochemical Company — The company is a joint venture of NPC and BF Goodrich. The Company's facilities are located adjacent to Abadan refinery. The facilities are based around a 25,000 metric tons per annum naphtha cracker with down-stream facilities of PVC, DDB, Caustic Soda and Chlorine. The PVC plant has an annual capacity of around 60,000 metric tons.

- Iran-Nippon Petrochemical — The facilities stated operation in 1972. The plant is capable of producing Dicotyle phthalate (DOP) and phthalic anhydride. The production capacity of DOP plant is 40,000 metric tons per annum.

- Polikan Company — This plant has facilities for manufacture of various types of PVC pipe and fittings. The PVC product of Abadan Petrochemical Company is utilized as raw material.

- Iran-Japan Petrochemical Project — The project was set at Bandar Shahpur by Iran-Japan Petrochemical Company, a joint venture of NPC and consortium of Japanese companies.

(a) The Petrochemical Industry in Iran, a paper presented at Seminar on Co-operation among developing countries in Petrochemical Industries Vienna March 7-9 1983 OPEC/UNIDO/OPEC FUND.

The project consists of three key units i.e. Chloralkali Olefins and Aromatics. The production slate of the project is given as below:

	CAPACITY (METRIC TONS PER ANNUM)
- Ethylene	540,000
- EDC	300,000
- VCM	150,000
- LDPE	100,000
- HDPE	60,000
- PP	50,000
- SBR	40,000
- Propylene	30,000
- Benzene	360,000
- Xylenes	120,000

The construction of the project started in 1977 and almost 80 percent of the work was completed in 1979 when the work suspended due to Islamic revolution. A second suspension which still is continuing occured when Iran-Iraq war started. The latest reports indicate that the work will be resumed duirng the last quarter 1984.

6.6 Indonesia

Indonesia is the second most populous country of the region. Oil/gas is dominating in the economy, generating over 50 percent of government income and around 70 percent of total export earnings. During the last two decades the country's economy has progressed considerably. The economic profile of Indonesia (covering 1960-82 is given in Annexure-XV. It can be seen from the Annexure that Agriculture, which in 1960 was dominating Indonesia economy (with a 54 percent share in GDP) become the lowest contributing sector (with 26 percent share in GDP) in 1982. During this period the maximum expansion took place in industrial sector. Major industries include oil exploration, mining, fisheries, forestery and textiles. Industrial sector's share in GDP rose from 14 percent in 1960 to 39 percent in 1982. The industrial sector showed a growth of 5.0 percent in 1960-70 which increased to about 11.0 percent in 1970-82. This high growth was primarily due to operation/expansion of oil/gas based production/refining facilities.

Indonesia's oil reserves are estimated to be about 10.0 trillion bbls and are the second largest oil reserves of the region. Oil production in 1982 averaged 1.45 million barrels per day, in 1983 the production dropped to 1.30 million barrels per day (quota fixed by OPEC). Oil refining is being done by nine refineries with a total crude refining capacity of 0.60 million b/cd. In 1982 crude oil refined for domestic consumption amounted to 181.2 million barrels, of which

98.4 million barrels were processed by domestic refineries and remaining 82.8 million barrels were refined in singapore.

Indonesia's natural gas reserves are estimated to be 24 trillion cubic feet, another 5.0 trillion cubic feet of associated gases are also available. The country's two LNG liquefaction plants have an annual capacity of about 8.0 million tons. The oil/gas based industry has extensive plans of addition of new facilities and expansion of existing facilities. The oil refining capacity will further increase after expansion of two additional projects in Balik papan (east Kalimantan and Dumai (Riau province, Sumatra) are completed. In case of LNG Indonesia is expected to be come world largest exporter.

The country's exports during 1982 were estimated to around US$ 22300, more then 80% was contributed by fuel and minerals and remaining by other primary commodities. The imports were estimated to be in the vicinity of US$ 17000 million during the year 1982. Machinery items and other manufactures were prononced in the imported goods.

The Third Five year plan (Repelitia-III, 1979-84) which recently terminated gave priority to economic development. Its specific objectives included expansion of the economy by an average of 6.5 percent a year; the creation of new and diversified job opportunities and promotion of development throughout the

country. The current plan, Repelita-IV (1984-89) continues these objectives although the target of annual growth in real gross domestic product (at 1973 prices) is fixed at 5 percent. The plan gives priority to development of the mining, forestry and agriculture sectors.(a)

e Petrochemical Industry

Indonesia's petrochemical industry currently, is limited to down-stream facilities of thermo-plastics and synthetic fibres. In thermo-plastics the country has two plants, one capable of producing 54,000 metric tons of PVC resin and other 37,000 metric tons of polypropylene. Additionally the country has polyester manufacturing capability(of about 60,000 metric tons per annum). Indonesia holds quite significant position with respect to end-petrochemical market. In 1980 thermo-plastics consumption was estimated to be around 300,000 metric tons. Synthetic fibres consumption during the same period was 90,000 metric tons. Synthetic rubber consumption in 1980 was estimated to be 15,000 metric tons. Indonesia's import/export data of petrochemical/chemical industry for 1970-80 period is given in Annexure-XVI. The petrochemical industry imports in 1980 were valued US$ 1.06 billion as compared to exports of US$ 4.07 billion (major proportion was taken-up by petroleum products). The chemical industry on the other hand was net

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(a) The Hong Kong and Shanghai Banking Corporation, Business profile series Indonesia, Third Edition, 1984.

importer as in 1980 its imports were about US$ 1.00 billion as compared to about US$ 100 million of exports.

Indonesia's plans for establishment of basic petrochemical facilities have been active from quite some time. The planned ethylene facilities are being set-up under joint venture arrangement of Petramina and Exxon Chemicals. The facilities will have production capacity of ethylene (350,000 metric tons) and down-stream plants of LDPE (180,000 metric tons) HDPE (60,000 metric tons) and PVC (150,000 metric tons). These facilities are expected to be operational in late 1980's. Aromatic facilities are also being planned. The planned facilities will have production capacity of Benzene 370,000 metric tons and Xylenes 240,000 metric tons. The country also plans to have methanol production capacity of 330,000 metric tons together with aromatic facilities are expected to be operational in 1990.

The latest news reports have indicated that Indonesian[(a)] government has temporarily suspended the plans for settingup ethylene facilities, the work on which was expected to start shortly. The suspension move of the government is part of the programme of reducing the public expenditure owing to reduction in revenues from oil and minerals exports. In all 47 major public sector investment projects involving large amounts of imported capital goods have been

(a) European Chemical News ECN issue dated May 30,1983.

rephased. The largest four rephased projects are aromatics, chemical project in sumatra, Musi river refinery project in Sumatra, olifin complex in Aceh and Bintan alumina plant in Riau province.(a)

(a) The Hong Kong & Shanghai Banking Corporation, Business profile series, Indonesia Third Edition-1984.

6.7 Thailand

Thailand has a population of 48.50 million with GDP per capita of US$ 786. Thailand's economy in the past has been dominated by agriculture and services sectors. During the last two decades major industrialization has also been in sectors having strong linkage with agriculture e.g. rice milling and sugar industry. The Country's GDP increased at the rate of 8.40 percent per annum during 1960-70 and 7.10 percent per annum during 1970-82 period. Thailand's economic profile is given in Annexure-XVII.It can be seen from the annexure that agriculture which was the leading sector in 1960,turned into a least contributing sector in 1982. Service sector improved it's position and in 1982 was the leading sector. Industrial sector's share in GDP increased from 19 percent in 1960 to 28 percent in 1982. During 1960-82 period industrial sector achieved highest growth with annual growth rate ranging between 9-12 percent. The manufacturing value added which stood at US$ 1675 million in 1970 achieved a level of US$ 4636 million in 1981. The main contribution come from food and agriculture, textiles and other manufactures. The exports during 1982 were estimated to be 6945 million US dollars. Primary commodities i.e. agriculture dominated the total exports. The total imports during 1982 were in the vicinity of 8548 million US$, the main categories of imports included fuels, machinery items and other manufactures.

Thailand's proven oil reserves are currently estimated to be around 103.0 million barrels. The country has three refineries with capacity to refine 176 thousand b/cd of crude oil. The natural gas reserves are in the vicinity of 8.0 trillion cft.

- Petrochemical Industry

Thailand's petrochemical industry is limited to thermo-plastics and fibres production facilities. In case of thermo-plastics there are two plants i.e. PVC and PP with 20,000 and 15,000 metric tons per annum capacity. Among fibres, polyester production capacity is quite significant i.e. 90,000 metric tons per annum, as compared to 10,000 metric tons capacity of polyamide. The country has sizeable market of end-petrochemical products. The thermo-plastics consumption in 1980 was in the region of 100,000 metric tons. Major proportion of this quantum was imported. The fibres consumption approximately equated the available capacity. Thailand's petrochemicals market is expected to expand considerably during the current decade. The thermo-plastics market would be in the range of 240 thousand metric tons as compared to synthetic fibres market of 160 thousand metric tons.(a)

Thailand has been actively pursuing the establishment of petrochemical industry. Based on the current development plans it is expected that the olefin facilities will be operational in 1990. The planned olefin complex will consist of cracking plant with down-stream facilities to produce LDPE (75,000 metric tons) PVC (50,000 metric tons) pp (70,000 metric tons) and ethylene glycol (50,000 metric tons). The investment cost for the olefin complex are estimated

(a) European Chemical News (ECN) issue No. Dated

to be US$ 850 million. The feed for the complex will be gases available from offshore gas fileds. All of the down-stream projects in olefins complex are expected to be undertaken by private investors. The government is providing incentives with the objective to promote conditions which will provide both attractive investment opportunities and faster growth in petrochemical demand. The following are the incentives being provided by the government:

- Exemption from custom duties and business taxes on equipment and machinery.
- Tax Holidays.
- Protection against new competition.
- Repatriation of earnings.
- Tariff protection from imports.

7.0 BASIC PROBLEMS AND ISSUES

The basic petrochemical production facilities of the region currently are limited to South Korea and India. Singapore facilities have recently started operation. In case of Iran the facilities have been partially constructed however, work is held-up due to prevailing political conditions. The region also has fairly developed oil/gas based industry which is quite similar to petrochemical industry with respect to technology operation and management. Another significant aspect of petrochemical industry development in the region is that two countries which now possess a sizeable capacity are net energy importer and major proportion of capacity is based on Naphtha feed. In coming years, these countries are expected to face problems in exporting their products, as international market will be highly price competitive. The situation of Singapore is slightly different as it is an export refining base, and the petrochemical facilities are joint arrangement of international companies. These facilities are expected to utilize a blend of naphtha, gas oil, LPG and refinery gases as feed.

Many countries of the region including Indonesia, Thailand, Phillipines, Hong Kong and Pakistan have been actively pursuing the establishment of petrochemical industry in their respective countries. Indonesian plans which earlier had been finalized have been temporarily suspended. The facilities were being set-up under the joint venture arrangement with Exxon Chemicals. Thailand's plans are also being finalized. The remaining countries like Phillipines, Pakistan and Hong Kong have not been able to implement

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their plans primarily due to international economic conditions, market size limitations, resource and feedstock availability constraints.

In case of Pakistan, the plans, of setting-up basic petrochemical facilities have been active from mid 1960's, the era when country's major industrial development took place. Since then, the project has been included repeatedly in country's development plans. Initially, the planned facilities were being set-up based on naphtha feed. Subsequently discoveries of associated gases suggested shifting to gas feedstock, another indigeneous feedstock i.e. molasses has also been under consideration. Apart, from uncertainity of feedstock and market limitations and resource constraints the factors which have been responsible for non-implementation of plans are listed below. It may mentioned that these factors are equally applicable to countries like Phillipine and Hong Kong. These factors are:

- International Market conditions.

- Continous inflation resulting in increase in capital outlay.

- Lack of interest by potential sponsors i.e. Transnational companies in view of expected excess capacity in developed region of the world.

- Shifting of priorities to other important sectors by governments of respective countries.

7.1 Economic

e Policy Implications

The establishment of petrochemical industry in a particular country first requires a basic policy decision at highest level accepting the need for industry's establishment and its economic contributions. Once this is done, a series of policy decisions as well as institutional measures have to be taken for making the industry's establishment and operation a success. These decisions and measures include:

- Allocation of special funds for industry's development.
- Import duty concessions
- Tariffs and other type of protection
- Tax incentives
- Promotion of investments in down-stream industries
- Assistance in Manpower Training
- Encouragement of local demand
- Supporting services.

Two countries of the region i.e. S.Korea and India which have ventured into manufacture of basic petrochemical in the past have done this with consistent

government's patronage. For example in case of S. Korea the industry got special attention in three successive five year economic development plans, as a result the current ethylene capacity of the industry is around 500 thousand metric tons. India, in this respect has followed a consistent policy of self-sufficiency and all development plans of industry are geared to cater the domestic market.

e Import Substitution

To start with in any developing country (with an exception of oil exporting countries) petrochemical industry is considered as import substitution. The products of the industry substitute the products which are of imported origin. Hence, the decision about deploying the funds for petrochemical industry (in most of the cases) is based on magnitude of foreign exchange savings generated, apart from the financial returns. While assessing the foreign exchange savings the inputs are normally taken at their opportunity costs and outputs at their current import costs.

In view of the prevailing depressed market conditions with respect to petrochemical industry, no new investment specifically in non oil exporting developing country can be justified based on this criterion. This is so because currently, severe price competition is in force. The producers from Western European countries are interested in disposal of their products at a price level at

which they can cover part of their fixed costs. The fixed cost element is quite lower as compared to the cost element of a plant in developing country, as these plants have been established years ago. On the other hand the producers of centralized economies due to their hard pressed foreign exchange requirement resort to dumping. These countries normally find buyers in developing countires such as Pakistan where the product quality is sacrificed over price savings. For example price of PVC imported in Pakistan during mid 1984 from countries like China and Romania was $ 2530 per metric tons lower then PVC imported from Japan/European sources.

An important aspect which decision maker noramlly do not take into considering while evaluating the proposals for establishment of petrochemical industry is that, industry apart from utilizing the domestically available raw material results in developing a broader and rapid growing industrial base which will have positive impact on country's GDP, employment, technical know-how.

- Domestic Market

The existence of an effective and potential demand for petrochemicals is considered to be a primary condition for establishment of petrochemical industry. Both developed and developing countries which now possess basic and down-stream petrochemical production facilities initially established these facilities based on consideration of their domestic markets.

Recently, a new situation has occurred when oil producing countries with quite small domestic markets have started setting-up basic petrochemical facilities. The facilities being planned are purely export oriented. This has been possible due to availability of cheap, wasted raw material like flared gas in these countries and joint venture arrangements with international companies who have taken the responsibility of marketing the products.

The developing countries generally have small market size as comapred to their counter parts in developed regions. The difference in per capita petrochemicals consumption of developed and developing region is enormous. For example in 1981 developing region thermo-plastics per capita consumption ranged betweer 2-6 Kg.[a] as compared to developed regions per capita consumption ranged between 20-45 Kg. This situation exists as most developing countries:

- Are at initial stage of development
- Have low per capita GDP with low standard of living
- Have easy availability of natural materials
- Have strong consumer resistance to switch over to synthetics (Petrochemcials)
- The markets are restricted to urban areas

(a) The Development of Petrochemical Industries in the Developing Countries. Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals, Vienna 7-9 March, 1983.

- Have intentionally restricted the growth of petrochemicals (in view of their imported origin involving foreign exchange) through high rate of duties and taxes and restrictive import policies.

The small domestic market size of developing countries and their inability to realistically assess the magnitude of potential demand has acted as an obstacle in establishment of petrochemical industry in these countries A typical example is of Pakistan, where domestic market size coupled with doubtful situation about export market potential have been an hindrance despite repeated attempts to set-up petrochemical facilities. Pakistan's current petrochemical products market primarily of ethylene derivates is such that world scale facilities cannot be justified. However, considerable potential market for various petrochemicals exists, which can be captured once the facilities are set-up. Here it may be stated that it is an admitted fact that local production of basic petrochemicals accelerates the demand not only in existing consuming sectors but also in new sectors where other natural materials are being used. As such considerable increase in per capita consumption takes place with the establishment of basic petrochemical industry. Turkey had a thermoplastics per capita consumption of 1.5 Kg. per annum before the start of production facilities in about five years consumption reached a level of 4.0 kg.[a]

(a) Market Study of Petrochemicals, ENAR Petrotech Services Ltd Karachi, Pakistan (1980).

e Export Market

The petrochemical production in a developing country is normally undertaken on the basis of domestic market demand. The domestic market size is small as compared to available economy size plants. The developing countries as such are compelled to install these plants and exports are considered as a stop gap arrangement till the domestic market equates the plant's capacity.

In the past the developing countries have not been successful in exporting their products even to developing countries with whom they have geogaphical proximity. This has been owing to the fact that historically, petrochemical trade has been dominated by international companies having origin in developed region, with world-wide distribution net work and effective technical back-up. These companies have established markets in developing countries, giving tough competition to new entrants. The difficulties faced in exports of petrochemicals by developing countries are partly attributed to the fact that petrochmeicals require a large supporting organization to maintain the required link between producer and client. In developing countries are not able to develop such a support specially during initial years. At the same time, developing countries in comparison with international companies (engaged in petrochemical exports) have limited technical back-up with practically no experience of export

markets. The developing countries are also at disadvantage due to disparity between size of domestic manufacturer and their international competitors.

Recently severe prices competition has been noticed in international trade of petrochemicals. The prices of petrochemicals in export markets in the past have been set at levels at which exporters have been willing to ship materials, and these levels have been subject to wide fluctuations. At times when, a high level of domestic demand existed in exporting countries from developed region, the export prices were higher as producers preferentially supplied their domestic customers. However, when substantial over capacity occurred, which is the case in current situation, the producers, export materials at marginal price just to provide, some extra loading on their plants. As compared the developing countries producers which have comparitively new plants, with high fixed cost element are unsuccessful in disposal of their products abroad. Another, limiting factor is frequent dumping of petrochemical products by centrally planned economies at lower prices. In the coming years the international market is expected to be highly competitive with respect to both price and technology. This situation will further limit the petrochemicals exports from developing countries. Among the countries of the region S.Korea is expected to face severe problems in disposal of products to export markets. This situation discourages the producers and planners of developing countries in expanding the industry's role as exisiing capacity is being under utilized.

- Up-Stream and Down-Stream Linkage

As explained earlier, petrochemical industry provides an excellent example of up-stream and down-stream linkage. The up-stream linkage is achieved by utilizing the available oil/gas resources, the down-stream linkage is achieved by developing series of industries e.g. plastic processing and textile and rubber processing. During the past, the developing countries which have ventured into basic petrochemical industry have not been successful in fully achieving the down-stream linkage which has ultimately affected the future development of the industry.

The developing countries establishing petrochemical industry in some cases have under valued the existance of down-stream industries, due to which considerable difficulties were faced in product marketing, adapting the down-stream industries to products being locally manufactured. All these factors resulted in delays in operating the facilities at desired capacity levels with additional economic costs.

The developing country entering the petrochemical industry has to take a stock of existing processing capability, with respect to available capacity, machinery and processes being employed and products currently being handled. Once this is done, efforts have to be taken to bring the industry at required level before the operation of planned facilities.

This can ideally be done during the construction phase, as the construction period normally extends from four to six years depending upon the size and magnitude of planned facilities. In this respect government of respective country has to take various institutional measures encouraging the establishment of these industries based on imported material for interim period. These measure have to be supported through liberal import policy with regard to petrochemicals, planned to be produced locally. However, it should be ensured that specifications of imported materials match the products planned to be produced.

The country should also take measures to develop the connected industries specifically required for downstream facilities. The connected industries can range from engineering back-up for plants construction to manufacture of machinery to be employed in processing petrochemicals. This will help in development of local technical know-how saving in foreign exchange which ought to be incurred alongwith savings due to lower local costs.

- Specialization

The past developments with respect to petrochemical industry has made it clear that specialization will have to be introduced for successful operation of existing and planned facilities. Specialization will help in brining harmony, and will activate the process of regional cooperation.

In view of the development plans of developing countries regarding petrochemical industry reveal that every country intends of produce whole lot of petrochemical products. (Indonesia, Thailand, Phillipines and Pakistan all are planning to set-up ethylene derivative production facilities). This situation if implemented is expected to lead to conflicts and building up of over capacities effecting economic viability of available facilities. Petrochemicals cover a wide range of products, the country venturing into the industry should study the available market, technical know-how and down-stream industry in it's own country as well countries in the same region. The decision as to set-up production facilities for a specific range of products, if possible should be taken in consultation with countries which can be a potential market. In order to ensure the availability of market a joint venture arrangement can be made. A typical example can be of Hong Kong, which has a sizeable market of Polystrene as compared to Pakistan which has a very small market of this product, an arragement can be made whereby Pakistan meets its requirements from production facilities of Hong Kong. Specialization will also act as catalyst for development of technical know-how required for engineering back-up and machinery manufacturing capability.

e Problem of Size and Scale of Economics

The petrochemical industry is known for large size plants particularly in case of basic products requiring substantial investments. The size of facilities becomes smaller and smaller as one moves

further down-stream to end products. The scaling up of plant capacities has been one of the essential features of petrochemical industry. This is substantiated by the fact, that during 1955-76 the typical size of ethylene facilities increased by more then twenty times. In 1955 typical size of ethylene facilities was 20,000 metric tons, in 1976 the size was around 500,000 metric tons. Similarly, the size of down-stream units, which in 1955 for LDPE was 10,000 metric tons increased to 100,000 metric tons in 1976.

The scaling-up of plant capacities resulted in reduction of unit capital and production costs. The impact of reduction varied from product to product and was more pronounced in some products

The developing countries historically have opted for small size plants in view of limitation of capital resource availability and domestic market size. This situation resulted in inability on the part of developing countries to compete in international market with similar product originating from facilities of developed countries which have advantage of economies of scale. Consequently, developing countries lost competiveness in international markets and also faced difficulties in domestic markets. To over come this problem these countries provided protection to local industry. The degree of protection varied from

country to country and product to product. This in turn has resulted in development of inefficient industry in many developing countries, as no incentive for cost effectiveness exists for the producer. This aspect will become more important as international market is expected to be highly price competitive once facilities of oil exporting countries are operational.

