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CURRENT WORLD SITUATION IN PETROCHEMICALS*

Prepared by the
UNIDO Secretariat

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References to dollars ($) are to United States dollars, unless otherwise stated.

Use of a dash between dates (e.g. 1980-1982) indicates the full period involved including the beginning and end years.

The following symbols have been used in tables:

Three dots (...) or a blank indicate that data are not available or are not separately recorded.

A dash (-) indicates that the amount is nil or negligible.

Unless otherwise indicated, a minus (-) before a figure indicates an amount subtracted and a plus (+) before a figure indicates an amount added.

The following abbreviations and synonyms appear in this publication:

Abbreviations

ABS	Acrylonitrile butadiene styerene
ACN	Acrylonitrile
DC	Developing countries
DMT	Dimethyl terephthalate
EDC	Ethylene dichloride
EE	Eastern Europe
EG	Ethylene glycol
EO	Ethylene oxide
HDPE	High density polyethylene
IPA	Isopropyl alchohol
LDPE	Low density polyethylene
LLDPE	Linear low density polyethylene
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
NG	Natural gas
PA	Polyamide (nylon)
PB	Polybutadiene
PMMA	Polymethyl methacrylate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl chloride
SBR	Styrene butadiene rubber
TNC	Transnational corporation
TPA	Terephthalic acid
UF	Urea formaldehyde
VCM	Vinyl chloride monomer
WE	Western Europe

I. INTRODUCTION

1. This report presents a brief review of developments in the petrochemical industry since the Second Consultation on the Petrochemical Industry, held in Istanbul, Turkey in 1981.1/ It also gives the short-term outlook for its future development. The report thus updates UNIDO's Second World-wide Study of the Petrochemical Industry,2/ giving special emphasis to the world demand and supply situation for major products and the global and regional economic trends underlying them.

2. Both in this connection, and in order to improve market transparency in the petrochemical field, UNIDO is building up its own data bank, the UNIDO Petrochemical Database.3/ Featuring information on petrochemical developments in the developing countries, it is based on surveys carried out in the developing countries themselves and on the results and forecasts for the industry published by petrochemical producers, associations and government agencies in industrialized countries. The period covered is currently 1963 to 1984 for actual performance and 1985 to 1990 for the forecasts. The data is updated annually in order to keep track of changes in developing countries' planned capacities--reflecting changes in their programmes and implementation schedules. It is therefore UNIDO's intention to issue a similar report each year for review by, among others, the North-South Expert Group on Opportunities for Co-operation between Industrialized and Oil- and Gas-producing Developing Countries.4/

3. Since the petrochemical sector includes a very large number of petrochemical products and their aggregates, it has so far only been possible to consider the more important ones, i.e. a selection of basic building blocks such as ethylene and benzene and end-products such as fibres and resins. The intention, however, is gradually to increase the number of products covered. The present report covers the following 24 materials:

- Ethylene, propylene, butadiene, benzene, toluene, xylenes and methanol;
- Styrene, acetaldehyde, vinyl chloride monomer (VCM), DMT/TPA, acrylonitrile, caprolactam, ethylene oxide;
- PVC, LDPE/LLDPE, HDPE, polypropylene, and polystyrene;
- Polyester, nylon (polyamide) and acrylic fibres;
- Styrene butadiene (SBR) and polybutadiene rubbers

4. The number of countries covered, presently 110, will also be expanded. For analysis purposes these are grouped (see table 1) according to the standard United Nations classification for the sector, i.e. North America refers to the United States and Canada only; Latin America includes all countries from Mexico to the South; Eastern Europe includes Yugoslavia; and Turkey is included in the Middle East. The data for each country covers demand, capacity, exports and imports for basic materials, intermediates, plastics, rubbers and fibres.

Table 1. Regional Groupings for the 110 Countries Currently Covered by the UNIDO Petrochemical Database

Western Europe

Austria
Belgium
Denmark
Finland
France
Germany Fed.Rep.of
Greece
Ireland
Italy
Netherlands
Norway
Portugal
Spain
Sweden
Switzerland
United Kingdom

Centrally Planned Economy Countries of Eastern Europe

Albania
Bulgaria
Czechoslovakia
German Dem. Rep.
Hungary
Poland
Romania
USSR
Yugoslavia

Other developed countries

Australia
Israel
New Zealand
South Africa

North America

Canada
United States

Japan

Japan

Asia

Afghanistan
Bangladesh
Burma
China
Dem. Kampuchea
Hong Kong
India
Indonesia
Korea, Rep. of
Korea Democratic Peoples Rep. of
Malaysia
Pakistan
Philippines
Singapore
Thailand
Viet Nam
Other Asia

Latin America

Argentina
Bolivia
Brazil
Chile
Colombia
Costa Rica
Cuba
Dominican Rep.
Ecuador
Mexico
Nicaragua
Paraguay
Peru
Trinidad & Tobago
Uruguay
Venezuela

Middle East

Democratic Yemen
Iran (Islamic Rep. of)
Iraq
Jordan
Libyan Arab. Yamahiriya
Kuwait
Lebanon
Oman
Qatar
Saudi Arabia
Syrian Arab Rep.
Turkey
United Arab Emirates
Yemen