This problem can to some extent be tackled if developing countries rather then opting for technologies applicable for world scale plants can utilize technologies meant specifically for small size plants, some of which have been practically discontinoued on world scale.

- Infra-structure Facilities

Existance of developed infra-structure facilities is considered to be essential pre-requisite for settingup and satisfactory operation of any industrial plant. The infra-structure requirements of petrochemical industry are more pronounced in view of its size and complexity. The developing countries generally lack the requisite facilities, and as such these facilities have to be constructed alongwith production facilities, due to which capital costs of facilities are considerably increased as in some locations the cost of infra-structure can equate the cost of petrochemical production facilities. The increase in capital cost results in high financial charges associated with it. As compared, the

entrepreneur of developed country is in an advantageous position as highly developed and reliable infra-structure is available at no cost on his part. In developing countries the infra-structure facilities are not even reliable and interruption/fluctuations in the availability are quite common, which further burden the producer of developing country.

- Capacity Utilization

The capacity utilization of petrochemical facilities throughout the world is currently at low level due to economic conditions and availability of excess capacity. In developing countries the capacity utilization generally is low for reasons over and above the economic conditions and market limitations. These are:

- Lack of training and experience of operating personnel.
- Low level of technical know-how.
- Dependence on developed countries on technical back-up.
- Non-availability of equipment spares and time lag involved in procurement.

- Financing

The petrochemical industry is highly capital intensive requiring huge amount of capital outlay. The aspect of industry's financing is crucial as

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developing countries have limited capital resource. In developing countries investments in petrochemicals compete with other priority areas, like provision of basic needs to majority of population and development of infra-structure.

The bulk of investment requirements for establishment of petrochemical plants in developing countries is in foreign exchange in view of nominal local input as such, major proportion of financing has to be arranged from outside sources. The developing countries in the past have relied on traditional sources of financing which include Suppliers Credit Loan financing through World Bank and Regional Development Bank etc. Lately, co-financing of projects through joint venture agreements have been common, examples are facilities of Singapore and Saudi Arabia.

In-capability, on the part of developing countries to arrange financing of this magnitude in the past has acted as an hindrance for industry's development and many projects have been shelved due to non-availability of funds. The forces which have been responsible include funds availability position of international companies, world economic conditions, stringent criterion of international financing agencies with respect to project's viability and country's economic progress and political conditions etc.

7.2 Technological Issues

Petrochemical Industry involves application of complex technology both for chemical processes and for many technical alternatives offered concerning products, processes and raw material. The spectuclar development of petrochemical industry has been possible only through continous perfection and improvement in the field of technology. The development and adoption of new technology in the industry has been necessiated by forces among which prominent are:

- Availability of low cost feedstocks.
- Development of new products in order to expand industry's role.
- Improvement in product characteristic for better marketability.
- Increasing industry's productivity and efficiency with respect to feedstock/energy consumption.

Much of the technological development in industry took place during 1950 to 60's, when most of the existing and petrochemical were developed and marketed. Traditionally, major technological developments in the industry have been done by chemcial companies having their own production facilities. The developing countries of the world are fully dependent with respect to technology, construction and in some cases operation of petrochemical plants. The pace of technological development with respect

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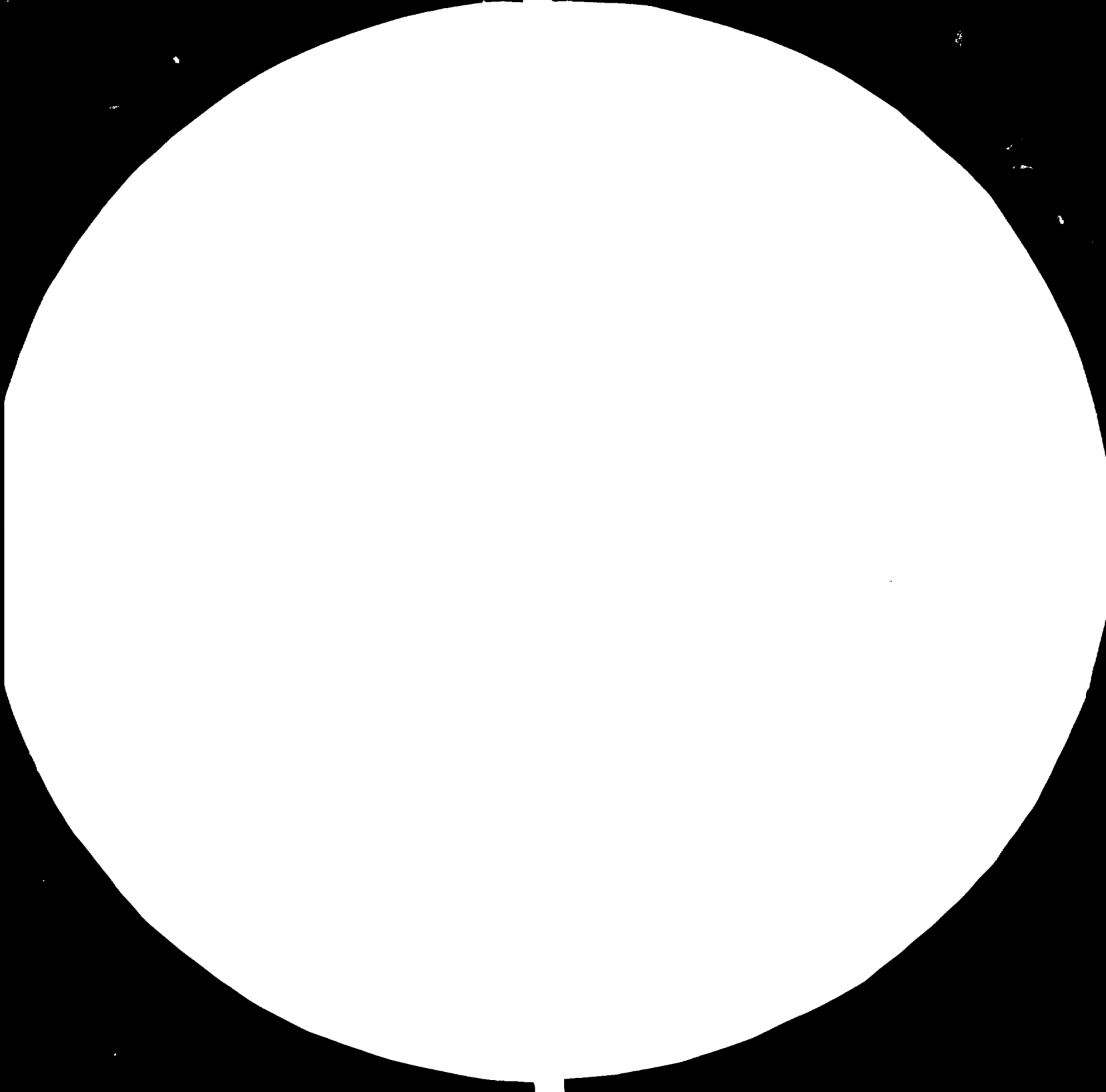
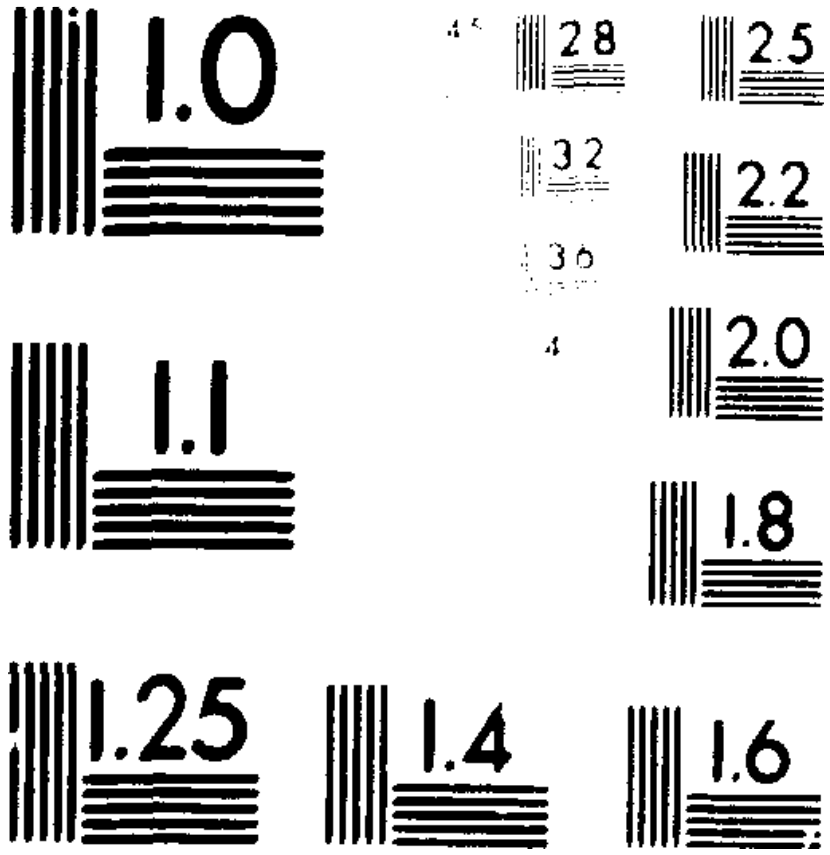




to processes and products posses a continous threat to developing countries with limited resources at their disposal.

Technology has been a prime mover of petrochemical industry, the industry by now has achieved a high degree of maturity and in medium term no new major break through in products or processes is expected. The technological development in remaining part of the current decade is expected to be directed towards improvement of processes and operation with a view to improve the yields, reduce feedstock and energy consumption, develop new feedstocks and flexibility of feedstocks in existing and new plants. Most promising is development of methanol as feedstock for production of olefins: ethylene and propylene. Technological developments in these areas seems to be imminent as producers of developed countries in order to remain competitive with producers of oil exporting countries will use technological advancements to their advantage. The oil exporting countries on the other hand have an advantage of availability of low cost feed.

This situation calls for following a very careful approach on the part of developing countries and necessiaties cooperation among developing countries themselves, especially between developing countries which have established petrochemical industry and new entrants. The discussion in the following paragraphs, deals with some of the important aspects of the problem.

- Types of Technologies Used

All the available technologies for production of various petrochemicals have been originated and developed by industrialized countries suiting their own conditions. The developing countries in the process of industrialization have no choice other then to procure these technologies from developed countries. The technology transfer has been through the normal commercial means as well through international cooperation.

The developing countries even those which by now have been able to achieve significant industrialization have faced numerous problems with respect to procurement and adaption of technology for a particular industry. The right type of technology to be used for any industrial plant is vital for its sucess, this aspect is more prominent in case of petrochemical industry which is highly complex, capital intensive and technology oriented.

Continous technological developements taking place in developed world has made the acquisition of right type of technology more difficult. The pace of technological development is such, that in certain cases developing countries plants have become obsolete in just few years after being in operation. This situation has resulted due to low level of technical know-how available in developing countries, their inability to evaluate

various aspects of technology being sought, and uncertainities as to future developments. Many developing countries with limited resources at their disposal have been burdened due to selection of wrong technology and technological innovation. An example in case of Pakistan is of polyethylene and PVC plants, the technology used by these plants has become obsolete.

For countries of developing ESCAP region, this problem is of relatively less importance. Many countries of the region (excluding those having basic petrochemical facilities) have petroleum refining industry, the technology of which is quite similar in nature to petrochemical industry. At the same time, these countries have sizeable down-stream processing industries.

- Degree of Adaption

The developing countries while choosing a particular type of technology should thoroughly assess local conditions and their consequences on selected technology. The technology should be such to which the country has some exposure, and is easily adaptable, this will help in reducing reliance on technology suppliers of developed countries. The adaption can be with respect to, as utilization of local feed-stock, type of products and plant size. In some

cases developing countries have established plants based on new technologies, with high capital costs. Subsequently, frequent shut-downs in these plants have been seen as the country concerned is not in a position to undertake work related to trouble shooting. The developing countries which are successfully operating petrochemical industry have an important role to play. These countries should share their experiences with new entrants from developing countries and wherever possible help them in acquiring and adapting the technology and wherever possible develop technology suited to developing countries circumstances.

- Technological Back-up Services

The developing countries generally lack the required technical back-up services. These services relate to operation and maintenance of petrochemical facilities (both basic and down-stream) as well marketing of final products. The technical and after sale services for newly established petrochemical facility in developing country is of paramount importance for correct and rapid development of the market. Technical Services to be provided by end-petrochemical producer include advice on adjustment of processing machines, and instructions on new end uses etc. The developing countries in many cases have under valued this important aspect of the industry which resulted in interruptions in plant's operation and difficulties in expanding petrochemicals market to desired levels.

- Local Manufacturing of Equipment

In developing countries generally a limited capability of manufacturing equipments required in petrochemical plants exists. As such major proportion of equipment needs are met by imports from developed countries resulting in high costs and considerable time lag.

The local manufacturing of equipments entails acquisition of technical know-how and development of series of industries. The newly industrialized countries e.g. South Korea and India have been able to acquire capability in some areas. However, the expansion in this respect is restricted due to the limitation of market size and thier inability to compete with comparable products from developed countries.

Since manufacturing of equipments is highly specialized and advantage of economies of scale are quite pronounced there is need to provide patranoge to existing facilities in countries of the region. This type of regional cooperation will enhance the quality of equipment, improve their competivity and reduce developing countries dependence on developed world.

- Evironmental Problems

Petrochemcial Industry, inview of the nature of raw material, processes and products is quite prone to health and environmental hazards. Most of the processes

employed by the industry operate at high temperatures and/or pressures and deal with catalytically activiated inflamable toxic or corrosive materials, and the effulents produced covered bring harmful effects to human, animal and plant life, adversely affecting the quality of the environment. The main environmental problems caused by the petrochemical industry are air and water pollution apart from disposal of solid wastes.

Air pollution emitted by the petrochemical industry include the following: Hydrocarbons, mostly paraffins, olefins, nitriles, chlorinated hydrocarbons, carbon mono-oxide oxides of nitrogen, particularly hydrochloric acid, sulphur dioxide. Air pollution can be reduced by process changes: incineration of waste stream for heat value: flares: scrubbers condensers: carbon absorption: bag filters and cyclones.

The waste stream generated by petrochemical plants are quite complex. The principal contaminents in the waste waters include oils, organic chemicals, suspended solids, acidity, heavy metals and other toxic materials: colour, taste and odour-producing compounds.

In the past it has been observed that generally in developing countries consideration to environmental hazards is not given during project's construction phase. This is due to once again limitation of capital resource (as inclusion of these facilities increase the capital cost of the plant) lack of experience and realization of environmental hazards. In most of the developing countries no regulation with respect to environmental hazards exist. There is need to enforce regulations

controlling the environmental hazards, such regulations are being strictly enforced in almost all the developed countries.

- Constraints of Skills, Education and Training

In view of technological complexity, and capital intensiveness of petrochemical industry and the adverse effects of un-scheduled stoppages on profits, the operation of production facilities is entrusted to highly qualified and skilled personnel. In developing countries the availability of skilled manpower in requisite quantum has acted as a constraint for establishment and rapid expansion of petrochemical industry.

The constraints of skills and education in developing countries exists as:

- Most of the countries are in initial stages of development and exposure to industry (particularly petrochemicals) is very recent.

- Lack of technological infra-structure and environment.

- Structure disproportions between graduate supply and demand due to lack of sufficient specialization of chemical and mechanical engineers as well as graduates of institutes. These disproportions have resulted in shortage of technicians, engineers, supervisors and all kinds of skilled manpower.

- The curriculum of engineering and technical colleges is to a large extent patterned after that of colleges of highly developed countries. The curriculum is academic rather than practice oriented and thus fails to take into account local industry and its problems.

- Non availability of vocational training schools in required number to prepare operators and technicians.

- Lack of qualified trainers, laboratory equipment and other facilities required to provide practical training. This is more common in case of technical and vocational schools.

- Limited interaction between technical educational institutions and industry.

In this situation main responsibility for training falls on industry. In many developing countries (specifically in initial years of industry) operation of plants is undertaken by expatriate personnel who at the same time train the local manpower. In many cases the manpower is trained abroad in facilities owned by contractor/multinational companies involved in the project. The severity of this problem in developing ESCAP region is relatively less. During the last two decades in many countries of the region significant work has been done in the direction to remove the constraints of skills and education. The number of vocational and technical institutions have been increased considerably, the curriculum has been altered and interaction between and educational institutions and industry has also increased.

The exodus of manpower from many countries of the region to Middle East has reactivated this problem. The policies which could be helpful to meet the growing manpower requirements of petrochemical industry in the developing countries are:

- Manpower Planning.
- Cooperation and coordination of activities between petrochemical industry and educational institutions.
- Training Policy and development of the institutional training.
- Cooperation among developing countries in the manpower field.
- Assistance of the developed countries and international agencies in the manpower field.

e Research Activities

The continous development and expansion of petrochemical industry has been the result of intensive research carried out by various companies in developed world involving huge capital and technological resources. In developing countries research development activities are almost non-existant due to constraints related to availability of specialized manpower, capital and technological resources. The R&D activities in developing countries are necessitated in view of rapid pace of technological development. Mere

transfer of technology from industrialized countries will not be sufficient to sustain durable development of the later unless it is backed by sufficient research and development of their own. The R&D activities of developing countries must be geared to their specific conditions and needs with greater emphasis on the use of local resources. The developing countries while negotiating a technology transfer agreements should emphasize its duplication and further development locally. India in this respect has successfully acquired technical know-how in case of fertilizer technology. Another, example is of Turkey which indigenously has undertaken work on country's second petrochemical complex.

8.0 TRENDS IN PETROCHEMICAL PRICES

The petrochemical prices prior to 1973 varied through time, with a general trend toward decreasing. This was mainly due to availability of cheap feedstock, technological improvements, strong competition and increases in plant capacities and their subsequent effect on units produced. The price/cost relationships for petrochemical products in these year were quite high as compared to other industrial products.

The consistent increases in crude oil and energy prices during post 1973, period changed the situation upsetting all the previously established balance. A new price/cost relationship with significantly reduced ratios of product prices of feedstock was introduced. Annexure-XVII illustrates trends in some of the petrochemical products during 1977-84 period. The review of Annexure-XVIII. indicates that the ethylene prices showed a consistent increase till 1981. In subsequent period, the prices have been declining. In most of the end petrochemicals prices, trends, similar to ethylene have been observed. The petrochemical prices during 1981-84 with prevailing economic recession and availability of excess production capacity in some case. have been even less then production costs. In future, however if excess capacity problem is overcome (which seems to be difficult) the petrochemical price will tend to increase with expected cost increase of raw material and energy as well as the increase in investment outlays.

9.0 WORLD PETROCHEMICALS DEMAND: FUTURE OUT-LOOK

The world petrochemical industry is now in transition, as rationalization and restructuring is taking place. The industry's future out-look is not expected to be as impressive one as it has been during the last two decades. The growth in world petrochemicals demand has been dictated by developments in industrialized world in view of their dominance in demand as well as production. This situation is expected to remain unchanged atleast during forseable future. The petrochemicals demand of developed countries is expected to show slow growth during the current decade. The developing countries with relatively a small share in world demand are still expected to achieve higher growth. The world economic conditions will also affect demand growth in developing world. The factors which are considered to be responsible for slow down in world petrochemical industry's growth are:

- General economic conditions specifically of developed countries which have a dominant share in the world market.
- Exhaustion of substitution opportunities in various consuming areas of developed countries markets.
- Restructure of industry with respect of feedstock pattern cost structure and technological innovation.
- Diversification of industry's base from consuming areas to oil rich developing countries, producers which have low production cost edge over existing producers.

The world end-petrochemical product demand (major product groups) for developing and developed regions of the world is presented in the Annexure- XIX. The following Table-7 gives a summary of the same:

TABLE - 7

WORLD END-PETROCHEMICALS PROJECTED DEMAND(a)

(MILLION METRIC TONS)

	1985	1987	1990
Plastics(Thermoplastics)	58.485	65.578	80.000
Synthetic Fibres	12.752	13.704	15.115
Synthetic Rubber	8.308	8.903	9.950

The world end-petrochemicals demand is expected to show an annual compound growth rate of 6 percent during 1985-90 period. During 1960-75 period petorchemicals consumption showed a growth rate of 12 percent per annum. The major petrochemical products (Thermo-plastics, main synthetic fibres and rubber) consumption during 1975-79 increased at an annual compound growth rate of 14 percent. Plastics are expected to remain dominant in world petrochemicals market. The petrochemical industry's growth in developed region of the world will be far lower in the coming decades then observed during the past. Plastics consumption during 1970-75 period showed a growth rate of 8 percent per annum which increased to 13 percent per annum (1975-79) During 1985-90 thermo-plastics expected to achieve a growth rate of 5 percent per annum. Synthetic fibres and rubbers growth will be in the range of 3-4 percent per annum. The petrochemicals growth in developing region during the current decade is expected to be slightly lower then achieved during 1975-79 period. For example plastics demand(basically thermo-plastics) during 1975-79

(a) Second World-wide Study on Petrochemical Industry:Process of Restructuring ID/WG.336/3 May, 1981.

increased at an annual compound growth rate of 12 percent, during 1985-90 period the demand is expected to increase at annual compound growth rate of 11 percent. The growth in synthetic fibres and rubbers during 1985-90 period is expected to be in the vicinity of 6 percent per annum as compared to growth of 8 percent per annum during 1975-79 period.

10.0 DEVELOPING ESCAP REGION; PETROCHEMICALS DEMAND: FUTURE OUT-LOOK

The developing ESCAP region has considerable potential for petrochemicals, in view of it's large population base and existance of fairly developed processing industry such as plastics and fibres. The end-petrochemicals demand growth in the past has been quite high as compared to other developing regions of the world. The demand growth during the current decade will still remain highest among the developing world despite the less bright economic proposects of the countries part of the region. However, region's petrochemical demand growth will be far lower then historical growth. The demand growth prospects can be better, if all the countries planning to establish petrochemical industry are successful in implementing their plants since, local production of petrochemicals accelerates the requirements of existing consuming sectors and help in creating demand for new consuming sectors.

The development of petrochemicals demand forecast for ESCAP region has been difficult in view of non-availability of country-wise future petrochemicals demand estimates. The demand pattern of petrochemicals in coming years is expected to vary from country to country. The demand projections were available for Asia only (second world-wide study). One alternative was to assume that Asia's growth rate of petrochemicals demand will be applicable to developing ESCAP region and then calculate the demand for each country based on their existing share in region's demand. This approach was not considered to be realistic, as growth rate (for each product) is expected to be different for each country,

depending upon the developments with respects to general economy and petrochemical industry.

The end-petrochemicals demand projections (1980-90) of countries in developing ESCAP region were developed with the help of growth rates. For each country and individual product different growth rates were applied using 1980 consumption data (given in Annexure-VIII) as base figures. The growth rates for each country have been selected considering the past demand growth and development with respect to general economy, growth in major consuming areas, expansion/establishment of basic petrochemical production facilities. Generally, higher growth rates have been used for countries which still have low penetration of petrochemicals and where basic or even down-stream production facilities have been recently established or are expected to be operational during the current decade. For example ASEAN countries growth rate is expected to be high due to aggresive marketing efforts of international companies involved in Singapore facilities which will further gear-up if Indonesian facilities are also operational.

In case of South Korea, demand growth is expected to be lower then historically high growth as significant market penetration has been achieved during the previous years and less export opportunities. On the other hand India is expected to maintain, growth achieved during the past. However, India's per capita consumption is expected to remain lowest in view of low standard of living and restricted penetration of petrochemicals in urban markets of the country.

Iran, is expected to over come the political turmoil and petrochemcial facilities will be operational maximum by late eightees. In view of less export opportunities domestic market will see considerable expansion. The countries like Pakistan, Philippines and Thailand even if they are not successful in implementing their plans of establishing basic petrochemicals production will show high growth which will be dictated by improvement in standard of living, marketing efforts by international companies involved in petrochemical complexes of Middle and Far Eastern region. Bangladesh, Sri-lanka and Burma are expected to remain small petrochemical markets.

The growth rates applied for each country and product are detailed in Annexure-XX . The growth rates for thermo-plastics ranged between 5-12 percent per annum. Synthetic fibres growth rate varied between 4-9 percent. Synthetic rubber growth rate were between 2-6 percent. The resulting demand projections of thermo-plastics, synthetic fibres and rubber in developing ESCAP region is presented in Annexure-XXI. A summary of the same is given in the following table:

T A B L E - 8

PROJECTED PETROCHEMICALS DEMAND (END-PRODUCTS)

(MILLION METRIC TONS)

	1985	1987	1990
- Thermo-plastics[(a)]	3.050	3.610	4.664
- Synthetic Fibres[(b)]	1.170	1.309	1.558
- Synthetic Rubber[(c)]	0.339	0.369	0.419

(a) Includes LDPE, HDPE, PP, PS.

(b) Includes Acrylic, Polyamide, Polyester.

(c) Includes SBR, PBR.

During 1985-90 period the demand for end-petrochemicals in ESCAP developing region is expected to increase at an annual compound growth rate of 8 percent. The above given demand projections are conservative. In UNIDO's Second World-wide Study on Petrochemicals, developing countries petrochemicals demand (during 1985-90) was projected to increase at an annual compound growth rate of 12 percent. Developing Asia's petrochemicals demand was projected to increase at an annual compound growth rate of 13 percent.

10.1 Product Pattern

- Thermo-Plastics

  Thermo-plastics will remain a dominant petrochemical end-product group. Thermo-plastics demand of the region is expected to increase at an annual compound growth rate of 9 percent during 1985-90 period as compared to developing Asia's projected growth rate of 12 percent per annum. (As given in Second World-wide Study on Petrochemicals). As mentioned earlier these demand projections are conservative. Among thero-plastics major share will be taken-up by LDPE and PVC. The region during the past has seen considerably penetration of thermo-plastics in natural materials market. With the expected improvement of standard of living the penetration is expected to further increase as per capita consumption is still far lower then developed regions. The penetration is considerably high in countries like South Korea, Hong Kong and Singapore. In countries like India, Pakistan, Thailand and Phillipines significant potential for

these materials exist as market penetration is low and is restricted to urban areas.

- Synthetic Fibres

Synthetic Fibres demand of the region is expected to increase at an annual compound growth rate 6 percent during 1985-90 period. The slow growth in synthetic fibres demand is in view of significant penetration in markets of Asean countries (which have a dominant share in region's demand), declining trend of polyamide for wearing apparel and availability of natural fibres i.e. cotton in countries like India, Pakistan. Among synthetic fibres, polyester will remain a dominant followed by acrylic.

- Synthetic Rubbers

Synthetic rubber market is expected to remain small in view of availability of natural rubber and limited expansion in it's outlets specifically automative tyre industry. Synthetic rubber demand of the region during 1985-90 is expected to increased at annual compound growth rate of 4 percent. SBR will maintain it's dominance in synthetic rubber market of the region.

10.2 Market Distribution

South Korea is expected to maintain its position as as major market for petrochemicals in the region. Indonesia will be second largest market with significant increase in per capita consumption specifically, thermo-plastics and rubber, India is also expected to

maintain its current position with low per capita consumption of end-petrochemicals. By the end of current decade significant market expansion will take place in countries like Iran, Malaysia, Hong-Kong. The remaining market areas will also expand with Phillipines, Thailand and Pakistan in leading positions.

11.0 DEVELOPING ESCAP REGION: PETROCHEMICAL FEEDSTOCK: FUTURE OUT-LOOK

The existing petrochemical industry is predominantly petroleum based. The facilities in South Korea are naphtha based. Major proportion of Indian facilities are also based on naphtha. In India a limited quantum of petrochemicals is also being produced from Biomass (Mollasses - Ethyl Alcohol - Ethylene) and coal. Singapore's facilities have flexibility of utilizing Naphtha, LPG, Gasoil. Iran's facilities will be first, gas based petrochemical venture of the region. The future complexion of region's petrochemical industry will be primarily governed by hydrocarbon availability apart from markets. Hydrocarbon is expected to remain a prime feedstock source for bulk of region's petrochemical production. Among the hydrocarbons, natural gas (both associated and non-associated) will have a significant edge over petroleum feed in view of yield advantage, indegeneous availability and uncertianity about crude oil supply and prices. Biomass and synthesis gas feed is not expected to make a significant penetration in feedstock pattern of petrochemicals in the region due to technological and economic reasons.

The following paragraphs contain discussion with respect to future outlook of these feedstocks for petrochemicals production in the region.

- Petroleum Feed

  - Crude Oil Production

    ESCAP region has crude oil reserves of approximately 72.0 billion barrells (details given in Annexure-XXII) Iran has 80% of total reserves followed by Indonesia, Malaysia and India. Other countries which have significant oil reserves are Pakistan and Thailand. In 1982 the ESCAP region crude oil production was around 4 million bbls/day. Bulk of production was shared by Iran (1.9 million bbls/day) and Indonesia (1.3 million bbls/day). The remaining production was taken-up by India and Malaysia etc.

  - Refining Capacity

    Developing ESCAP region crude oil refining capacity (52 refineries) is currently estimated to be 4.35 million b/cd. Major proportion of refining capacity is currently being shared by countries such as Signapore, (an export refining base) India, South Korea, Iran and Indonesia. Annexure-XXII. gives details of region's current crude oil refining capacity.

- Naphtha

  It is very difficult to give an indication about quantums of petroleum feed (Naphtha, Gasoil, LPG and refinery gases) expected to be available during the coming years, due to non-availability of relevant

data. In case of naphtha country-wise data about surplus/exports is not available, as petroleum products exports are categorized into Heavy, Middle and Light ends. The naphtha production in the region is estimated to be 2.0 million metric tons. (Details given in Annexure- XXIII.

Major proportion of total naphtha production is taken up by Singapore, South Korea and India. These countries in view of existance of petrochemical industry are consuming their own naphtha which in some cases is supplemented with imports from various sources within and outside the region.

Naphtha availability position will improve as many countries of the region have firmed up plans for expansion in their refining capacity. Currently significant naphtha exports are originating from countries like Pakistan, Bangla Desh and Srilanaka etc.

e Natural Gas

Developing ESCAP region has largest concentration of natural gas reserves among the five regions of developing countries. Region's total proven reserves of natural gases are estimated to be around 600 trillion feet. Bulk of regions natural gas reserves are located in Iran (about 86%) and remaining are divided in eight countries among which significant are Indonesia, Malaysia and Pakistan as given in Annexure-XIV. The region has also estimated availability of associated gases to the tune of 37 biln.cf.Associated gas resource of the region is concentrated in Iran. Other countries

which are significant is this respect are Indonesia and Malaysia. Among the countries where no natural gas reserves exist are South Korea, Signapore and Srilanka. The potential ethylene production from natural gas (both associated and non-associated) is estimated to be around 1.00 billion metric tons. As such the current natural gas availability can feed ethylene production capacity of 30 million tons for about 30 years period.

- Bio Mass

It is being suggested that biomass might be able to replace significant quantum of petroleum derived chemical feedstocks during the turn of this century. Biomass is currently being used in very limited quantum for petrochemicals and pharmaceuticals. Major quantum of biomass in more recent years is being consumed as automative fuel, substituting petroleum. Since petrochemicals fuel are high valued products, then petroleum. Some countries are considering utilization of this material in bulk as feed for petrochemicals The utilization of biomass for petrochemicals production is quite advantageous for countries which are oil/gas deficient but possess surplus biomass input. These countries are facing consistent balance of payments problems and are not in a position to afford foreign exchange being incurred on imports of petrochemicals. When at the same time an indegenous renewable resource which can be converted into petrochemicals is available.

The factors which have restricted the utilization of biomass as petrochemical feedstock include:

- Obsolete technology.
- Limited quantity of ethylene production.
- Uncertainities in availability of mollasses (since crop production in developing countries fluctuates significantly).
- The problem related to collection of mollasses/alcohol, as sugar mills/distelleries are located at various places in the region.
- Economics of ethylene production from biomass mollasses or corn (based on mollasses, ethylene production cost comes to almost double then from naphtha).

In ESCAP region only three countries Pakistan, Phillipine and Thailand have surplus Biomass (Mollasses) which can be effectively utilized for production of petrochemicals. India, is already using Mollasses as feed for petrochemical production. However, the potential of ethylene production from this feed source is quite limited. For example surplus quantum of mollasses from three countries is currently, estimated to be 1.3 million metric tons. From this quantum of mollasses only 160 thousand metric tons of ethylene can be produced.

- Coal

Coal once again is being considered as petrochemical feed. ESCAP region has limited coal resources restricted to India, South Korea and Pakistan. In case of coal the cost of mining, transportation and environmental investments are still high enough to block its use for the industry on competitive basis against petroleum feed. Further more synthesis gas which has been utilized for production of number of petrochemicals is not so economical.

12.0 DEVELOPING ESCAP REGION: FUTURE SUPPLY/DEMAND GAP

With rapid industrilization in the region, the emphasis on development of petrochemical industry has increased. Many countries of the region realizing the capability of petrochemical industry in gearing up the pace of industrialization have prepared ambitious plans for development of the industry. This not only holds true for developing ESCAP region but also for developing countries generally, among which Latin American and Middle Eastern countries are prominent. In the following sections the petrochemical supply/demand gap in the region is exmained. The complexion of proposed facilities which can be set-up based on regional cooperation has also been indicated.

12.1 Production Capacity

The period 1985-90 is expected to see enormous expansion in basic and down-stream petrochemical facilities. Currently, basic petrochemicals facilities are available in three countries of the region. Iran's facilities which are partially constructed are expected to operational by late eightees. The possible addition to existing petrochemical producers are Indonesia, Thailand, Phillipines and Pakistan. By 1990 only Indonesian and Thailand facilities are expected to be operational. The planned facilities of Phillipines and Pakistan if implemented will be operational some time during early nintees.

The region's basic and end-petrochemical capacity expected to be operational in 1990 has been estimated based on the following assumptions.

- India will keep on expanding it's production capacities in view of increase in local demand. However, implementation of available plans to increase ethylene capacity from 250 thousand metric tons to 920 thousand metric tons seems to be unlikely.

- Iran's facilities will be fully operational by 1990.

- Korea's third complex will be operational by 1990. This seems to be unlikely as Korea high production cost (utilizing imported crude oil and naphtha) will undermine the competitiveness, which is expected to prevail in international market.

- Facilities of Indonesia and Thailand will be operational in 1990.

Developing ESCAP region's petrochemical production capacity for basic and end-petrochemicals is given in the following table-9.The table also give comparative figures for 1980.

. . . .

TABLE - 9

BASIC AND MAIN END-PETROCHEMICALS PRODUCTION CAPACITY IN DEVELOPING ESCAP REGION

(Million Metric Tons)

	1980	1990
e Basic Products:		
- Ethylene	0.775	3.220
- Propylene	0.403	1.140
- Butadiene	0.075	0.270
- Xylenes	0.105	0.960
- Benzene	0.315	1.280
- Methanol	0.423	1.210
e End-Products:		
- Thermo-Plastics	1.489	2.948
- Synthetics Fibres	0.959	1.182
- Synthetics Rubbers	0.180	0.240

Among the basic petrochemicals maximum tonnage increase will be of ethylene followed by xylenes and methanol. Among end-petrochemicals maximum production capacity increase will be of thermo-plastics. Thermoplastics production capacity is expected to increase to about 3.0 million metric tons in 1990 which will be almost double then the capacity available in 1980. Synthetic Fibres capacity in 1990 is expected to be around 1.2 million metric tons as compared to about 1.00 million metric tons in 1980. Marginal increase in production capacity of Synthetic rubbers is expected to take place by 1990.

12.2 Supply/Demand Gap

For arriving at region's petrochemicals supply/demand gap, the demand projections arrived earlier have been used, the supply has been taken as 90% of production capacity to be available in 1990. In view of the fact that region's petrochemicals demand is made-up of ethylene/propylene derivatives, the demand/supply has been calculated only for these products. The basic petrochemical production facilities normally sized according to the size of planned down-stream facilities as such the supply/demand gap has been arrived at only for end-petrochemicals.

The future supply/demand position of the region is given in Annexure-XXV .The same is summarized in the following table:

T A B L E - 10

FUTURE END-PETROCHEMICALS SUPPLY/DEMAND GAP

Product	1990 Quantity In Million Metric Tons
e Thermo-plastics	
- LDPE	0.337
- PVC	0.495
- HDPE	0.386
- PP	0.511
- PS	0.280
e Synthetic Fibres	
- Polyester	0.128
- Acrylic	0.080
- Polyamide	0.054

Product	1990 Quantity In Million Metric Tons
e Synthetic Rubbers	
- SBR	0.200
- PBR	0.003

The maximum deficits of the region will be in thermo-plastics. Among thermo-plastics PVC will be leading followed by HDPE and LDPE. Among Synthetic fibres maximum deficits will be in case of Polyester which is highest tonnage material among the end-petrochemical products being considered.

From the above it is evident that based on firmed-up plans region will have deficits of main petrochemicals despite considerable increase in production capability. The deficits are expected to remain significantly unchanged even if facilities of Phillipines and Pakistan are operational in 1990.

At the same time, the deficits can be higher then indicated if India and South Korea's plans are not implemented. The projected gap in supply and demand is expected to be met from supplies outside the region more specifically the facilities of Middle East oil exporting countries. Here may be mentioned that these countries have considered many countries of the developing ESCAP region as their target markets.

This situation calls for highly activated regional cooperation with respect to establishment/expansion of petrochemical industry. This type of cooperation will some extent guarantee the successful operation

of existing as well as planned petrochemical facilities of the region. In the subsequent section the configuration of proposed petrochemical production facilities possibly based on regional cooperation is given. The arrangement as to partners of each individual facilities has not been indicated as it seems to be too premature as finalization of these proposals will require exhausative studies and are expected to be dictated by feedstock availability position (discussed in earlier section) and various other factors. However, at this stage it can be said that based on analysis of feedstock, infra-structure and availability and other factors the region can be divided into zones whereby each facility takes care of market in it's own zone.

The existing organizations involved in technical/economic cooperation among developing countries can provide an infrasturctural base for regional/sub-regional cooperation in petrochemical industry. Asean which is currently in the process of formingindustrial joint ventures can provide a support to the Indonesian and Thailand petrochemical projects as well new projects. Recently, formed South Asian Regional Cooperation (SARC) comprising of India, Pakistan Bangla Desh, Nepal, Bhutan, Maldives and Srilanka can also provide support for forming a joint venture for setting-up petrochemical facilities in any of these countries. Similar cooperation arrangement can be finalized between two countries like Iran and Pakistan (which already have economic cooperation arrangement) In this case down-stream facilities of petrochemicals can be established in Pakistan based on imported ethylene from Iranian facilities.

12.3 Potential Petrochemical Projects.

Based on earlier arrived supply/demand gaps ethylene/propylene requirements were worked out. The worked out requirements indicate that four sizeable petrochemical

facilities can easily be established possibly based on regional cooperation. The number can be reduced to two if world scale plants(as planned in Saudi Arabia) are installed. The configuration of proposed petrochemical complexes (based on the premise that four such complexes are installed in the region) alongwith capital costs (highly indicative)is given in the following Table-11. The down-stream facilities have not been exactly matched with the gap in supply/demand. In certain cases the gap is higher then the indicated capacity and in some cases capacity is more then the quantum of deficits.

T A B L E - 11

CONFIGURATION OF PROPOSED PETROCHEMICAL COMPLEX

FACILITIES	CAPACITY[a] (IN THOUSAND METRIC TONS)	CAPITAL COST[b] (IN MILLION US$ 1980 PRICES)
- Ehtylene	300	630
- Propylene	150	-
- LDPE	100	185
- HDPE	100	105
- PVC	100	225
- EG	100	104
- PP	160	273
Total:	1910	1522

(a) The conversion factors (tons of starting material per ton of product) used are as follows:

- LDPE 1.05 Ethylene
- PP 1.07 Propylene
- Ethylen glycol 0.70 Ethylene
- HDPE 1.05 Ethylene
- PVC 1.06 Vinylchoride & 0.50 Ethylene for Vin-ylchorid.

Source: The Petrochemical Industry, UNIDO/1 06,1973.

(b) Opportunities for Cooperation among the Developing countries for the Establishment of Petorchemical Industry. UNIDO/IS 16 March,1983.

The total ethylene production capacity of proposed four petrochemical complexes will be of the magnitude of 1.200 million metric tons per annum. The feedstock requirements in terms of naphtha would approximately be about 3.5 million metric tons. The total capital cost of these complexes will be 6.00 billion US$ (in 1980 prices). The proposed facilities will not include polyester fibres plants as well as TPA production facilities (an input for polyester manufacture). The ethylene glycol (another input for polyester manufacture) has been included in the proposed complex. The region's deficits in polyester fibre/yarn are expected to be in the vicinity of 1.0 million metric tons. To meet this quantum of deficits about 20 plants of 50,000 metric tons capacity each will be needed. The capital cost of these plants will be of the order of US$ 5.0 billion (in 1980 prices).[(a)] The T.P.A requirements for these plants would be of the same magnitude as polyester i.e. 1.0 million metric tons. The T.P.A. facilities have to be installed or polyester plants have to be dependent on T.P.A. facilities outside the region. For this tonnage of T.P.A. approximately 0.70 million metric tons of para xylenes will be needed. This tonnage of para xylenes can be supplied from huge aromatic complex the possibility of which has not been considered in the study.

(a) Opportunities for Cooperation among the Developing Countries for the Establishment of Petrochemicals Industry, UNIDO/IS 26 March, 1983.

13.0 COOPERATION IN THE DEVELOPMENT AND OPERATION OF PETROCHEMICAL INDUSTRY

Petrochemical industry historically, has been dominated by major oil and international chemical companies. Consequent to early 1970's crisis the industry has undergone major structural changes creating new conditions necessitating adoption of approach towards cooperation.

13.1 Global Cooperation(a)

Cooperation in the field of petrochemical industry prior to 1972 between the developed and developing countries was mainly based on direct investment by the major chemical companies of developed countries in the developing countries. This approach did not resulted in significant expansion of petrochemical industry in the developing region.

Since increase in oil prices and energy crisis of the 1970s the petrochemical industry has undergone major structural changes. these changes primarily pertained to position of hydrocarbon producers and oil/chemical majors. In view of the increasing demand for oil, the oil producing countries (i.e. OPEC) were able to exercise control over the supply and price of hydrocarbons. They consequently become a major factor in the international petrochemical industry. Since feedstock, energy

(a) Second World-wide Study on Petrochemicals Industry:Process of Restructuring,UNIDO ID/WG/336/3/Add.1 20 May,1981.

supply and prices are major factors for the successful operation of the industry, the major oil and chemicals companies in order to secure their source of supply have found joint ventures for huge petrochemical complexes with the hydrocarbon producers. As such the hydrocarbon producers are currently in the process of implementing their plans of valorization of their resources through expansion of refining capacities and establishment of basic and intermediate petrochemical production facilities. At the same time developing countries which have or plan to establish petrochemical production facilities based on imported hydrocarbon resource are expected to loose their competitiveness coupled with uncertainties as to the feedstock supplies and their prices. Additionally, developed countries with a high proportion of outdated petrochemical production capacity needing renewal under conditions of high inflation and economic recession coupled with insecurity of raw materials and energy supply has further compounded the industry's problems.

The problems of the world petrochemical industry created by the current process of restructuring may be amenable to resolution by considering a global approach on cooperation. The basic element to be considered in such an approach:

- Energy and feedstock supply: Long-term arrangements as to price and availability.

- Re-deployment of basic and intermediate petrochemicals capacities towards the sources of raw materials.

- Establishment of end-petrochemicals in the developing country/region which are sizeable markets with considerable potential.

- Opening of the markets of developed countries to petrochemical products from the developing countries.

- Stabilization of petrochemical prices in international market.

- Assistance to developing countries (with no or limited hydrocarbon resources) in development and successful operation of petrochemical industry.

13.2 Regional Cooperation

From the preceeding analysis of international market situation of petrochemicals and earlier discussion of obstacles in development of petrochemical industry in developing countries it is apparent that individually most of the developing countries are not in position to establish petrochemical plants and successfully

operate them as well as face the competition in international markets. The developing countries (specifically OPEC countries) in order to overcome these problems have entered into joint venture arrangement with international companies. Another possible alternative based on cooperation can be capital, technological, raw material, markets and manpower resources at regional level for setting-up the required facilities. This will help in development of industry in the developing countries and reducing the dependence on developed countries.

Till-to-date regional/sub-regional cooperation in petrochemical industry has been mainly in the areas of training and research. Most of the developing ESCAP region petrochemical facilities have been set-up under a joint venture arrangement or solely by Trans national companies e.g. Indian petrochemical facilities were set-up by Union Carbide. Singapore facilities have been set-up in joint venture with Japenese companies.

The need for the regional cooperation seems to be more pronounced in case of developing ESCAP region. The region is expected to face a unique situation; its petrochemical producers, i.e. India, South Korea and even Singapore are expected to loose competitivity for export purposes leading to under utilization of available production capacity in these countries. The region will also be importing considerable quantum of petrochemicals from developed region producers and new entrants from developing world (OPEC Countries). On the other hand the petrochemica

industry plans of countries even possessing substantial gas resource e.g. Indonesia are expected to be delayed due to uncertainty about their competitivity for export purposes and to some extent capital resource constraint despite sizeable domestic market and exposure to similar industries, e.g. petroleum refining and LNG.

The countries such as Pakistan and Philippines which have limitations of raw materials alongwith market, capital and technological resource can also be benefitted from regional cooperation arrangement in petrochemical industry whereby down-stream units can be installed in these countries based on basic petrochemical facilities located in some other country e.g. Iran and Indonesia. The countries which possess significant basic petrochemical industry e.g. India and South Korea can play an effective role in implementing regional plans of petrochemical industry by providing necessary machinery and equipment, technical know-how and assistance.

The regional cooperation arrangement would require utilization of existing organizational infrastructure or creation of a centralized organization to be responsible, for all the aspects involved. The aspects in this regard can range from identifying the regional cooperation projects to their implementation and operation and finally to provision of product marketing and back-up services. Recently,

ASEAN Economic Ministers have finalized agreements on Industrial joint ventures. In all twenty projects have so far been identified[a]. Efforts should be made for inclusion of various petrochemical industrial projects. Additionally, a regional level organization can be established for undertaking research and development in various technological areas related to petrochemical industry. This organization can develop specific technologies suited to region's requirements. Similarly, a joint arrangement of manpower training can be organized whereby manpower of member countries can be trained in available facilities of the region.

(a) TCDC News, 1984-No.1, United Nations Development Programme (UNDP).

ANNEXURES

LIST OF ANNEXURES

ANNEXURE NO.

LIST OF ANNEXURES

LIST OF ANNEXURES

ANNEXURE NO.

ANNEXURE-I

DEVELOPING ESCAP REGION

ECONOMIC PROFILE

COUNTRIES	AREA THOUSAND SQ. KMS	POPULATION: NUMBER (IN MILLIONS)		POPULATION: INCREASE PERCENT PER ANNUM	GROSS DOMESTIC PRODUCT (GDP): VALUE IN CURRENT US $ (MILLIONS)		GDP: AVERAGE ANNUAL GROWTH RATE (PERCENT)		GDP: RATE OF [illegible] GROWTH (PERCENT)	GROSS DOMESTIC PRODUCT PER CAPITA	
		1960	1982	1960-82	1960	1982	1960-70	1970-82	1982	1960	1982
Afghanistan	645	11.70	16.80	1.70	1190	3230*	2.50	3.90**	***	[illegible]	[illegible]*
Bangla Desh	144	53.90	92.90	2.50	3170	10940	3.70	4.10	3.30	59	118
Burma	677	22.36	34.90	2.00	1280	590	2.60	5.00	5.50	57	[illegible]
Hong Kong	1	[illegible]	[illegible]	[illegible]	950	2444	10.0	[illegible]	5.4	[illegible]	[illegible]
India	3288	429.02	717.00	2.40	29550	150760	3.40	3.60	6.50	69	210
Indonesia	1919	95.45	152.60	2.20	8670	90160	3.90	7.70	2.90	91	590
Iran	1648	21.43	41.20	3.00	4120	***	11.30	***	***	192	***
South Korea	98	24.95	39.30	2.10	3810	66420	8.60	8.60	9.70	153	1740
Malaysia	330	8.11	14.50	2.70	2290	25870	6.50	7.70	5.60	282	1760
Nepal	141	9.25	15.40	2.30	410	2510	2.50	2.70	0.90	44	163
Pakistan	804	45.61	87.10	3.00	3500	24660	6.70	5.00	5.80	77	285
Phillipines	300	27.37	50.70	2.90	6960	39350	5.10	6.00	1.00	254	770
Singapore	1	1.60	2.50	1.90	700	14650	8.80	8.50	7.90	429	5860
Srilanka	66	9.84	15.20	2.00	1500	[illegible]	4.60	4.50	4.70	152	290
Thailand	514	26.63	48.50	[illegible]	2500	36790	8.40	7.10	5.80	96	790

* Data for 1981
** Data for 1970-81
*** Denotes data not available.

SOURCE - World Bank Development Report, 1980-84 published for the World Bank, Oxford University Press.
- Asian Development Bank, Annual Report, 1983.

DEVELOPING ESCAP REGION

ECONOMIC PROFILE

Attachment to Annexure-I

COUNTRIES	DISTRIBUTION OF GROSS DOMESTIC PRODUCT (PERCENT)									AVERAGE ANNUAL GROWTH (PERCENT)					
	AGRICULTURE			INDUSTRY			SERVICES			AGRICULTURE		INDUSTRY		SERVICES	
	1960	1970	1980	1960	1970	1980	1960	1970	1980	1960-70	1970-80	1960-70	1970-80	1960-70	1970-80
Afghanistan	70	66	55[e]	14	20	28[e]	16	14	17[e]	...	3.2[ee]	...	8.2	...	5.6
Bangla Desh	57	59	47	7	11	14	36	31	39	2.70	2.5	6.50	6.7	4.2	5.6
Burma	39	43	47	12	14	11	49	43	42	4.10	3.4	2.8	5.4	2.8	5.1
Hong Kong	4	4	1[e]	39	36	33[e]	57	59	67[e]	...	3.0[ee]	...	...	...	...
India	51	44	38	20	23	26	30	32	41	1.90	1.60	5.40	4.8	4.60	5.9
Indonesia	54	39	29	13	26	39	32	35	32	2.70	3.80	5.20	10.1	4.80	...
Iran	29	22	10[e]	33	65	54[e]	25	38	36[e]	4.40	...	15.40	...	11.1	...
South Korea	37	31	16	20	27	39	43	42	45	4.40	2.0	17.20	11.7	8.9	7.3
Malaysia	36	31	23	18	31	30	46	38	47	...	5.1	...	9.20	...	8.40
Nepal	66	70	57[e]	10	11	13[e]	22	19	30[e]	...	...	...	...	...	...
Pakistan	46	35	31	16	25	25	38	40	44	4.90	2.70	10.00	5.4	7.00	6.2
Philippines	26	31	22	28	30	36	46	40	42	4.30	4.80	6.90	8.0	5.20	5.2
Singapore	4	3	1	18	34	37	78	64	62	5.00	1.60	12.50	8.00	7.70	8.60
Sri Lanka	32	42	27	20	19	27	48	39	46	3.00	3.20	6.60	4.20	4.60	5.20
Thailand	40	34	22	19	23	28	41	43	50	5.60	4.40	12.90	9.00	9.10	7.40

e Data for 1980
ee Data for 1970-81
... Denotes data not available.

SOURCE World Bank Development Report 1982-84
Published for the World Bank, Oxford University Press.

WORLD PETROCHEMICALS PRODUCTION

BASIC PRODUCTS

ANNEXURE-II

(THOUSAND METRIC TONS

C O U N T R I E S	ETHYLENE			PROPYLENE			BENZENE			BUTADIENE			XYLENES			METHANOL		
	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981
DEVELOPED COUNTRIES																		
- Japan	3400	4800	3900	2300	3100	xxxx	1600	2000	xxxx	500	670	xxxx	580	860	xxxx	700	900	xxxx
- West Europe	7900	12350	10500	4100	6500	xxxx	3150	4800	xxxx	1080	1710	xxxx	960	1380	xxxx	2400	3000	xxxx
- North America	9700	14300	11400	4000	7200	xxxx	3600	5400	xxxx	1250	1750	xxxx	1450	2380	xxxx	2500	3450	xxxx
- USSR and East Europe	2000	3000	3000	1200	1500	xxxx	2150	2600	xxxx	300	400	xxxx	600	800	xxxx	2100	2500	xxxx
- Other Industrialized Countries	250	500	700	120	230	xxxx	80	140	xxxx	75	110	xxxx	20	30	xxxx	xxxx	30	xxxx
TOTAL:	23250	34950	32500	12120	18530	xxxx	10780	15040	xxxx	3205	4640	xxxx	3610	5450	xxxx	7700	10280	xxxx
DEVELOPING COUNTRIES																		
- Africa	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
- Middle East - North Africa	xxxx	100	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	400	xxxx
- Middle East - West Asia	xxxx	50	210	xxxx	30	xxxx	xxxx	xxxx	xxxx	10	20	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx	xxxx
- Asia	250	900	1600	200	450	xxxx	130	360	xxxx	80	110	xxxx	30	320	xxxx	90	400	xxxx
- China	300	450	xxxx	70	210	xxxx	200	320	xxxx	40	80	xxxx	xxxx	20	xxxx	140	210	xxxx
- Latin American	600	1300	1700	200	500	xxxx	320	510	xxxx	90	210	xxxx	130	320	xxxx	110	310	xxxx
TOTAL:	1150	2800	3510	470	1190	xxxx	650	1190	xxxx	210	420	xxxx	160	660	xxxx	340	1320	xxxx
WORLD TOTAL:	24400	37650	35253	12590	19720	16445	11431	17180	16501	3445	5060	8201	3770	6110	9512	7540	11720	xxxx
Share of Developing Countries in World Total(%)	4.71	7.4	9.94	3.7	6.0	xxxx	5.7	6.9	xxxx	6.1	8.3	xxxx	4.2	10.8	xxxx	4.5	11.3	xxxx

xxxx Denotes data not available.

SOURCE - Annex to second world-wide study on the Petrochemical Industry: Progress of Restructuring ID/WG.336/5/Add.1 dated 20th May,1981.

- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OAPEC/PIDC Seminar on Petrochemicals Vienna 2-6 March,1981.

- Hydrocarbon Processing, Gulf Publishing Co. U.S.A., Aug.1981.

WORLD PETROCHEMICALS PRODUCTION

END-PRODUCTS

ANNEXURE-III-A

(THOUSAND METRIC TONS)

C O U N T R I E S	T H E R M O - P L A S T I C S																	
	P.V.C.			H.D.P.E.			L.D.P.E.			Polypro-pylene			Poly-styrene			T O T A L		
	1973	1977	1983	1973	1977	1983	1973	1977	1983	1973	1977	1983	1973	1977	1983	1973	1977	1983
DEVELOPED COUNTRIES																		
- Japan	1130	1570	1151	350	670	670	740	1375	977	390	1020	1016	690	1150	850	3710	6110	5264
- West Europe	3100	4320	3215	1350	1770	1357	3600	4520	3764	650	1530	1655	1500	1800	1250	9400	13940	11241
- North America	1740	2970	2746	1260	2560	2400	2380	3920	3868	900	1850	1884	1275	1940	1753	7555	13240	12651
- USSR and East Europe	850	1500	1300	130	280	370	600	1130	1120	150	150	280	300	450	410	2030	3510	3480
- Other Industrialized Countries	100	250	490	40	100	140	120	210	290	-	60	100	40	70	60	300	690	1080
TOTAL:	6920	10630	8902	3130	5310	5137	7040	11150	9983	2290	4640	4937	3800	5400	3942	23995	37490	32921
DEVELOPING COUNTRIES																		
- Africa	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
- Middle East - North Africa	***	50	100	***	***	***	***	40	180	***	***	***	***	***	10	***	90	290
- Middle East - West Asia	***	40		***	***	***	10	15		***	***	***	***	20		10	75	
- Asia	200	740	1220	50	100	220	100	330	660	50	180	350	50	150	240	450	1500	2690
- China	220	350	***	5	20	***	25	250	***		90	***	***	10	***	250	720	***
- Latin America	250	420	535	30	170	250	320	490	410	***	80	100	140	240	240	740	1360	1535
TOTAL:	670	1600	1855	85	290	470	455	1085	1250	50	350	450	190	420	490	1490	3745	4515
WORLD TOTAL:	7590	12230	10717	3215	5360	5607	7495	12235	11233	2340	4990	5387	3790	5910	4432	25485	41235	37436
Share of Developing Countries in World Total (%)	8.83	13.08	17.31	2.64	5.0	8.38	6.07	8.87	11.12	2.1	7.0	8.35	5.0	7.1	10.99	5.94	9.10	12.06

SOURCE: - Annex to Second World-wide Study on the Petrochemical Industry: Progress of Restructing ID/WG.336/3/Add.1 dated 20th May,1981.

- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.

- Hydrocarbon Processing, Gulf Publishing Co. USA, August,1983.

*** Denotes data not available.

WORLD PETROCHEMICALS PRODUCTION

END-PRODUCTS

ANNEXURE-III-B

(THOUSAND METRIC TONS)

COUNTRIES	SYNTHETIC-FIBRES												SYNTHETIC-RUBBER						TOTAL		
	ACRYLIC FIBRES			POLYAMIDE (NY) FIBRES			POLYESTER FIBRES			TOTAL			S.B.R.			POLYBUTA-DIENE					
	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981
DEVELOPED COUNTRIES																					
- Japan	250	360	***	280	310	***	450	630	***	980	1300	1281	500	600	***	150	150	***	650	750	[illegible]
- West Europe	530	750	***	620	720	***	650	800	***	1800	2270	2841	1000	1150	***	250	270	***	1250	1420	[illegible]
- North America	240	350	***	900	1300	***	1400	1950	***	2540	3600	4567	1170	1600	***	350	450	***	1520	2050	2511
- USSR and East Europe	120	150	***	350	450	***	280	400	***	750	1000	1000	1100	1400	***	140	200	***	1240	1600	2510
- Other Industrialized Countries	***	***	***	30	30	***	20	40	***	50	70	70	30	50	***	10	20	***	40	70	[illegible]
TOTAL:	1140	1610	***	2180	2810	***	2800	3820	***	6120	8240	9759	3800	4800	***	900	1090	***	4700	5890	[illegible]
DEVELOPING COUNTRIES																					
- Africa	***	***	***	***	15	***	30	35	***	30	50	***	***	***	***	***	***	***	***	***	***
- Middle East - North Africa	***	***	***	10	10	***	10	20	***	20	30	80	***	***	***	***	***	***	***	***	20
- Middle East - West Asia	***	***	***	15	30	***	45	60	***	60	90		10	20	***	***	***	***	10	20	
- Asia	100	160	***	150	200	***	400	550	***	650	910	1730	80	100	***	30	40	***	110	140	287
- China	10	45	***	***	5	***	5	70	***	15	120	***	30	40	***	* *	***	***	30	40	***
- Latin America	60	100	***	130	170	***	210	330	***	400	600	500	150	240	***	40	60	***	190	300	350
TOTAL:	170	305	***	305	430	***	700	1065	***	1175	1800	2310	270	400	***	70	100	***	340	500	642
WORLD TOTAL:	1310	1915	***	2485	3240	***	3500	4885	***	7295	10040	12069	4070	5200	***	970	1190	***	5040	6390	[illegible]
Share of Developing Countries in World Total(%)	12.98	15.93	***	12.27	13.27	***	20.0	21.80	***	16.11	17.93	19.14	6.63	7.69	***	7.22	8.40	***	6.75	7.82	7.57

SOURCE: - Annex.to Second World-wide Study on the Petrochemical Industry: Process of Restructuring ID/WG.336/Add.1 dated 20th May,1983.

- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.

*** Denotes data not available.

ANNEX.IV-A.

WORLD PETROCHEMICALS CONSUMPTION (END-PRODUCTS)

THERMO-PLASTICS

(THOUSAND METRIC TONS)

C O U N T R I E S	P.V.C.			H.D.P.E.			L.D.P.E.			P.P.			P.S.			T O T A L			[illegible]	[illegible]
	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	[illegible]	[illegible]
DEVELOPED COUNTRIES																				
- Japan	1000	1520	1110	220	680	523	680	1200	824	440	930	932	600	1130	487	2940	5460	3876	16.6	-14.51
- West Europe	2800	3930	3192	950	1500	1363	2600	4000	3417	600	1300	1403	1250	1700	1095	8200	12430	10470	11.0	- 7.38
- North America	1710	2350	2552	1190	2250	2157	2310	3460	3338	780	1550	1594	1240	1900	1705	7230	12010	11346	13.7	- 2.76
- USSR and East Europe	1000	1430	1150	150	300	350	700	1130	1100	200	280	330	300	450	410	2350	3590	3340	11.2	- 3.48
- Other Industrialized Countries	200	300	430	80	110	170	240	240	260	40	80	120	40	70	80	600	800	1060	7.4	15.00
TOTAL:	6710	10030	8434	2590	4840	4563	6530	10030	8939	2060	4140	4379	3430	5250	3777	21320	34290	30092	12.6.	6.12
DEVELOPING COUNTRIES																				
- Africa	30	50	***	10	10	***	30	50	***	10	20	***	20	20	***	100	150	***	10.7	***
- Middle East - North Africa	70	100	350	20	20	145	70	100	340	10	20	100	20	20	95	190	260	1030	3.2	18.00
- Middle East - West Asia	130	150		40	50		120	180		20	50		40	50		350	480		8.2	
- Asia	360	800	1300	140	400	520	410	900	1220	150	450	600	140	300	320	1200	2850	3560	24.2	11.8
- China	250	360	***	10	50	***	60	260	***	20	90	***	***	40	***	340	800	***	23.7	***
- Latin America	320	650	630	130	310	320	410	720	700	100	220	250	140	270	230	1100	2170	2180	18.6	0.2
TOTAL:	1160	2110	2280	350	840	985	1100	2210	2260	310	850	900	360	700	695	3280	6710	6770	19.6	0.4
WORLD TOTAL:	7870	12140	10714	2940	5680	5548	7630	12270	11199	2370	4990	5329	3790	5950	4472	24600	41000	36862	13.6	- 5.04
Share of Developing Countries in World Total(%)	14.74	17.38	21.28	11.90	14.79	17.75	14.42	18.01	20.18	13.08	17.03	17.83	9.50	11.76	15.54	13.33	16.37	18.37		***

SOURCE: - Annex.to Second World-wide Study on the Petrochemical Industry: Process of Restructuring ID/WG.336/3/Add.1 20 May,1981.

- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemical Vienna 7-9 March,1983.

*** Denotes data not available.

WORLD PETROCHEMICALS CONSUMPTION

END-PRODUCTS

ANNEXURE-IV-3

(THOUSAND METRIC TONS)

C O U N T R I E S	S Y N T H E T I C F I B R E S												INCREASE IN SYNTHETIC FIBRES CONSUMPTION PERCENT PER ANNUM	
	ACRYLIC			POLYAMIDE			POLYESTER			T O T A L				
	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975-79	1979-81
DEVELOPED COUNTRIES														
- Japan	150	270	***	210	280	***	280	510	***	640	1060	1315	13.5	11.5
- West Europe	470	650	***	570	690	***	520	760	***	1570	2100	2893	7.5	17.0
- North America	230	280	***	900	1200	***	1350	1750	***	2480	3230	3921	6.8	10.2
- USSR and East Europe	120	180	***	350	450	***	300	400	***	770	1030	1030	7.5	***
- Other Industrialized Countries	20	40	***	30	40	***	30	60	***	80	140	140	15.0	***
TOTAL:	990	1420	***	2060	2660	***	2490	3480	***	5540	7560	9299	8.1	11.0
DEVELOPING COUNTRIES														
- Africa	10	15	***	20	35	***	35	50	***	65	100	***	11.1	***
- Middle East - North Africa	10	15	***	20	30	***	30	40	***	60	85	220	9.0	1.1
- Middle East - West Asia	10	20	***	40	50	***	50	60	***	100	130		6.8	
- Asia	90	150	***	200	300	***	500	700	***	790	1150	1950	9.8	30.0
- China	40	70	***	***	5	***	40	250	***	80	325	***	42.0	***
- Latin America	70	120	***	150	200	***	240	360	***	460	680	600	10.2	-5.88
TOTAL:	230	390	***	430	620	***	895	1460	***	1555	2470	2770	12.4	5.9
WORLD TOTAL:	1220	1810	***	2490	3280	***	3385	4940	***	7095	10030	12069	9.0	9.7
Share of Developing Countries in World Total(%)	18.85	21.55	***	17.27	18.90	***	26.44	29.55	***	21.92	24.63	22.95	***	***

SOURCE: - Annex.to Second World-wide Study on the Petrochemical Industry: Process of Restructuring ID/WG.336/3/Add.1 dated 20th May,1981.

- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.

*** Denotes data not available.

WORLD PETROCHEMICALS CONSUMPTION — ANNEXURE-IV-C

END-PRODUCTS

(THOUSAND METRIC TONS)

COUNTRIES	SYNTHETIC RUBBER										
	S.B.R.			POLYBUTADIENE			TOTAL			INCREASE IN SYNTHETIC RUBBER CONSUMPTION PERCENT PER ANNUM	
	1975	1979	1981	1975	1979	1981	1975	1979	1981	1975-79	1979-81
DEVELOPED COUNTRIES											
- Japan	350	440	***	100	120	***	450	560	951	5.6	23.0
- West Europe	850	870	***	210	240	***	1060	1110	1734	1.2	25.0
- North America	950	1450	***	300	430	***	1250	1880	2232	10.7	9.0
- USSR and East Europe	1250	1610	***	150	200	***	1400	1810	2450	3.1	16.0
- Other Industrialized Countries	60	80	***	10	20	***	70	100	155	9.3	24.8
TOTAL:	3460	4450	***	770	1010	***	4230	5460	7422	6.6	16.6
DEVELOPING COUNTRIES											
- Africa	10	30	***	***	10	***	10	40	***	42.0	***
- Middle East - North Africa	10	20	***	***	10	***	10	30	60	32.0	7.14
- Middle East - West Asia	20	30	***	***	10	***	20	40		19.0	
- Asia	180	290	***	40	50	***	220	340	450	11.5	15.0
- China	30	90	***	***	***	***	30	90	***	32.0	***
- Latin America	200	310	***	50	70	***	250	380	495	11.0	14.8
TOTAL:	450	770	***	90	150	***	540	920	1005	14.4	4.5
WORLD TOTAL:	3910	5220	***	860	1160	***	4770	6330	8427	7.4	15.0
Share of Developing Countries in world Total (%)	11.51	14.75	***	10.47	12.93	***	11.32	14.42	11.93	***	***

SOURCE:- Annex.to Second World-wide Study on the Petrochemical Industry-Process of Resturcturing ID/WG.336/3/Add.1 dated 20th May,1981.

- The Development of Petrochemical Industries in the Developing Countries,Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.

*** Denotes data not available.

ANNEXURE-V

DEVELOPING ESCAP REGION

CHARATERISTICS OF PETROCHEMICAL INDUSTRY

COUNTRIES	YEAR	VALUE ADDED '000 US$	NUMBER OF EMPLOYEES	MEAN SIZE OF ESTAB-LISHMENT
AFGHANISTAN				
Industrial Chemicals	1980	-	3,830	3,830
Other Chemicals	1980	-	402	80
Petroleum Refineries	1980	-	-	-
Misc. Petr. & Coal Products	-	-	-	-
Plastic Products.	1980	-	771	25
BANGLADESH				
Industrial Chemicals	1979	44,673	5,300	279
Other Chemicals	1979	55,166	23,750	67
Petroleum Refineries	1979	1,609	450	450
Misc. Petr. & Coal Products	1979	-	-	-
Plastic Products	1979	386	640	23
HONG KONG				
Industrial Chemicals	1979	34,476	1,500	12
Other Chemicals	1979	62,298	5,400	12
Petroleum Refineries	-	-	-	-
Misc. Petr. & Coal Products	-	-	-	-
Plastic Products.	1979	416,532	87,900	19
INDIA				
Industrial Chemicals	1978	736,109	165,000	106
Other Chemicals	1978	849,799	262,000	79
Petroleum Refineries	1978	138,967	10,000	303
Misc. Petr. & Coal Products	1978	103,065	30,000	102
Plastic Products.	1978	736,109	165,000	106

ANNEXURE-V Cont'd

	YEAR	VALUE ADDED '000 US$	NUMBER OF EMPLOYEES	MEAN SIZE OF ESTABLISHMENT
INDONESIA				
Industrial Chemicals	1979	129,760	12,700	128
Other Chemicals	1979	95,840	38,100	132
Petroleum Refineries	-	-	-	-
Misc. Petr. & Coal Products	-	-	-	-
Plastic Products.	1979	22,240	16,500	76
IRAN				
Industrial Chemicals	1979	34,340	2,240	172
Other Chemicals	1979	186,883	13,970	155
Petroleum Refineries	1979	577,251	18,400	1,314
Misc. Petr. & Coal Products	1979	1,135	360	120
Plastic Products	1979	112,669	11,710	94
REP. OF KOREA				
Industrial Chemicals	1979	809,666	40,600	57
Other Chemicals	1979	913,999	49,400	84
Petroleum Refineries	1979	334,279	3,600	82
Misc. Petr. & Coal Products	1979	188,419	12,300	42
Plastic Products.	1979	435,306	52,300	53
MALAYSIA, WEST				
Industrial Chemicals	1978	57,476	3,700	46
Other Chemicals	1978	73,034	8,600	63
Petroleum Refineries	1978	75,627	500	100
Misc. Petr. & Coal Products	1978	864	100	17
Plastic Products	1978	41,487	11,500	73
PAKISTAN				
Industrial Chemicals	1976	54,343	11,400	190
Other Chemicals	1976	55,556	40,596	188
Petroleum Refineries	1976	171,344	1,000	250
Misc. Petr. & Coal Products	1976	303	125	125
Plastic Products.	1976	2,222	1,150	44

ANNEXURE-V Cont'd

	YEAR	VALUE ADDED '000 US$	NUMBER OF EMPLOYES	MEAN SIZE OF ESTAB-LISHMENT
PHILLIPINES				
Industrial Chemicals	1977	49,413	9,400	57
Other Chemicals	1977	148,778	23,300	76
Petroleum Refineries	1976	171,344	1,000	250
Misc. Petr. & Coal Products	1976	4,834	100	11
Plastic Products	1977	31,052	19,200	67
SINGAPORE				
Industrial Chemicals	1980	50,935	2,140	48
Other Chemicals	1980	142,056	4,270	48
Petroleum Refineries	1980	686,916	3,340	334
Misc. Petr. & Coal Products	1980	686,916	3,340	334
Plastic Products	1980	81,308	9,150	47
SRILANKA				
Industrial Chemicals	1979	2,377	769	48
Other Chemicals	1979	16,058	4,469	26
Petroleum Refineries	1979	18,884	4,729	4,729
Misc. Petr. & Coal Products	1979	193	291	291
Plastic Products	1979	3,661	1,543	23
THAILAND				
Industrial Chemicals	1975	119,237	7,979	80
Other Chemicals	1975	126,593	25,951	108
Petroleum Refineries	1975	352,193	2,266	453
Misc. Petr. & Coal Products	1975	1,415	440	88
Plastic Products	1975	23,462	3,821	41

SOURCE: ASIAN INDUSTRY IN FIGURES

Statistical profile of Key Sectors in Selected ESCAP Countries. UNIDO/IS.390 15th June,1983.

DEVELOPING ESCAP REGION

ANNEXURE VIII-1

PETROCHEMICALS EXISTING PRODUCTION CAPACITIES (BASIC PRODUCT)

(THOUSAND METRIC TONS)

COUNTRY	ETHYLENE			PROPYLENE			BUTADIENE			T O T A L		
	1977	1979	1980	1977	1979	1980	1977	1979	1980	1977	1979	1980
India	180	240	240	100	120	120	36	50	50	316	410	410
Iran	12	30	30	***	15	15	***	***	***	12	45	45
S.Korea	100	150	505	60	80	268	20	25	25	180	255	798
TOTAL:	292	420	775	160	215	403	56	75	75	508	710	1253

	XYLENES			BENZENE			METHANOL			T O T A L		
	1977	1979	1980	1977	1979	1980	1977	1979	1980	1977	1979	1980
India	17	40	40	69	150	150	33	33	33	119	223	223
S.Korea	***	50	50	100	110	155	390	390	390	490	550	595
Pakistan	***	12	12	***	5	5	***	***	***	***	17	17
TOTAL:	17	102	102	169	265	310	423	423	423	609	790	835

SOURCE: - First World-wide Study on the Petrochemical INdustry 1975-2000 UNIDO/ICIS.83 12 December,1978.

- Second World-wide Study on Petrochemicl Industry: Process of Restructuring ID/WG.336/3 dated 19 May,1981.

- The Development of Petrochemical INdustries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.

*** Denotes data not available.

ANNEXURE-VI-3

DEVELOPING ESCAP REGION

PETROCHEMICALS EXISTING PRODUCTION CAPACITIES (END PRODUCTS)

THERMO-PLASTICS

(THOUSAND METRIC TONS)

COUNTRIES	P.V.C.			POLYSTYRENE			LDPE			HDPE			POLY PROPYLENE			T O T A L		
	1977	1979	1980	1977	1979	1980	1977	1979	1980	1977	1979	1980	1977	1979	1980	1977	1979	1980
Hong Kong	***	***	***	68	68	68	***	***	***	***	***	***	***	***	***	68	68	68
India	80	132	132	24	24	24	50	112	112	30	30	30		30	30	184	328	328
Indonesia	12	40	40	***	***	***	***	***	***	***	***	***	20	37	37	32	77	77
Iran	60	60	60	***	***	***	***	***	***	***	***	***	***	***	***	60	60	60
S.Korea	50	200	300	3	50	117	50	70	150		70	140	105	125	185	208	515	892
Malaysia	***	25	25	7	7	7	***	***	***	***	***	***	***	***	***	7	32	32
Pakistan	5	5	5	***	***	***	5	***	***	***	***	***	***	***	***	10	5	5
Phillipines	29	50	50	13	13	13	***	***	***	***	***	***	***	***	***	42	63	63
Singapore	10	10	10	***	***	***	***	***	***	***	***	***	***	***	***	10	10	10
Thailand	20	20	20	***	15	15	***	***	***	***	***	***	***	***	***	20	35	35
TOTAL:	266	542	642	115	177	244	105	182	262	30	100	170	125	192	252	641	1193	1570

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December, 1978.

- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 dated 19 May, 1981.

- The Development of Petrochemical Industry in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March, 1983.

*** Denotes data not available.

ANNEXURE-VI-C

DEVELOPING ESCAP REGION

PETROCHEMICALS EXISTING PRODUCTION CAPACITIES (END PRODUCTS)

SYNTHETIC FIBRES

(THOUSAND METRIC TONS)

COUNTRY	ACRYLIC			POLYAMIDE			POLYESTER			T O T A L		
	1977	1979	1980	1977	1979	1980	1977	1979	1980	1977	1979	1980
Hong Kong	***	***	***	6	6	6	***	***	***	6	6	6
India	1	16	16	20	40	40	34	60	60	55	116	116
Indonesia	***	6	6	5	8	8	39	55	55	44	69	69
Iran	***	***	***	10	10	10	***	***	20	10	10	30
S.Korea	100	130	130	80	100	100	171	215	215	351	445	445
Malaysia	***	***	***	***	***	***	8	36	36	8	36	36
Pakistan	***	***	***	3	3	3	***	***	13	3	3	13
Phillipines	***	***	***	8	15	15	26	30	50	34	45	65
Singapore	***	***	***	8	8	8	20	20	20	28	28	28
Thailand	***	***	***	10	10	10	77	80	80	87	90	90
TOTAL:	101	152	152	149	200	200	375	496	549	625	848	901

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December,1978.
- Second World-wide Study on Petrochemical Industry: Proces of Restructuring ID/WG.336/3 dated 19 May,1981.
- The Development of Petrochemical Industry in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.

*** Denotes data not available.

ANNEXURE-VI-D

DEVELOPING ESCAP REGION

PETROCHEMICALS EXISTING PRODUCTION CAPACITIES (END-PRODUCTS)

SYNTHETIC RUBBER (THOUSAND METRIC TONS)

COUNTRY	S. B. R.			POLY BUTADIENE			T O T A L		
	1977	1979	1980	1977	1979	1980	1977	1979	1980
India	30	30	30	20	20	20	50	50	50
S.Korea	50	70	100	***	***	30	50	70	130
TOTAL:	80	100	130	20	20	50	100	120	180

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December 1978.

- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 dated 19 May,1981.

- The Development of Petrochemical Industry in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.

*** Denotes data not available.

ANNEXURE-VII-A

DEVELOPING ESCAP REGION
ACTUAL PETROCHEMICAL PRODUCTION
BASIC PRODUCTS

(THOUSAND METRIC TONS)

	ETHYLENE				PROPYLENE				BUTADIENE				T O T A L			
	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980
India	47	57	102	102	33	37	58	58	5	6	7	7	85	100	167	167
S.Korea	96	87	185	373	59	56	111	203	15	17	26	57	170	156	322	633
TOTAL:	143	144	287	475	92	93	169	266	20	19	33	64	255	256	489	805

	XYLENES				BENZENE				METHANOL				T O T A L			
	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980
India	15	15	30	30	56	64	75	75	25	30	30	30	96	109	135	135
S.Korea	51	86	99	120	36	56	65	103	59	175	317	212	146	317	481	435
Pakistan	***	***	***	7	***	***	***	2	***	***	***	***	***	***	***	9
TOTAL:	66	101	129	157	92	120	140	180	84	205	347	242	242	624	616	579

SOURCE:
- First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December,1978.
- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 19 May,1981 & Annex.Ref:ID/WG.336/3/Add.1 20th May,1981.
- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.
- World Petrochemical SRI International.
- Market Study of Petrochemicals,EMAR Petrochemical Ltd.(1980) Karachi Pakistan.

*** Denotes data not available.

DEVELOPING ESCAP REGION

ANNEXURE-III-9

ACTUAL PETROCHEMICALS PRODUCTION (END-PRODUCTS)

THERMO-PLASTICS

(THOUSAND METRIC TONS)

COUNTRY	P V C				P S				L D P E				P P				T O T A L			
	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980	1977	1977	1977	1980
Hong Kong	***	***	***	***	***	40	50	60	***	***	***	***	***	***	***	***	***	40	50	60
India	42	57	89	100	9	15	24	11	51	47	100	98	***	***	20	25	102	119	193	234
Indonesia	8	10	25	25	***	***	***	***	***	***	***	***	***	***	***	***	8	10	25	25
Iran	15	15	20	20	***	***	***	***	***	***	***	***	10	15	20	20	25	30	40	40
S.Korea	68	124	225	237	13	33	38	47	64	64	112	201	60	108	100	146	205	329	475	631
Malaysia	***	***	10	15	3	4	5	5	***	***	***	***	***	***	***	***	3	4	15	20
Pakistan	2	3	4	4	***	***	***	***	***	***	***	***	***	***	***	***	2	3	4	4
Phillipines	8	12	20	25	7	8	10	11	***	***	***	***	***	***	***	***	15	20	30	36
Singapore	***	8	8	8	***	***	***	***	***	***	***	***	***	***	***	***	***	8	8	8
Thailand	10	15	15	15	***	***	8	10	***	***	***	***	***	***	***	***	10	15	23	25
TOTAL:	153	244	386	449	32	100	125	144	115	111	212	299	70	123	140	191	370	576	862	1053

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December,1978.
- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 19 May,1981 & Annex.ID/WG.336/3/Add.1 20th May,1981.
- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.
- World Petrochemical SRI International.
- Market Study of Petrochemicals, EMAR Petrotech Service Ltd.(1980) Karachi Pakistan.

*** Denotes data not available.

ANNEXURE-VII-C

DEVELOPING ESCAP REGION

ACTUAL PETROCHEMICALS PRODUCTION (END-PRODUCTS)

SYNTHETIC FIBRES

(THOUSAND METRIC TONS)

COUNTRY	ACRYLIC				POLYAMIDE				POLYESTER				T O T A L			
	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980
India	***	***	10	12	13	15	20	30	16	26	40	50	29	41	70	92
Indonesia	***	***	4	4	2	3	5	5	20	30	45	45	22	33	54	54
Iran	***	***	***	***	5	6	8	8	***	***	***	***	5	6	8	8
S.Korea	60	90	115	120	59	70	90	90	112	158	180	200	231	318	385	410
Malaysia	***	***	***	***	***	***	***	***	***	5	30	30	***	5	30	30
Pakistan	***	***	***	***	2	2	2	2	***	***	***	8	2	2	2	10
Phillipines	***	***	***	***	4	6	9	10	13	20	25	35	17	26	34	45
Singapore	***	***	***	***	***	6	7	7	10	15	18	18	10	21	25	25
Thailand	***	***	***	***	6	8	9	9	32	65	70	70	38	73	79	79
TOTAL:	60	90	129	136	91	116	150	161	203	319	408	456	354	525	687	753

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December, 1978.

- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 19 May, 1981 & Annex. ID/WG.336/3/Add.1 20th May, 1981.
- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March, 1983.
- World Petrochemical SRI International.
- Market Study of Petrochemicals, ENAR Petrotech Service Limited (1980) Karachi Pakistan.

*** Denotes data not available.

ANNEXURE-VII-D

DEVELOPING ESCAP REGION

ACTUAL PETROCHEMICALS PRODUCTION (END-PRODUCTS)

SYNTHETIC RUBBER

(THOUSAND METRIC TONS)

COUNTRY	S.B.R				P.B.R.				T O T A L			
	1975	1977	1979	1980	1975	1977	1979	1980	1975	1977	1979	1980
India	23	27	28	28	10	15	15	17	33	42	43	45
S.Korea	24	44	62	70	***	***	***	20	24	44	62	90
TOTAL:	47	71	90	98	10	15	15	37	57	86	105	135

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December,1978.

- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 19 May,1981 & Annex.ID/WG.336/3/Add.1 20th May,1981.
- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.
- World Petrochemical SRI International.
- Market Study of Petrochemicals, EWAR Petrochemical Service Limited (1980) Karachi Pakistan.

*** Denotes data not available.

ANNEXURE-VIII-A

DEVELOPING ESCAP REGION

PETROCHEMICALS CONSUMPTION (END-PRODUCTS)

PLASTICS

(THOUSAND METRIC TONS)

COUNTRIES	1965	1970	1975	1980*	INCREASE IN CONSUMPTION PERCENT 1965-75	INCREASE IN CONSUMPTION PERCENT 1975-80
Bangla Desh	***	***	***	14	***	***
Hong Kong	75	150	165	193	8.2	3.2
India	55	110	150	252	10.6	10.9
Indonesia	11	65	145	295	29.5	15.2
Iran	50	100	200	141	15.0	-5.9
S.Korea	25	100	234	577	27.8	15.2
Malaysia	***	***	***	108	***	***
Pakistan	6	20	60	55	26.0	-1.7
Phillipines	37	100	125	93	13.0	-5.1
Singapore	10	25	60	75	19.8	4.6
Srilanka	***	***	***	8	***	***
Thailand	20	95	90	98	16.2	1.6
TOTAL:	289	765	1279	1909	16.1	8.3

NOTE : * 1980 Figures pertain to Thermo-plastics (PE, PVC, PS and PP)

SOURCE - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December,1978.

- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 19 May,1981 & Annex. ID/WG.336/3/Add.1 20th May,1981.
- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO OPEC/OAPEC (IEA) Seminar on Petrochemicals Vienna 7-9 March,1983.
- World Petrochemical SRI International
- Market Study of Petrochemicals, EVAR Petrotech Services Limited (1980) Karachi Pakistan.

*** Denotes data not available.

ANNEXURE-VI.1.1

DEVELOPING ESCAP REGION

PETROCHEMICALS CONSUMPTION (END-PRODUCTS)

SYNTHETIC FIBRES

(THOUSAND METRIC TONS)

COUNTRIES	1965	1970	1975	1980	INCREASE IN CONSUMPTION 1965-75 % /ANNUM	1975-80
Bangla Desh	***	***	***	2	***	***
Hong Kong	2	12	25	25	28.8	***
India	9	22	26	38	11.0	28.0
Indonesia	***	12	96	90	***	-1.3
Iran	2	27	55	57	39.5	0.7
S.Korea	10	68	90	320	24.8	28.8
Malaysia	***	***	10	40	***	32.0
Pakistan	***	6	22	73	***	27.0
Phillipines	7	20	46	54	20.8	3.3
Singapore	30	37	42	7	3.5	-16.7
Thailand	7	24	48	89	21.2	13.0
TOTAL:	67	228	460	845	21.2	12.9

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.83 12 December,1978.

- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 19 May,1981 & Annex. ID/WG.336/3/Add.1 20th May,1981.
- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 7-9 March,1983.
- World Petrochemical SRI International
- Market Study of Petrochemicals, ENAR Petrotech Services Limited (1980) Karachi Pakistan.

*** Denotes data not available.

ANNEXURE-VIII-C

DEVELOPING ESCAP REGION

PETROCHEMICALS CONSUMPTION (END-PRODUCTS)

SYNTHETIC RUBBER

(THOUSAND METRIC TONS)

COUNTRIES	1965	1970	1975	1980	INCREASE IN CONSUMPTION %/ANNUM 1965-75	1975-80
Bangla Desh	***	***	***	0.20	***	***
Hong Kong	4	10	26	13	20.8	-10.0
India	-	***	***	48	***	***
Indonesia	23	35	35	15	4.3	-11.4
Iran	2	8	50	16	32.5	-13.6
S.Korea	10	35	60	127	19.8	16.2
Malaysia	***	***	***	6	***	***
Pakistan	***	***	3	5	***	10.8
Phillipines	12	14	21	13	5.8	-7.6
Singapore	***	***	***	3	***	***
Thailand	***	***	***	9	***	***
TOTAL:	52	102	201	225.20	14.3	2.3

SOURCE: - First World-wide Study on the Petrochemical Industry 1975-2000 UNIDO/ICIS.33 12 December, 1978.

- Second World-wide Study on Petrochemical Industry: Process of Restructuring ID/WG.336/3 19 May, 1981 & Annex. ID/WG.336/3/Add.1 20th May, 1981.
- The Development of Petrochemical Industries in the Developing Countries, Paper presented by UNIDO Secretariat at Joint UNIDO/OPEC/OPEC FUND Seminar on Petrochemicals Vienna 2-9 March, 1983.
- World Petrochemical SRI International
- Market Study of Petrochemicals, EVAR Petrotech Services Limited (1980) Karachi Pakistan.

*** Denotes data not available.

ANNEXURE- IX

PAKISTAN - ECONOMIC PROFILE

- AREA (THOUSAND SQ.KM)		804	
- POPULATION (IN MILLIONS)		1960	1982
		45.61	87.10
- GROSS DOMESTIC PRODUCT (GDP) (IN CURRENT US$ MILLIONS)		3500	24660
e Average Annual Growth in GDP (percent)	- 1960-70	6.70	
	- 1970-82	5.00	
e Distribution of GDP(percent)			
a. Agriculture		46.00	31.00
b. Industry		16.00	25.00
c. Services		38.00	44.00
e Average Annual Growth (percent)		1960-70	1970-82
a. Agriculture		4.90	2.70
b. Industry		10.00	5.90
c. Services		7.00	6.20
- MANUFACTURING VALUE ADDED (MILLIONS OF 1975 US DOLLARS)		1970	1981
		1492	2496
e Distribution of manufacturing value added (percent; 1975 prices)			
a. Food and Agriculture		***	46
b. Textiles and Clothing		***	14
c. Machinery and Transport Equpt.		***	7
d. Chemicals		***	16
e. Other manufacturing		***	17

Cont'd to Annexure- IX

- MERCHANDISE TRADE

e Exports - 1982 (Millions of US Dollars) 2403

	1960-70	1970-82
Average Annual Growth in Exports (percent)	9.90	4.70
Structure of Merchandise Export (Percent)	1960	1981
a. Fuel and Minerals	***	7.00
b. Other Primary Commodities	73.00	40.00
c. Textiles and Clothing	23.00	41.00
d. Machinery and Transport Equpt.	1.00	1.00
e. Other Manufactures	3.00	11.00

e Imports - 1982 (Millions of US Dollars) 5396

	1960-70	1970-82
Average Annual Growth in Imports (percent)	5.40	3.90
Structure of merchandise import (percent)	1960	1981
a. Food	22.00	14.00
b. Fuels	10.00	28.00
c. Other Primary Commodities	2.00	8.00
d. Machinery and Transport Equpt.	27.00	23.00
e. Other Manufactures	39.00	27.00

SOURCE: World Bank Development Report 1980-84, published for the World Bank, Oxford University Press.

*** Denotes data not available.

ANNEXTURE-X

PLASTICS PRODUCTS

IMPORT/LOCAL MARKET (AVERAGE) PRICES

(IN US$ M/T)

YEAR	L.D.P.E.		H.D.P.E.		PVC(RESIN)		P.P.	
	IMPORT PRICES	LOCAL MARKET PRICES	IMPORT PRICES	LOCAL MARKET PRICES	IMPORT PRICES	LOCAL MARKET PRICES	IMPORT PRICES	LOCAL MARKET PRICES
1977	550-600	1270	600	1380	500	1210	610	1320
1978	600-900	1710-2260	750-900	1760-2350	490	1430	600-700	1710
1979	1150-1200	2320	1150	2420	800	1930	900-1000	2090
1980	930	2540	1050	2590	800-600	2040	800-900	2420
1981	750-800	2460	980-1000	2530	500	2090	900	2590
1982	750	2590	940	2760	475	2090	950	2870
1983	830-850	2116	800-910	2116	650-700	1852	870-900	2116
1984 (IInd QRT.)	805-900	1912	810-900	1961	600-625	1615	830-850	2000

SOURCE: Market Study of Petrochemical, ENAR Petrotech Services Ltd (1980) Karachi Pakistan.

ANNEXURE- XI

INDIA - ECONOMIC PROFILE

- AREA (THOUSAND SQ.KM)		3288	
- POPULATION (IN MILLIONS)		1960	1982
		429.0	717.00
- GROSS DOMESTIC PRODUCT (GDP) (IN CURRENT US$ MILLIONS)		29550	150760
e Average Annual Growth in GDP (percent)	- 1960-70	3.40	
	- 1970-82	3.60	
e Distribution of GDP(percent)			
a. Agriculture		50.00	33.00
b. Industry		20.00	26.00
c. Services		30.00	41.00
e Average Annual Growth (percent)		1960-70	1970-82
a. Agriculture		1.90	1.80
b. Industry		5.40	4.30
c. Services		4.60	5.50
- MANUFACTURING VALUE ADDED (MILLIONS OF 1975 US DOLLARS)		1970	1981
		10232	16190
e Distribution of manufacturing value added (percent; 1975 prices)			
a. Food and Agriculture		***	13.00
b. Textiles and Clothing		***	18.00
c. Machinery and Transport Equpt.		***	20.00
d. Chemicals		***	14.00
e. Other manufacturing		***	35.00

Cont'd to Annexure-XI

MERCHANDISE TRADE

- Exports - 1982 (Millions of US Dollars) 8446

	1960-70	1970-82
Average Annual Growth in Exports (percent)	4.70	4.70

Structure of Merchandise Export (Percent)	1960	1981
a. Fuel and Minerals	10.00	8.00
b. Other Primary Commodities	45.00	33.00
c. Textiles and Clothing	35.00	23.00
d. Machinery and Transport Equpt.	1.00	8.00
e. Other Manufactures	9.00	28.00

- Imports - 1982 (Millions of US Dollars) 14088

	1960-70	1970-82
Average Annual Growth in Imports (percent)	-0.90	2.60

Structure of merchandise import (percent)	1960	1981
a. Food	21.00	9.00
b. Fuels	6.00	45.00
c. Other Primary Commodities	28.00	8.00
d. Machinery and Transport Equpt.	30.00	13.00
e. Other Manufactures	15.00	25.00

SOURCE: World Bank Development Report 1980-84, published for the World Bank, Oxford University Press.

*** Denotes data not available.

ANNEXURE-XII

INDIA

IMPORTS AND EXPORTS OF CHEMICALS BY PRODUCT GROUP
('000 US $)

SITC	PRODUCT GROUP	IMPORTS 1970	IMPORTS 1975	IMPORTS 1979	EXPORTS 1970	EXPORTS 1975	EXPORTS 1979
2512	SYNTHETIC RUBBER,ETC.	4004	8142	19806	2	5	6
2652	SYNTHETIC FIBERS	4077	6541	86960	...	3	11
2653	REGENERATED FIBERS	2557	542	67012	9	...	47
2741	SULFHUR,OTHER THAN SUBLIMED	16058	53637	100082	41	57	...
2814	ROASTED IRON PYRITES	...	...	7	...	...	...
512	ORGANIC CHEMICALS	68455	164612	230652	3507	9005	20226
5121	HYDROCARBONS & DERIVATIVES	6404	17541	32712	56	243	838
5122	ALCOHOLS,PHENOLS,ETC.	7279	11158	37659	767	305	5497
5123	ETHERS,EPOXIDES,ACETALS	435	309	4805	3	34	31
5124	ALDEHYDE-,ETC. FUNCTION COMP.	1539	2198	8965	1320	2740	7234
5125	ACIDS & DERIVATIVES	5637	8997	13123	608	864	1701
5126	INORGANIC ESTERS,ETC.	273	260	580	15	...	20
5127	NITROGEN-FUNCTION COMPOUNDS	29223	95697	27908	138	3529	3304
5128	ORGANO-INORGANIC COMPOUNDS	2352	6399	24729	152	43	36
5129	OTHER ORGANIC CHEMICALS	15313	42054	79972	448	1247	1565
513	INORGANIC CHEMICALS	13056	37150	67777	2189	11416	5658
5131	OXYGEN,NITROGEN,ETC.	124	185	...	76	28	...
5132	CHEMICAL ELEMENTS,N.E.S.	5987	8185	10146	246	901	2131
5133	INORGANIC ACIDS,ETC.	269	22145	22214	622	2769	1319
5134	HALOGEN COMP. OF NON-METALS	101	99	501	...	2	13
5135	METALLIC OXIDES	3327	3454	9881	672	768	1175
5136	OTHER INORGANIC BASES	3247	3081	25035	573	5948	1020
514	OTHER INORGANIC CHEMICALS	7992	9564	40671	3335	10773	14745
5141	METALLIC SALTS & PEROXYSALTS	1690	2098	9226	1669	2695	7287
5142	OTHER METALLIC SALTS(I)	3543	1268	25618	1031	6513	2277
5143	OTHER METALLIC SALTS(II)	2005	2733	1585	518	947	1875
5149	INORG. CHEM. PRODUCTS,N.E.S.	754	3465	4242	116	618	3305
53	DYEING,TANNING,ETC. MATERIALS	11523	14939	28007	8386	23167	48741
531	SYNTHETIC ORG. DYESTUFFS,ETC.	5452	4586	9175	2902	12157	31754
532	DYEING & TANNING EXTRACTS,ETC.	4221	6814	14258	338	275	1216
5321	DYEING EXTRACTS	267	796	...	112	204	...
5323	SYNTHETIC TANNING MATERIALS	141	71	1969	176	15	137
5324	TANNING EXTR.(VEGETABLE ORIG.)	3671	5888	12289	50	56	1080
5325	TANNIC ACIDS	142	59	...	...	...	...
533	PIGMENTS,PAINTS,ETC.	1850	3540	4575	5147	10735	15771
5331	COLOURING MATERIALS,N.E.S.	564	413	332	298	136	3238
5332	PRINTING INKS	8	115	237	94	157	219
5333	PREPARED PAINTS,ETC.	1279	3011	4006	4755	10442	12315
541	MEDICINAL & PHARM. PRODUCTS	31044	43567	96423	11216	28543	75363
5411	VITAMINS & PROVITAMINS	3416	3154	4736	155	112	328
5413	PENICILLIN,STREPTOMYCIN,ETC.	3363	4350	6923	1599	3211	294
5414	OPIUM ALKALOIDS,ETC.	859	686	946	1716	3649	3179
5415	HORMONES	72	382	473	...	58	31
5416	GLYCOSIDES,ETC.	354	968	2062	95	168	528
5417	MEDICAMENTS	22853	33726	80617	7246	17756	69016
5419	PHARMACEUTICAL GOODS	127	299	666	405	3589	1985
55	ESSENTIAL OILS,ETC.	2511	2768	7375	9666	18282	29814
551	ESSENTIAL OILS,PERFUME	2350	2475	5489	5293	5643	4190
5511	ESSENTIAL OILS & RESINOIDS	2214	2097	5225	5229	5579	4002
5512	SYNTHETIC PERFUME,ETC.	136	379	264	64	64	188
553	PERFUMERY & COSMETICS	44	87	65	3072	6739	17470
554	SOAPS,CLEANSING,ETC. PREPS.	117	206	1821	1302	5899	8154
5541	SOAPS	33	23	118	905	1553	2101
5542	SURFACE-ACTING AGENTS	29	40	1208	331	4083	5203
5543	POLISHES,PASTES,ETC.	55	143	495	65	263	850
561	FERTILIZERS,MANUFACTURED	63584	745424	405362	...	...	6
5611	NITROGENOUS FERTILIZERS	47016	466885	167973	...	...	...
5612	PHOSPHATIC FERTILIZERS	64	20840	41191	...	...	...
5613	POTASSIC FERTILIZERS	6660	34803	137273	...	...	6
5619	FERTILIZERS,N.E.S.	9836	222859	58925	...	...	...
5711	EXPLOSIVES,ETC.	305	550	2406	...	116	347
5712	FUSES,PRIMERS & DETONATORS	77	88	...	118	636	1440
5713	PYROTECHNICAL ARTICLES	8	337	...	10	9	58
5811	PRODUCTS OF CONDENSATION,ETC.	1479	2930	13104	58	51	256
6674	SYNTHETIC PRECIOUS STONES	39	89	211	569	252	1969
8623	CHEM. PRODS. FOR PHOTOGRAPHY	249	378	448	...	4	1
TOTAL	CHEMICAL INDUSTRY	229022	1111239	1171312	39114	102318	198688

INDIA

ANNEXURE-XII

IMPORTS AND EXPORTS OF PETROCHEMICALS BY PRODUCT GROUP
('000 US $)

SITC	PRODUCT GROUP	IMPORTS 1970	IMPORTS 1975	IMPORTS 1979	EXPORTS 1970	EXPORTS 1975	EXPORTS 1979
3216	LIGNITE BRIQUETTES	...	...	...	7	...	...
3218	COKE & SEMI-COKE OF COAL,ETC.	191	16	1	2011	989	33
332	PETROLEUM PRODUCTS	35443	223263	841673	11377	20679	17012
3321	MOTOR SPIRIT	1251	8404	...	4555	4967	1618
3322	LAMP OIL & WHITE SPIRIT	7697	141784	...	2442	10135	7770
3323	DISTILLATE FUELS	...	...	841673	3197	...	27
3324	RESIDUAL FUEL OILS	3404	73075	...	171	5576	6236
3325	LUBRICATING OILS & GREASES	22285	...	...	248	...	685
3326	MINERAL JELLY & WAXES	758	...	...	402	...	5
3329	PITCH,RESIN,ETC.	49	...	...	363	...	670
3411	GAS,NATURAL	9	-	54	...	...	...
3412	GAS,MANUFACTURED	40	18	3	5	6	-
521	MINERAL TAR,ETC.	584	876	...	2293	7540	5727
5211	MINERAL TAR	40	46	...	9	180	...
5214	DISTILL. PRODS. OF COAL TAR	544	829	...	2284	7360	5727
5812	PRODS. OF POLYMERIZATION,ETC.	3504	12738	70691	3999	613	1575
893	ARTS. OF ARTIFICIAL PLASTIC M.	364	1075	2658	1811	6453	12830
TOTAL	PETROCHEMICAL INDUSTRY	40135	237986	915079	21505	36281	37177

REPUBLIC OF SOUTH KOREA - ECONOMIC PROFILE

- AREA (THOUSAND SQ.KM)		98	
- POPULATION (IN MILLIONS)		1960	1982
		24.95	39.30
- GROSS DOMESTIC PRODUCT (GDP) (IN CURRENT US$ MILLIONS)		3810	68420
e Average Annual Growth in GDP (percent)	- 1960-70	8.60	
	- 1970-82	8.60	
e Distribution of GDP(percent)			
a. Agriculture		37.00	16.00
b. Industry		20.00	39.00
c. Services		43.00	45.00
e Average Annual Growth (percent)		1960-70	1970-8.
a. Agriculture		4.40	2.90
b. Industry		17.20	13.60
c. Services		8.90	7.80
- MANUFACTURING VALUE ADDED (MILLIONS OF 1975 US DOLLARS)		1970	1981
		2346	10542
e Distribution of manufacturing value added (percent; 1975 prices)			
a. Food and Agriculture		***	16.00
b. Textiles and Clothing		***	23.00
c. Machinery and Transport Equpt.		***	18.00
d. Chemicals		***	11.00
e. Other manufacturing		***	32.00

Cont'd to Annexure- XIII

- MERCHANDISE TRADE

e Exports - 1982(Millions of US Dollars) 21853

	1960-70	1970-82
Average Annual Growth in Exports (percent)	34.70	20.20
Structure of Merchandise Export (Percent)	1960	1981
a. Fuel and Minerals	30.00	2.00
b. Other Primary Commodities	56.00	8.00
c. Textiles and Clothing	8.00	30.00
d. Machinery and Transport Equpt.	***	22.00
e. Other Manufactures	6.00	38.00

e Imports - 1982(Millions of US Dollars) 24251

	1960-70	1970-82
Average Annual Growth in Imports (percent)	19.70	9.80
Structure of merchandise import (percent)	1960	1981
a. Food	10.00	12.00
b. Fuels	7.00	30.00
c. Other Primary Commodities	25.00	15.00
d. Machinery and Transport Equpt.	12.00	23.00
e. Other Manufactures	46.00	20.00

SOURCE: World Bank Development Report 1980-84, published for the World Bank, Oxford University Press.

*** Denotes data not available.

ANNEXURE-XIV

REPUBLIC OF SOUTH KOREA

IMPORTS AND EXPORTS OF CHEMICALS BY PRODUCT GROUP
('000 US $)

SITC	PRODUCT GROUP	IMPORTS 1970	IMPORTS 1975	IMPORTS 1980	EXPORTS 1970	EXPORTS 1975	EXPORTS 1980
2312	SYNTHETIC RUBBER,ETC.	4201	14920	96385	47	14	327
2662	SYNTHETIC FIBRES	30376	28326	24878	2914	7318	41455
2663	REGENERATED FIBRES	7007	10516	13352	-	38	1308
2741	SULPHUR,OTHER THAN SUBLIMED	4422	16455	49409	2	...	351
2814	ROASTED IRON PYRITES	...	...	343	...	...	...
512	ORGANIC CHEMICALS	61665	339066	949975	999	31489	159103
5121	HYDROCARBONS & DERIVATIVES	8372	43686	209511	247	5118	23873
5122	ALCOHOLS,PHENOLS,ETC.	7420	45968	93280	8	263	36605
5123	ETHERS,EPOXIDES,ACETALS	1077	4735	20680	...	10	1968
5124	ALDEHYDE-,ETC. FUNCTION COMP.	1437	8034	31604	-	194	6
5125	ACIDS & DERIVATIVES	8600	96700	198100	35	660	11416
5126	INORGANIC ESTERS,ETC.	4207	14297	20375	...	...	110
5127	NITROGEN-FUNCTION COMPOUNDS	13095	60377	121089	626	21174	60637
5128	ORGANO-INORGANIC COMPOUNDS	16711	63208	249261	83	3627	11815
5129	OTHER ORGANIC CHEMICALS	747	2061	6075	...	442	12674
513	INORGANIC CHEMICALS	10569	27395	77166	321	554	11042
5131	OXYGEN,NITROGEN,ETC.	126	264	489	...	7	-
5132	CHEMICAL ELEMENTS,N.E.S.	1492	2429	11857	-	14	2
5133	INORGANIC ACIDS,ETC.	2203	8047	8379	268	111	2297
5134	HALOGEN COMP. OF NON-METALS	117	203	942	-	...	19
5135	METALLIC OXIDES	2321	4083	8576	17	200	2086
5136	OTHER INORGANIC BASES	4309	12369	46922	35	222	6636
514	OTHER INORGANIC CHEMICALS	5529	23875	61729	256	9070	40076
5141	METALLIC SALTS & PEROXYSALTS	754	3241	7678	230	466	577
5142	OTHER METALLIC SALTS(I)	2909	11297	26615	6	3852	4441
5143	OTHER METALLIC SALTS(II)	1261	6549	21742	-	4714	23824
5149	INORG. CHEM. PRODUCTS,N.E.S.	604	2789	5693	20	39	11234
515	RADIOACTIVE MATERIALS	50	110	3978	...	...	10
5151	RADIOACTIVE CHEM. ELEMENTS	39	100	3731	...	...	10
5152	STABLE ISOTOPES & THEIR COMP.	1	1	4	...	...	...
5153	COMPOUNDS OF THORIUM,ETC.	10	8	243	...	...	...
53	DYEING,TANNING,ETC. MATERIALS	11649	78857	143896	37	2635	21578
531	SYNTHETIC ORG. DYESTUFFS,ETC.	7333	42631	79423	33	1957	15795
532	DYEING & TANNING EXTRACTS,ETC.	363	1881	5805	-	29	23
5321	DYEING EXTRACTS	5	30	255	...	-	...
5323	SYNTHETIC TANNING MATERIALS	141	1429	4581	...	-	23
5324	TANNING EXTR.(VEGETABLE ORIG.)	201	391	968	-	6	...
5325	TANNIC ACIDS	16	31	...	...	22	...
533	PIGMENTS,PAINTS,ETC.	3954	34345	58669	4	649	5760
5331	COLOURING MATERIALS,N.E.S.	779	5145	19024	...	54	2568
5332	PRINTING INKS	145	214	181	-	7	6
5333	PREPARED PAINTS,ETC.	3030	28986	39464	4	588	3186
541	MEDICINAL & PHARM. PRODUCTS	15219	27483	72332	1365	9669	19631
5411	VITAMINS & PROVITAMINS	895	1989	6205	1	69	480
5413	PENICILLIN,STREPTOMYCIN,ETC.	6260	15125	34726	2	411	3621
5414	OPIUM ALKALOIDS,ETC.	344	1624	3271	...	...	-
5415	HORMONES	1064	2684	5708	...	...	2569
5416	GLYCOSIDES,ETC.	713	1157	6347	3	1473	862
5417	MEDICAMENTS	5749	4227	13871	1359	5169	8522
5419	PHARMACEUTICAL GOODS	194	676	2203	-	2547	3576
55	ESSENTIAL OILS,ETC.	5160	21632	56893	169	2238	9664
551	ESSENTIAL OILS,PERFUME	1335	8662	26060	37	12	86
5511	ESSENTIAL OILS & RESINOIDS	79	2399	4687	1	...	1
5512	SYNTHETIC PERFUME,ETC.	1256	6263	21373	36	12	85
553	PERFUMERY & COSMETICS	780	421	3076	110	224	322
554	SOAPS,CLEANSING,ETC. PREPS.	3044	12549	27758	22	2002	9256
5541	SOAPS	125	165	1257	1	1352	6075
5542	SURFACE-ACTING AGENTS	2848	12030	24782	20	531	3178
5543	POLISHES,PASTES,ETC.	71	355	1718	-	119	3
561	FERTILIZERS,MANUFACTURED	4083	139684	36825	6333	30	343639
5611	NITROGENOUS FERTILIZERS	825	10467	459	5698	30	150576
5612	PHOSPHATIC FERTILIZERS	-	63939	6	-	...	4626
5613	POTASSIC FERTILIZERS	2584	64913	36282	-	-	-
5619	FERTILIZERS,N.E.S.	673	565	78	635	-	188437
5711	PROPELLENT POWDERS,ETC.	47	8	481	21	20	139
5712	FUSES,PRIMERS & DETONATORS	-	-	98	3	11	456
5713	PYROTECHNICAL ARTICLES	1	4	138	...	480	2273
5811	PRODUCTS OF CONDENSATION,ETC.	11721	23366	66314	11	4594	14904
6674	SYNTHETIC PRECIOUS STONES	44	773	4738	141	234	6473
8523	CHEM. PRODS. FOR PHOTOGRAPHY	131	770	4830	57	15	38
TOTAL	CHEMICAL INDUSTRY	171374	753439	1663758	12675	68409	672468

ANNEXURE-XIV

REPUBLIC OF SOUTH KOREA

IMPORTS AND EXPORTS OF PETROCHEMICALS BY PRODUCT GROUP
('000 US $)

SITC	PRODUCT GROUP	IMPORTS 1970	IMPORTS 1975	IMPORTS 1980	EXPORTS 1970	EXPORTS 1975	EXPORTS 1980
3215	BRIQUETTES OF COAL	-	-	1404	-	-	-
3216	LIGNITE BRIQUETTES	7	...	12	...	...	...
3218	COKE & SEMI-COKE OF COAL,ETC.	2710	10280	13914	...	-	-
33102	PETROLEUM,PARTLY REFINED	2092	3622	...	...	-	...
332	PETROLEUM PRODUCTS	7611	68059	530476	4702	95040	29417
3321	MOTOR SPIRIT	4	1959	52290	3243	25229	-
3322	LAMP OIL & WHITE SPIRIT	349	471	7602	-	27615	206
3323	DISTILLATE FUELS	1	880	63	-	21366	879
3324	RESIDUAL FUEL OILS	-	31833	352559	1460	10631	19687
3325	LUBRICATING OILS & GREASES	2925	24893	94802	-	4579	3616
3326	MINERAL JELLY & WAXES	1219	2774	9680	...	1	649
3329	PITCH,RESIN,ETC.	3112	5250	13480	-	5618	4379
3411	GAS,NATURAL	1	5	26057	11	9120	3832
3412	GAS,MANUFACTURED	2	-	-	-	...	...
521	MINERAL TAR,ETC.	275	3890	21811	6	6285	13101
5211	MINERAL TAR	119	281	39	-	67	1498
5213	AMMONIACAL GAS LIQUORS	...	-	...	6	...	...
5214	DISTILL. PRODS. OF COAL TAR	155	3609	21772	...	6218	11603
5812	PRODS. OF POLYMERIZATION,ETC.	22260	56327	157301	1709	3238	126946
58132	REGENERATED CELLULOSE,ETC.	2614	9165	22897	8	796	1681
85101	FOOTWEAR WITH PLASTIC MATERIAL	27	2	141	11245	54046	110690
893	ARTS. OF ARTIFICIAL PLASTIC M.	3583	9327	23322	2211	86601	103699
TOTAL	PETROCHEMICAL INDUSTRY	41181	160677	797336	19893	255126	389365

ANNEXURE- XV

INDONESIA - ECONOMIC PROFILE

- AREA (THOUSAND SQ.KM)		1919	
- POPULATION (IN MILLIONS)		1960	1982
		95.445	152.60
- GROSS DOMESTIC PRODUCT (GDP) (IN CURRENT US$ MILLIONS)		8670	90160
e Average Annual Growth in GDP (percent)	- 1960-70	3.90	
	- 1970-82	7.70	
e Distribution of GDP(percent)			
a. Agriculture		54.00	26.00
b. Industry		-14.00	39.00
c. Services		32.00	35.00
e Average Annual Growth (percent)		1960-70	1970-82
a. Agriculture		2.70	3.80
b. Industry		5.20	10.70
c. Services		4.80	9.30
- MANUFACTURING VALUE ADDED (MILLIONS OF 1975 US DOLLARS)		1970	1981
		1517	5998
e Distribution of manufacturing value added (percent; 1975 prices)			
a. Food and Agriculture		***	28.00
b. Textiles and Clothing		***	8.00
c. Machinery and Transport Equpt.		***	7.00
d. Chemicals		***	12.00
e. Other manufacturing		***	45.00

Cont'd to Annexure-XV

- MERCHANDISE TRADE

e Exports - 1982 (Millions of US Dollars) 22294

	1960-70	1970-82
Average Annual Growth in Exports (percent)	3.50	4.40
Structure of Merchandise Export (Percent)	1960	1981
a. Fuel and Minerals	33.00	83.00
b. Other Primary Commodities	67.00	13.00
c. Textiles and Clothing	***	1.00
d. Machinery and Transport Equpt.	***	1.00
e. Other Manufactures	***	2.00

e Imports - 1982 (Millions of US Dollars) 16859

	1960-70	1970-82
Average Annual Growth in Imports (percent)	1.90	12.30
Structure of merchandise import (percent)	1960	1981
a. Food	23.00	11.00
b. Fuels	5.00	13.00
c. Other Primary Commodities	10.00	6.00
d. Machinery and Transport Equpt.	17.00	36.00
e. Other Manufactures	45.00	34.00

SOURCE: World Bank Development Report 1980-84, published for the World Bank, Oxford University Press.

*** Denotes data not available.

INDONESIA

ANNEXURE-XVI

IMPORTS AND EXPORTS OF CHEMICALS BY PRODUCT GROUP
('000 US $)

SITC	PRODUCT GROUP	IMPORTS 1970	IMPORTS 1975	IMPORTS 1980	EXPORTS 1970	EXPORTS 1975	EXPORTS 1980
2312	SYNTHETIC RUBBER,ETC.	...	1351	19172	...	...	...
2612	SYNTHETIC FIBRES	...	30813	42889	...	...	...
2613	REGENERATED FIBRES	...	1425	52119	...	...	...
2741	SULPHUR,OTHER THAN SUBLIMED	...	430	327	15	...	...
512	ORGANIC CHEMICALS	6260	61886	348892	...	1146	8983
5121	HYDROCARBONS & DERIVATIVES	...	10343	69164	...	...	...
5122	ALCOHOLS,PHENOLS,ETC.	...	6318	41707	...	1112	6155
5123	ETHERS,EPOXIDES,ACETALS	...	673	2274	...	...	916
5124	ALDEHYDE-,ETC. FUNCTION COMP.	...	1990	5496	...	...	1
5125	ACIDS & DERIVATIVES	3687	16363	97548	...	...	235
5126	INORGANIC ESTERS,ETC.	...	121	3733	...	...	...
5127	NITROGEN-FUNCTION COMPOUNDS	...	7672	35395	...	6	1670
5128	ORGANO-INORGANIC COMPOUNDS	...	16446	88790	...	6	...
5129	OTHER ORGANIC CHEMICALS	2311	1961	4786	...	23	6
513	INORGANIC CHEMICALS	6393	31948	85309	...	692	1513
5131	OXYGEN,NITROGEN,ETC.	...	575	453	...	...	...
5132	CHEMICAL ELEMENTS,N.E.S.	...	7805	32569	...	610	272
5133	INORGANIC ACIDS,ETC.	...	2567	6739	...	...	...
5134	HALOGEN COMP. OF NON-METALS	...	90	158	...	...	...
5135	METALLIC OXIDES	...	6072	18505	...	15	...
5136	OTHER INORGANIC BASES	4387	14838	26885	...	66	1241
514	OTHER INORGANIC CHEMICALS	7267	25616	80831	...	46	1825
5141	METALLIC SALTS & PEROXYSALTS	...	2784	9641	...	44	36
5142	OTHER METALLIC SALTS(I)	1620	16621	55485	...	2	1
5143	OTHER METALLIC SALTS(II)	4673	1980	5686	...	...	2
5149	INORG. CHEM. PRODUCTS,N.E.S.	...	4231	10019	...	...	1785
515	RADIOACTIVE MATERIALS	...	139	921	...	...	...
5151	RADIOACTIVE CHEM. ELEMENTS	...	43	232	...	...	...
5152	STABLE ISOTOPES & THEIR COMP.	...	8	1	...	...	...
5153	COMPOUNDS OF THORIUM,ETC.	...	88	689	...	...	...
53	DYEING,TANNING,ETC. MATERIALS	15492	57092	97439	289	134	1540
531	SYNTHETIC ORG. DYESTUFFS,ETC.	10150	44430	70222	...	...	216
532	DYEING & TANNING EXTRACTS,ETC.	...	1201	2984	289	65	1251
5321	DYEING EXTRACTS	...	533	202	40	...	...
5323	SYNTHETIC TANNING MATERIALS	...	450	2257	...	...	...
5324	TANNING EXTR.(VEGETABLE ORIG.)	...	191	450	249	65	1251
5325	TANNIC ACIDS	...	27	76	...	...	...
533	PIGMENTS,PAINTS,ETC.	5289	11461	24233	...	69	72
5331	COLOURING MATERIALS,N.E.S.	...	2098	5822	...	...	3
5332	PRINTING INKS	...	1127	2369	...	4	...
5333	PREPARED PAINTS,ETC.	...	8237	16043	...	64	70
541	MEDICINAL & PHARM. PRODUCTS	20825	32643	79871	2729	12428	11668
5411	VITAMINS & PROVITAMINS	...	2939	14820	...	...	99
5413	PENICILLIN,STREPTOMYCIN,ETC.	...	12474	35960	...	73	58
5414	OPIUM ALKALOIDS,ETC.	...	1623	3160	2724	11592	6750
5415	HORMONES	...	1528	7140	...	...	...
5416	GLYCOSIDES,ETC.	...	936	2269	...	15	...
5417	MEDICAMENTS	7193	11454	14740	5	718	4761
5419	PHARMACEUTICAL GOODS	13419	1689	1783	...	29	...
55	ESSENTIAL OILS,ETC.	4908	15288	40740	2112	9610	21571
551	ESSENTIAL OILS,PERFUME	3246	6843	14774	2109	9588	21177
5511	ESSENTIAL OILS & RESINOIDS	...	1450	1833	2109	9582	21127
5512	SYNTHETIC PERFUME,ETC.	2789	5394	12941	...	7	50
553	PERFUMERY & COSMETICS	...	2413	3578	-	4	302
554	SOAPS,CLEANSING,ETC. PREPS.	...	6032	22387	4	18	92
5541	SOAPS	...	1811	744	4	18	91
5542	SURFACE-ACTING AGENTS	...	3851	21143	...	...	2
5543	POLISHES,PASTES,ETC.	...	370	501	...	...	...
561	FERTILIZERS,MANUFACTURED	16691	401262	71915	2	177	34892
5611	NITROGENOUS FERTILIZERS	9515	278453	16792	...	177	34892
5612	PHOSPHATIC FERTILIZERS	2298	109288	24007	...	...	...
5613	POTASSIC FERTILIZERS	...	4786	26346	...	...	...
5619	FERTILIZERS,N.E.S.	4073	8734	4771	2	...	...
5711	PROPELLENT POWDERS,ETC.	...	2695	6562	...	...	...
5712	FUSES,PRIMERS & DETONATORS	...	949	2503	...	...	...
5713	PYROTECHNICAL ARTICLES	...	70	55	...	...	...
5811	PRODUCTS OF CONDENSATION,ETC.	...	8659	49888	...	1	3
6674	SYNTHETIC PRECIOUS STONES	...	-	1	...	...	...
8623	CHEM. PRODS. FOR PHOTOGRAPHY	...	939	1956	...	...	...
TOTAL	CHEMICAL INDUSTRY	77836	673205	981390	5147	24233	81995

ANNEXURE-XVI

INDONESIA

IMPORTS AND EXPORTS OF PETROCHEMICALS BY PRODUCT GROUP
('000 US $)

SITC	PRODUCT GROUP	IMPORTS 1970	IMPORTS 1975	IMPORTS 1980	EXPORTS 1970	EXPORTS 1975	EXPORTS 1980
3215	BRIQUETTES OF COAL	...	21	104	...	17	...
3216	LIGNITE BRIQUETTES	...	...	99	...	...	...
3218	COKE & SEMI-COKE OF COAL,ETC.	...	1866	5343	...	...	...
33102	PETROLEUM,PARTLY REFINED	...	46322	88804	...	10195	...
332	PETROLEUM PRODUCTS	14080	198582	692224	37863	395241	1187458
3321	MOTOR SPIRIT	...	8863	71688	2688	11146	109
3322	LAMP OIL & WHITE SPIRIT	941	61660	271470	342	233275	96
3323	DISTILLATE FUELS	485	10957	74254	2272	27658	462
3324	RESIDUAL FUEL OILS	...	62485	149307	30751	91852	1178253
3325	LUBRICATING OILS & GREASES	5494	19788	72433	...	1	317
3326	MINERAL JELLY & WAXES	...	895	3047	1810	3081	8221
3329	PITCH,RESIN,ETC.	5897	33934	50026	...	498	...
3411	GAS,NATURAL	...	689	3789	...	...	2881241
3412	GAS,MANUFACTURED	...	13	43	...	...	...
521	MINERAL TAR,ETC.	...	537	837	...	4	1679
5211	MINERAL TAR	...	86	114	...	...	...
5213	AMMONIACAL GAS LIQUORS	...	1	130	...	...	...
5214	DISTILL. PRODS. OF COAL TAR	...	451	594	...	4	1679
5812	PRODS. OF POLYMERIZATION,ETC.	...	68064	213560	...	3	26
58132	REGENERATED CELLULOSE,ETC.	...	6118	27639	...	...	...
85101	FOOTWEAR WITH PLASTIC MATERIAL	...	492	438	...	18	775
893	ARTS. OF ARTIFICIAL PLASTIC M.	...	9042	23866	...	2	127
TOTAL	PETROCHEMICAL INDUSTRY	14080	331748	1056745	37863	405480	4071306

ANNEXURE- XVII

THAILAND - ECONOMIC PROFILE

- AREA (THOUSAND SQ.KM)		514	
- POPULATION (IN MILLIONS)		1960	1982
		26.634	48.50
- GROSS DOMESTIC PRODUCT (GDP) (IN CURRENT US$ MILLIONS)		2550	36790
e Average Annual Growth in GDP (percent)	- 1960-70	8.40	
	- 1970-82	7.10	
e Distribution of GDP(percent)			
a. Agriculture		40.00	22.00
b. Industry		19.00	28.00
c. Services		41.00	50.00
e Average Annual Growth (percent)		1960-70	1970-82
a. Agriculture		5.60	4.40
b. Industry		11.90	9.30
c. Services		9.10	7.40
- MANUFACTURING VALUE ADDED (MILLIONS OF 1975 US DOLLARS)		1970	1981
		1675	4636
e Distribution of manufacturing value added (percent; 1975 prices)			
a. Food and Agriculture		***	31.00
b. Textiles and Clothing		***	26.00
c. Machinery and Transport Equpt.		***	15.00
d. Chemicals		***	3.00
e. Other manufacturing		***	25.00

Cont'd to Annexure-XVII

MERCHANDISE TRADE . . . .

e Exports - 1982 (Millions of US Dollars) 6945

	1960-70	1970-82
Average Annual Growth in Exports (percent)	5.20	9.10
Structure of Merchandise Export (Percent)	1960	1981
a. Fuel and Minerals	7.00	8.00
b. Other Primary Commodities	91.00	65.00
c. Textiles and Clothing	***	10.00
d. Machinery and Transport Equpt.	***	5.00
e. Other Manufactures	2.00	12.00

e Imports - 1982 (Millions of US Dollars) 8548

	1960-70	1970-82
Average Annual Growth in Imports (percent)	11.30	4.30
Structure of merchandise import (percent)	1960	1981
a. Food	10.00	4.00
b. Fuels	11.00	30.00
c. Other Primary Commodities	11.00	8.00
d. Machinery and Transport Equpt.	25.00	26.00
e. Other Manufactures	43.00	32.00

SOURCE: World Bank Development Report 1980-84, published for the World Bank, Oxford University Press.

*** Denotes data not available.

	1977				1978				1979				1980			
	I QTR	II QTR	III QTR	IV QTR	I QTR	II QTR	III QTR	IV QTR	I QTR	II QTR	III QTR	IV QTR	I QTR	II QTR	III QTR	IV QTR
STYRENE	337	332	320	325	340	[illegible]	[illegible]	325	470	545	[illegible]	630	[illegible]	[illegible]	[illegible]	[illegible]
LDPE	663	659	610	615	640	475	610	615	650	900	1090	1110	1240	[illegible]	[illegible]	[illegible]
HDPE	750	760	750	670	730	740	750	670	545	1000	[illegible]	1200	[illegible]	1125	[illegible]	930
PVC	570	571	560	580	[illegible]	545	[illegible]	530	675	1130	[illegible]	540	[illegible]	[illegible]	[illegible]	[illegible]
PP	920	723	550	500	610	615	650	500	670	1050	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	620
EG	450	450	450	360	350	315	370	360	520	690	750	800	330	715	610	550

	1981				1982				1983				1984			
	I QTR	II QTR	III QTR	IV QTR	I QTR	II QTR	III QTR	IV QTR	I QTR	II QTR	III QTR	IV QTR	I QTR	II QTR	III QTR	IV QTR
STYRENE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	625	565	553	565	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
LDPE	[illegible]	[illegible]	[illegible]	[illegible]	***	670	655	632	635	[illegible]	***	***	[illegible]	740		
HDPE	860	[illegible]	840	[illegible]	***	747	752	[illegible]	[illegible]	724	***	***	727	725		
PVC	[illegible]	[illegible]	645	[illegible]	***	425	[illegible]	[illegible]	[illegible]	[illegible]	***	***	[illegible]	[illegible]		
PP	[illegible]	740	[illegible]	840	***	[illegible]	[illegible]	[illegible]	721	[illegible]	***	***	[illegible]	[illegible]		
EG	650-675	675	570	580	***	398	395	420	412	411	***	***	451	443		

SOURCE: - European Chemical News (ECN) Business Press International Ltd.
- The International Petrochemical Report, McGraw - Hill Inc.
- Price News Letter, [illegible] Systems International Ltd.

*** Denotes data not available.

ANNEXURE-XIX-A

WORLD PETROCHEMICALS PROJECTED DEMAND(END-PRODUCTS)

THERMO-PLASTICS

(THOUSAND METRIC TONS)

COUNTRIES	P.V.C.		H.D.P.E.		L.D.P.E.		P.P.		P.S.		T O T A L		Growth Rate (%)
	1985	1990	1985	1990	1985	1990	1985	1990	1985	1990	1985	1990	1985-90
DEVELOPED COUNTRIES													
Japan	1775	2020	739	770	1060	1080	1125	1320	1290	1450	6089	6640	2.0
W.Europe	4686	5430	1930	2380	4608	5190	2130	3350	2190	2700	15594	19050	4.1
N.America	4153	5690	3051	3930	4616	5860	2489	3690	2706	3640	17015	22810	6.1
USSR and E.Europe	2122	2850	760	1150	1778	2500	527	800	462	900	5829	8200	7.1
Other Industrialized Countries	335	430	167	210	336	410	104	130	94	120	1036	1300	4.7
TOTAL:	13071	16420	6647	8440	12418	15040	6425	9290	6922	8810	45483	58000	5.0
DEVELOPING COUNTRIES													
Africa	112	200	22	40	112	200	45	80	45	80	336	600	12.2
Middle East-North Africa	168	300	45	80	168	300	34	60	34	60	449	800	12.2
Middle East-West Asia	337	600	112	200	337	600	112	200	112	200	1010	1800	12.2
Asia	1683	3000	785	1400	1683	3000	898	1600	561	1000	5610	10000	12.2
China	785	1400	112	200	444	750	168	300	79	150	1588	2800	12.0
Latin America	1183	1700	541	800	1408	2100	449	800	428	600	4009	6000	8.4
TOTAL:	4268	7200	1617	2720	4152	6950	1706	3040	1259	2090	13002	22000	11.2
WORLD TOTAL:	17339	23620	8264	11160	16570	21990	8131	12330	8181	10900	58485	80000	6.5
Share of Developing Countries in World Total(%)	24.62	30.48	19.57	24.37	25.06	31.61	20.98	24.66	15.39	19.17	22.23	27.50	

SOURCE: - Annex to Second World-wide Study on the Petrochemical Industry; Progress of Restructing ID/WG.336/3/Add.1 dated 20th May, 1981.

ANNEXURE-XIX-5

WORLD PETROCHEMICAL PROJECTED DEMAND

END-PRODUCTS

THOUSAND METRIC TONS

COUNTRIES	SYNTHETIC FIBRES						TOTAL		INCREASE IN DEMAND PERCENT PER ANNUM
	ACRYLIC		POLYAMIDE		POLYESTER				
	1985	1990	1985	1990	1985	1990	1985	1990	1985-1990
DEVELOPED COUNTRIES									
Japan	294	315	290	300	583	650	1167	1265	1.6
W.Europe	671	730	660	680	797	890	2128	2300	1.6
N.America	280	280	1450	1450	2206	2350	3936	4080	0.8
USSR & E.Europe	321	450	629	800	686	900	1636	2150	5.6
Other Industrialized Countries	52	60	52	60	83	100	187	220	3.3
TOTAL :	1618	1835	3081	3290	4355	4890	9054	10,015	2.0
DEVELOPING COUNTRIES									
Africa	21	30	52	65	75	110	148	205	6.7
Middle East - North Africa	21	30	43	60	77	110	141	200	7.2
Middle East - West Asia	31	40	63	80	86	100	180	220	4.1
Asia	224	310	392	525	1058	1400	1674	2235	6.0
China	107	150	56	100	393	700	556	950	11.2
Latin America	181	250	252	320	566	720	999	1290	5.3
TOTAL :	585	810	858	1150	2255	3140	3698	5100	6.6
WORLD TOTAL :	2203	2645	3939	4440	6610	8030	12,752	15,115	3.5
Share of Developing Countries in World Total(%)	26 .55	30.62	21.78	25.90	34.11	39.10	29.00	33.74	

SOURCE : Annex to Second World-wide Study on the Petrochemical Industry; Progress of Restructing ID/WG.336/Add.1 dated 20th May,1981.

ANNEXURE-VIII-C

WORLD PETROCHEMICALS PROJECTED DEMAND

END-PRODUCTS

(THOUSAND METRIC TONS)

COUNTRIES	SYNTHETIC RUBBER				TOTAL		INCREASE IN DEMAND PERCENT PER ANNUM	
	S.B.R.		POLYBUTADIENE					
	1985	1990	1985	1990	1985	1990	1985	1990
DEVELOPED COUNTRIES								
Japan	573	700	177	220	750	920	2.4	
W.Europe	958	1000	295	320	1253	1320	1.0	
N.America	1622	1750	508	550	2130	2300	1.5	
USSR & E.Europe	2203	2800	365	450	2568	3250	4.8	
Other Industrialized Countries.	107	150	21	30	129	180	7.0	
TOTAL :	5463	6400	1366	1570	6829	7970	3.2	
DEVELOPING COUNTRIES								
Africa	41	50	11	20	52	70	6.1	
Middle East - North Africa	31	40	10	10	41	50	4.1	
Middle East - West Asia	31	40	10	10	41	50	4.1	
Asia	415	500	73	90	488	590	3.9	
China	163	250	41	50	204	300	8.0	
Latin America	535	750	118	170	653	920	7.1	
TOTAL :	1216	1630	263	350	1479	1980	6.0	
WORLD TOTAL :	6679	8030	1629	1920	8308	9950	3.7	
Share of Developing Countries in World Total (%)	18.21	20.30	16.14	18.20	17.80	19.90	-	

SOURCE : Annex to Second World-wide Study on the Petrochemical Industry; Progress of Restructing ID/WG.336/Add.1 dated 20th May,1981.

ANNEXURE-IX-A

ENAR

DEVELOPING ESCAP REGION

GROWTH RATES USED FOR DEVELOPMENT OF DEMAND PROJECTIONS (1980-90)

THERMO-PLASTICS

(PERCENT PER ANNUM)

COUNTRIES	P.V.C.		H.D.P.E.		H.D.P.E.		P.P		P.S.	
	1980-85	1985-90	1980-85	1985-90	1980-85	1985-90	1980-85	1985-90	1980-85	1985-90
Afghanistan	***	***	***	***	***	***	***	***	***	***
Bangla Desh	8.0	8.0	15.0	10.0	5.0	5.0	***	***	***	***
Burma	***	***	***	***	***	***	***	***	***	***
Hong Kong	10.0	10.0	8.0	8.0	5.0	5.0	8.0	6.0	12.0	10.0
India	10.0	12.0	10.0	7.0	10.0	8.0	12.0	9.0	12.0	10.0
Iran	7.0	12.0	10.0	15.0	10.0	15.0	8.0	10.0	10.0	8.0
Republic of Korea	8.0	6.0	11.0	8.0	12.0	9.0	9.0	9.0	10.0	8.0
Malaysia	10.0	8.0	10.0	8.0	8.0	8.0	12.0	10.0	12.0	10.0
Nepal	***	***	***	***	***	***	***	***	***	***
Pakistan	11.0	8.0	12.0	15.0	11.0	10.0	10.0	15.0	10.0	8.0
Phillipines	10.0	8.0	10.0	8.0	8.0	8.0	12.0	10.0	12.0	10.0
Singapore	10.0	8.0	10.0	8.0	8.0	8.0	12.0	10.0	12.0	10.0
Srilanka	8.0	8.0	15.0	10.0	5.0	5.0	***	***	***	***
Thailand	10.0	8.0	10.0	8.0	8.0	8.0	12.0	10.0	12.0	10.0

*** Denotes data not available.

ANNEXURE-XV-B

ENAR

DEVELOPING ESCAP REGION

GROWTH RATES USED FOR DEVELOPMENT OF DEMAND PROJECTIONS (1980-90)

(PERCENT PER ANNUM)

COUNTRIES	SYNTHETIC FIBRES						SYNTHETIC RUBBER			
	ACRYLIC		POLYMIDE		POLYESTER		S.B.R.		P.B.R.	
	1980-85	1985-90	1980-85	1985-90	1980-85	1985-90	1980-85	1985-90	1980-85	1985-90
Afghanistan	***	***	***	***	***	***	***	***	***	***
Bangla Desh	***	***	5.0	5.0	8.0	6.0	3.0	2.0	***	***
Burma	***	***	***	***	***	***	***	***	***	***
Hong Kong	5.0	4.0	6.0	4.0	7.0	6.0	6.0	4.0	5.0	4.0
India	8.0	7.0	10.0	8.0	13.0	10.0	5.0	4.0	4.0	3.0
Indonesia	5.0	4.0	6.0	4.0	7.0	6.0	6.0	4.0	5.0	4.0
Iran	6.0	5.0	4.0	3.0	7.0	6.0	5.0	4.0	3.0	2.0
Republic of Korea	5.0	4.0	7.0	5.0	6.0	5.0	7.0	5.0	5.0	4.0
Malaysia	5.0	4.0	6.0	4.0	7.0	6.0	6.0	4.0	5.0	4.0
Nepal	***	***	***	***	***	***	***	***	***	***
Pakistan	6.0	5.0	3.0	2.0	10.0	8.0	5.0	4.0	3.0	2.0
Phillipines	5.0	4.0	6.0	4.0	7.0	6.0	6.0	4.0	5.0	4.0
Singapore	5.0	4.0	6.0	4.0	7.0	6.0	6.0	4.0	5.0	4.0
Srilanka	***	***	***	***	***	***	***	***	***	***
Thailand	5.0	4.0	6.0	4.0	7.0	6.0	6.0	4.0	5.0	4.0

*** Denotes data not available.

DEVELOPING ESCAP REGION

ANNEXURE- XXI-A

PROJECTED PETROCHEMICALS DEMAND (END-PRODUCTS)

THERMO-PLASTICS

(THOUSAND METRIC TONS)

COUNTRY	P V C			H D P E			L D P E			P P			P S			T O T A L			INCREASE IN CONSUMPTION (PERCENT)	
	1985	1987	1990	1985	1987	1990	1985	1987	1990	1985	1987	1990	1985	1987	1990	1985	1987	1990	1985-87	1987-90
Bangla Desh	11.76	13.72	17.29	0.61	0.74	0.98	6.38	7.34	8.15	***	***	***	***	***	***	18.75	21.50	26.42	7.1	7.1
Hong Kong	48.31	58.45	77.80	24.98	29.14	36.71	63.82	70.36	81.46	23.50	26.40	31.44	140.09	170.60	227.07	301.60	354.95	454.47	8.5	8.6
India	132.06	165.66	232.74	101.46	116.16	142.20	129.17	139.00	175.10	35.25	41.88	54.24	22.92	27.73	36.91	419.86	490.43	641.29	9.3	9.3
Indonesia	148.17	172.82	217.71	103.07	120.23	151.46	113.13	131.95	166.22	88.12	106.62	141.91	21.55	25.60	34.08	474.04	557.22	711.38	8.4	8.5
Iran	98.17	123.14	173.01	30.60	40.47	61.55	45.01	59.65	90.72	17.64	21.34	28.40	19.68	22.95	28.91	211.19	267.55	382.59	12.2	12.2
S.Korea	263.01	295.52	351.97	119.64	139.55	175.75	239.68	284.76	368.78	227.72	270.55	350.73	69.25	80.77	101.75	919.30	1071.15	1348.66	8.0	8.0
Malaysia	35.43	41.32	42.06	33.83	39.64	49.71	44.07	51.41	64.76	42.30	51.18	68.12	19.40	23.47	31.24	175.03	206.84	265.89	8.7	8.7
Pakistan	32.02	37.35	47.06	5.29	6.99	10.64	33.70	40.78	54.29	16.10	21.30	32.41	4.83	5.64	7.11	91.94	112.06	151.51	10.4	10.6
Phillipines	40.27	46.97	59.17	16.10	18.78	23.65	29.40	34.29	43.19	44.05	53.31	70.95	22.92	27.73	36.91	152.74	181.08	233.87	8.9	8.9
Singapore	25.77	30.06	37.86	12.89	15.03	18.93	20.57	24.00	30.23	44.05	53.31	70.95	21.55	25.60	34.08	124.83	148.00	192.05	8.9	9.1
Srilanka	7.34	8.56	10.78	***	***	***	3.87	4.22	4.88	***	***	***	***	***	***	11.17	12.78	15.66	7.0	7.0
Thailand	29.00	33.83	42.62	32.21	33.57	47.34	44.07	51.41	64.76	26.44	31.99	42.58	26.44	31.99	42.58	158.16	186.79	239.88	8.7	8.7
TOTAL:	871.31	1027.40	1320.07	480.68	564.12	719.06	762.92	898.87	1152.53	565.17	677.88	891.37	369.53	442.08	580.64	3049.61	3610.35	4663.67	8.8	8.9

*** Denotes data not available.

ANNEXURE- XXI-B

DEVELOPING ESCAP REGION

PROJECTED PETROCHEMICALS DEMAND (END-PRODUCTS)

SYNTHETIC FIBRES (THOUSAND METRIC TONS)

COUNTRY	ACRYLIC			POLYAMIDE			POLYESTER			T O T A L			INCREASE IN CONSUMPTION % PER ANNUM	
	1985	1987	1990	1985	1987	1990	1985	1987	199	1985	1987	1990	1985-87	1987-90
Afghanistan	***	***	***	***	***	***	***	***	***	***	***	***	***	***
Bangla Desh	***	***	***	1.15	1.19	1.25	1.47	1.65	1.97	2.62	2.84	3.22	4.1	4.9
Burma	***	***	***	***	***	***	***	***	***	***	***	***	***	***
Hong Kong	2.56	2.77	3.12	17.41	18.83	21.17	14.03	15.76	18.77	34.00	37.36	43.06	4.8	4.8
India	14.69	16.82	18.92	16.10	18.78	23.65	101.34	122.62	163.21	132.13	158.22	205.78	9.4	9.4
Indonesia	19.15	20.72	23.31	20.07	21.70	24.41	84.16	94.56	112.61	123.38	136.98	160.33	5.4	5.4
Iran	9.37	10.33	16.64	18.24	19.35	21.15	49.08	55.14	65.68	76.69	84.82	103.47	5.2	5.8
S.Korea	105.93	114.58	128.89	112.20	123.70	143.20	210.10	231.64	268.23	428.23	469.92	540.24	4.7	4.7
Malaysia	2.32	2.42	2.57	4.01	4.34	4.88	49.08	55.14	65.68	55.41	61.90	73.13	5.7	5.7
Pakistan	13.38	14.75	17.07	9.27	9.65	10.24	88.58	103.32	130.16	111.23	127.72	157.37	7.2	7.2
Phillipines	7.67	8.30	9.34	24.08	26.04	29.29	42.07	47.27	59.48	73.82	81.61	98.11	5.2	6.3
Singapore	1.15	1.19	1.25	1.34	1.45	1.63	7.01	7.88	9.33	9.50	10.52	12.26	5.2	5.2
Thailand	11.49	12.43	13.99	13.38	14.48	16.29	98.17	110.30	130.30	123.04	137.21	160.58	5.6	5.4
TOTAL:	187.71	204.31	235.10	237.25	259.51	297.16	745.09	845.28	1025.29	1170.05	1309.10	1557.65	5.8	5.9

*** Denotes data not available.

ANNEX/PE-WP.2-C

DEVELOPING ESCAP REGION

PROJECTED PETROCHEMICALS DEMAND (END-PRODUCTS)

SYNTHETIC RUBBER

(THOUSAND METRIC TONS)

COUNTRY	S.B.R.			P.B.R.			T O T A L			INCREASE IN CONSUMPTION / ANNUM	
	1985	1987	1990	1985	1987	1990	1985	1987	1990	1985-87	1987-90
Afghanistan	***	***	***	***	***	***	***	***	***	***	***
Bangla Desh	0.25	0.27	0.30	***	***	***	0.25	0.27	0.30	4.0	3.6
Burma	***	***	***	***	***	***	***	***	***	***	***
Hong Kong	14.72	15.92	17.91	2.56	2.77	3.12	17.28	18.69	21.03	4.0	4.0
India	44.68	48.33	54.36	15.81	16.77	18.32	60.49	65.10	72.68	3.8	3.8
Indonesia	17.41	18.83	21.17	2.56	2.77	3.12	19.97	21.60	24.29	4.0	4.0
Iran	17.87	19.32	21.73	2.32	2.42	2.57	20.19	21.74	24.30	3.8	3.8
S.Korea	148.57	163.80	189.62	24.26	26.24	29.52	172.83	190.04	219.14	4.9	4.9
Malaysia	6.70	7.25	8.15	1.28	1.38	1.56	7.98	8.63	9.71	4.0	4.0
Nepal	***	***	***	***	***	***	***	***	***	***	***
Pakistan	5.10	5.51	6.20	1.15	1.19	1.25	6.25	6.70	7.45	3.6	3.6
Phillipines	14.72	15.92	17.91	2.56	2.77	3.12	17.28	18.69	21.03	4.0	4.0
Singapore	2.68	2.90	3.27	1.28	1.38	1.56	3.96	4.28	4.83	4.0	4.1
Thailand	10.71	11.59	13.03	1.28	1.38	1.56	11.99	12.97	14.59	4.0	4.0
TOTAL:	283.41	309.64	353.65	55.06	59.07	65.70	338.47	368.71	419.35	4.4	4.4

*** Denotes data not available.

DEVELOPING ESCAP REGION

ANNEXURE- XVII

CRUDE OIL PRODUCTION & REFINING CAPACITY

COUNTRIES	ESTIMATED PROVED RESERVES 1-1-1983	OIL PRODUCTION			NUMBER OF REFINERIES	CRUDE REFINING CAPACITY (b/cd) AS ON JANUARY 01, 1982
	OIL (1,000 bbl)	PRODUCING WELLS ** JULY 1,82	ESTIMATED 1982 (1,000 b/d)	% CHANGE FROM 1981		
Afghanistan	***	***	***	***	***	***
Bangladesh	***	***	***	***	1	31,200
Burma	32,000	445	30.0	***	2	26,300
Hong Kong	***	***	***	***	***	***
India	3,416,400	1,560	384.0	+ 32.0	12	752,694
Indonesia	9,550,000	4,341	1,341.0	- 16.4	9	341,300
Iran	55,308,000	530	1,896.0	+ 42.3	4	530,000
Korea South	***	***	***	***	6	754,500
Malaysia	3,325,000	265	306.0	+ 15.9	3	175,000
Nepal	***	***	***	***	***	***
Pakistan	196,300	32	12.0	+ 20.0	3	133,100
Phillipines	35,600	6	7.0	+ 250.0	3	236,000
Singapore	***	***	***	***	5	1,096,000
Srilanka	***	***	***	***	1	50,000
Thailand	103,000	26	(c) 6.0	***	3	176,000
TOTAL IN ESCAP REGION.	71,966,300	7,205	3,982.0		52	4,352,094

(c). Condensate

** Does not include shut in, injection, or service

SOURCE: Oil & Gas Journal Pennwell Publishing Co.

*** Denotes data not available.

DEVELOPING ESCAP REGION

ACTUAL NAPHTHA PRODUCTION

ANNEXURE- XXIII

(THOUSAND METRIC TONS)

COUNTRIES	1970	1975	1979
Bangla Desh	***	56	56
Burma	12	***	***
India	1253	1849	2533
Indonesia	***	392	870
Iran	508	971	690
S.Korea	535	1720	2570
Malaysia	850	218	220
Pakistan	163	115	144
Phillipines	3	4	18
Singapore	***	1647	2557
Sirlanka	113	108	90
Thailand	75	271	190
TOTAL:	3512	7351	9938

*** Denotes data not available.

DEVELOPING ESCAP REGION

ANNEXURE XXIV

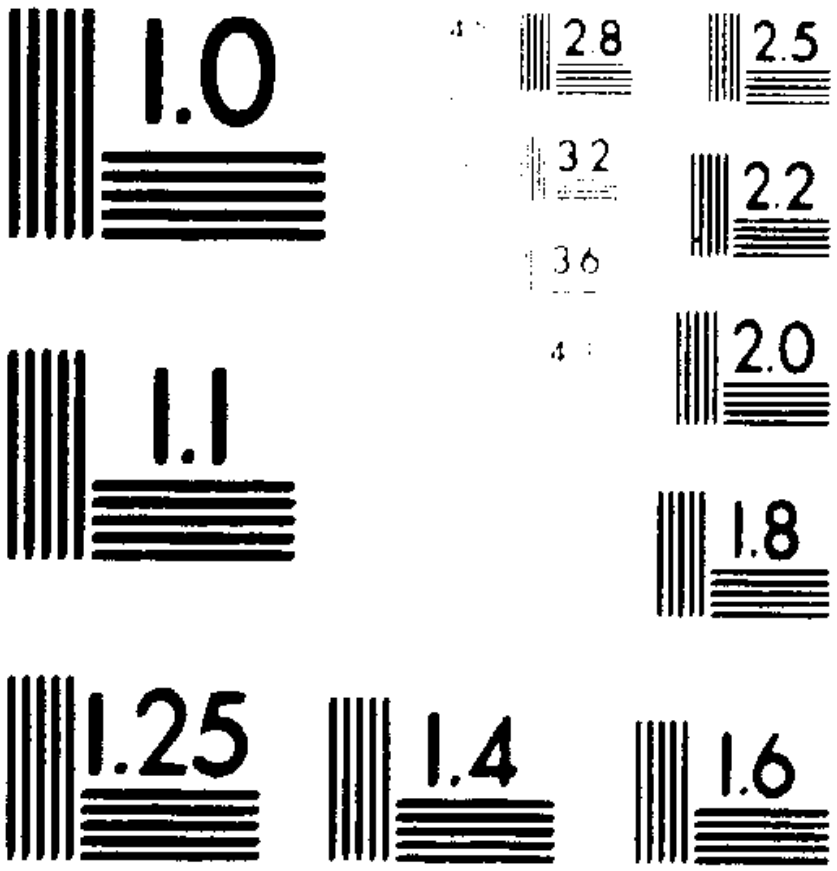
PETROCHEMICALS FEEDSTOCK AVAILABILITY POSITION

NATURAL GAS (ASSOCIATED & NON-ASSOCIATED -1990)

COUNTRIES	PROVED RESERVES NATURAL GAS BCF	DOMESTIC DEMAND BCF	POTENTIAL ETHYLENE PRODUCTION MILL.TONS	ESTIMATED ASSOCIATED GAS MILL. CF	POTENTIAL ETHYLENE PRODUCTION MILL.TONS	TOTAL POTENTIAL ETHYLENE PRODUCTION MILL.TONS
Afghanistan	***	64	***	***	***	***
Bangla Desh	8000	28	13	***	***	13
Burma	135	41	***	12500	***	***
India	9300	189	15	1300000	1	16
Indonesia	24000	755	39	4800000	5	44
Iran	490000	850	828	29000000	32	860
Malaysia	17000	85	29	1400000	2	31
Pakistan	15800	605	26	100000	***	26
Phillipines	***	***	***	12500	***	***
Thailand	8000	***	14	***	***	14
TOTAL:	572235	2617	964	36625000	40	1004

*** Denotes data not available.

B-624



DEVELOPING ESCAP REGION

PROJECTED PETROCHEMICALS DEMAND/SUPPLY (END-PRODUCTS)

(THERMOPLASTICS - 1990)

ANNEXURE-XXIV-A

(THOUSAND METRIC TONS)

COUNTRY	P V C			H D P E			L D P E			P P			P S		
	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)
Afghanistan	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
Bangladesh	***	17.29	(17.29)	***	0.98	(0.98)	***	8.15	(8.15)	***	***	***	***	***	***
Burma	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
Hong Kong	***	77.80	(77.80)	***	36.71	(36.71)	***	81.45	(81.45)	***	31.44	(31.44)	60.00	227.07	(167.07)
India	168.30	232.74	(64.44)	27.00	142.30	(115.30)	100.80	175.10	(74.30)	27.00	54.24	(27.24)	21.60	36.91	(15.31)
Indonesia	135.00	217.71	(82.71)	54.00	151.46	(97.46)	162.00	166.22	(4.22)	33.30	141.91	(108.61)	***	34.08	(34.08)
Iran	135.00	173.01	(38.01)	54.00	61.55	(7.55)	90.00	90.72	(0.72)	45.00	28.40	16.60	***	28.91	(28.91)
S.Korea	270.00	351.97	(81.97)	126.00	175.79	(49.79)	288.00	368.78	(80.78)	184.50	350.37	(165.87)	180.00	101.75	78.25
Malaysia	22.50	52.06	(29.56)	***	49.71	(49.71)	***	64.76	(64.76)	***	68.12	(68.12)	6.00	31.24	(25.24)
Nepal	***	***	***	***	***	***	***	***	***	***	***	***	***	***	***
Pakistan	4.00	47.06	(43.06)	***	10.64	(10.64)	***	54.29	(54.29)	***	32.41	(32.41)	***	7.11	(7.11)
Phillipines	45.00	59.17	(14.17)	***	23.65	(23.65)	***	43.19	(43.19)	***	70.95	(70.95)	11.70	36.91	(25.21)
Singapore	***	37.86	(37.86)	72.00	18.92	53.07	108.00	30.23	77.77	90.00	70.95	19.05	***	34.08	(34.08)
Srilanka	***	10.78	(10.78)	***	***	***	***	4.88	(4.88)	***	***	***	***	***	***
Thailand	45.00	42.62	2.38	***	47.34	(47.34)	66.60	64.76	1.84	***	42.58	(42.58)	20.70	42.58	(21.88)
TOTAL:	824.80	1320.07	(495.27)	333.00	719.06	(386.06)	815.40	1152.53	(337.13)	379.80	891.37	(511.57)	300.00	580.14	(280.64)

*** Denotes data not available.

DEVELOPING ESCAP REGION

PROJECTED PETROCHEMICALS DEMAND/SUPPLY (END-PRODUCTS)

SYNTHETIC FIBRES - 1990

ANNEXURE-XXV-9

(THOUSAND METRIC TONS)

COUNTRIES	ACRYLIC FIBRES			POLYAMIDE FIBRE			POLYESTER FIBRE		
	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)
Afghanistan	***	***	***	***	***	***	***	***	***
Bangla Desh	***	***	***	***	1.25	(1.25)	***	1.97	(1.97)
Hong Kong	***	3.12	(3.12)	***	21.17	(21.17)	***	13.77	(13.77)
India	14.40	18.92	(4.52)	36.00	23.65	12.35	134.10	163.21	(29.11)
Indonesia	5.40	23.31	(17.91)	7.20	24.41	(17.21)	100.00	112.61	(12.61)
Iran	18.00	16.64	1.36	14.40	21.15	(6.75)	18.00	65.68	(47.68)
S.Korea	117.00	128.89	(11.89)	162.00	143.20	18.80	225.00	268.15	(43.15)
Malaysia	***	2.57	(2.57)	***	4.88	(4.88)	32.40	65.63	(33.28)
Pakistan	***	17.07	(17.07)	3.00	10.24	(7.24)	36.00	130.16	(94.16)
Phillipines	***	9.34	(9.34)	13.50	29.29	(15.79)	45.00	59.48	(14.48)
Singapore	***	1.25	(1.25)	7.00	1.63	5.37	***	9.38	(9.38)
Thailand	***	13.99	(13.99)	***	16.29	(16.29)	72.00	130.30)	(58.30)
TOTAL:	154.80	235.10	(80.30)	242.50	297.16	(54.66)	662.50	845.23	(128.78)

*** Denotes data not available.

ANNEXE-XIV-C

DEVELOPING ESCAP REGION

PROJECTED PETROCHEMICALS DEMAND/SUPPLY (END-PRODUCTS)

SYNTHETIC RUBBER - 1990

(THOUSAND METRIC TONS)

COUNTRIES	S.B.R.			POLY BUTADIENE		
	SUPPLY	DEMAND	SURPLUS/ (DEFICITS)	SUPPLY	DEMAND	SURPLUS (DEFICITS)
Bangla Desh	***	0.30	(0.30)	***	***	***
Hong Kong	***	17.91	(17.91)	***	3.12	(3.12)
India	27.00	54.36	(27.36)	18.00	18.32	(0.32)
Indonesia	***	21.17	(21.17)	***	3.12	(3.12)
Iran	36.00	21.73	14.27	***	2.57	(2.57)
S.Korea	90.00	189.62	(99.62)	45.00	29.52	15.48
Malaysia	***	8.15	(8.15)	***	1.56	(1.56)
Pakistan	***	6.20	(6.20)	***	1.25	(1.25)
Phillipines	***	17.91	(17.91)	***	3.12	(3.12)
Singapore	***	3.27	(3.27)	***	1.56	(1.56)
Thailand	***	13.03	(13.03)	***	1.56	(1.56)
TOTAL:	153.00	353.65	(200.65)	63.00	65.70	(2.70)

*** Denotes data not available.