Africa

Algeria
Angola
Botswana
Cameroon, United Rep. of
Chad
Central African Rep.
Congo
Egypt
Gabon
Gambia
Ghana
Ivory Coast
Kenya
Liberia
Mali
Madagascar
Mauritania
Morocco
Namibia
Mozambique
Nigeria
Liberia
Zimbabwe
Madagascar
Sudan
Morocco
Tunisia
Mozambique
Zambia
Niger
Zaire
Senegal
Somalia
Tanzania, United Rep. of
Uganda

II. THE EVOLUTION OF THE PETROCHEMICAL INDUSTRY

General trends

5. The economic recession of the 1980s has lead to a severe drop in the demand for petrochemicals world-wide. The countries most affected were those of the OECD, which faced considerable under-utilization of capacity for most petrochemical plants.5/ Many of these countries' industries also experienced major cutbacks in employment levels.6/ Increasing production costs and their inability to raise product prices also led to considerable losses for many producers.7/ As they responded, two major trends emerged. Firstly, they took steps to reduce their production costs--through process improvements 8/ and energy saving measures;9/ secondly they made a concerted effort to rationalize their operations--by means of capacity cuts, mergers, product specialization and diversification.10/

6. The petrochemical industry in the developing countries, although exhibiting the same symptoms--particularly falling demand and increased production costs--performed relatively better. The fact that demand has not yet reached saturation point in these countries enabled them continue production, shutdowns were generally avoided and their governments could continue to plan for future expansion.11/ Market opportunities for petrochemicals in the developing countries are thus still very promising. Moreover, the availability of low-priced feedstocks in many of them would provide a competitive edge over traditional producers for the production of basic and intermediate products.

7. With these forces at work, a greater degree of internationalization of petrochemical production seems likely to predominate in the future.12/ In particular, greater share of production capacity will migrate towards the sources of raw materials and energy, and new production centres in oil- and gas-producing countries will emerge. At the same time, traditional producers will increasingly specialize in higher value added products, concentrating on products and activities where their strength lies.

Trends in industrialized countries

8. Dramatic changes brought about by oil price adjustments during the 1970s continued to have a profound impact on the industrialized countries' operations in the 1980s. Responding in various ways and at varying speeds, producers are restructuring their operations to take into account both the higher cost of energy and feedstocks and the arrival of new producers with access to both at favourable prices. This process seems likely to continue through much of the decade.

9. These factors coupled with slackness in demand and the strength of the United States dollar relative to other major currencies also changed the trade flow of volume petrochemicals. In North America, the deregulation of gas prices increased feedstock costs, reducing United States producers' competitive edge. As a result, exports from the region declined and imports increased.13/ This helped not only many developing countries to increase capacity utilization, but also took some of the over-capacity pressure off producers in Europe and Japan. Overall, however, all three major producing regions--North America, Western Europe and Japan--have been losing both their own and third markets to new producers.14/

10. With key Third World market areas such as Brazil, India and Mexico moving rapidly towards self-sufficiency in several commodity petrochemicals, the prospects are for conditions of oversupply and overcapacity to continue into the 1990s. Producers are therefore concentrating on improving their competitive position--by minimizing costs, investing according to a longer term commitment perspective,16/ developing new and better products, using low-cost technology, and shifting to specialities and tailor-made customer services. R and D expenditures, which have more than doubled since early 1970s, underpin the implementation of these long-term corporate strategies.

11. Restructuring strategies of major producers have involved capacity reductions in the form of permanent shut-downs of obsolete and marginal plants, plus temporary idling of others.17/ In some cases old plants were revamped with the introduction of new technology and energy saving measures.18/ Availability of low-pressure, low-temperature processing, more effective rare-metal based catalysts, and new technological routes for some

products has forced producers to re-evaluate their resources and to reallocate them to develop a strong technology edge.19/ Alongside there have been many mergers, consolidation of operations, shifts to high value-added products and rationalization moves.

12. Compounding their difficulties, major producers face problems of tightened environmental control, rising trade barriers, increased engineering costs, reduced availability of finance and accelerated rates of technological obsolescence.20/ All these complicate the long-term planning now needed if the industry is to return to reasonable profit levels. (To some extent developing countries are also suffering from these same difficulties, see below.)

13. More recently there have been signs that the recession may be over. Certainly the chemical producers, for many of which petrochemicals are a major activity, performed fairly well during 1984--better than industry in general, and better than oil producers.21/ Their growth rates saw a substantial improvement and their average return on assets was more than 5 percent--compared with returns of 3.8 and 2.1 per cent in 1980 and 1982 respectively. In the United States, where petrochemicals benefited from the major economic upturn, shipments of many products rose by 10 to 20 per cent.22/ The average growth for some plastics groups was 15-20 per cent. The recent downward trend in feedstock prices and the general improvement in industrialized countries' economies have further improved petrochemical producers' prospects.

Trends in developing countries

14. Whereas the petrochemical industry in industrialized countries is considered to have reached maturity in the area of commodity petrochemicals,23/ in developing countries the situation is still very different. This is principally because of the tremendous growth potential in countries where per capita consumption is still minimal.24/ Nevertheless, a large number of factors, both indigenous and exogenous, will influence their growth pattern--the level of economic development, the structure of the economy, per capita income, the diversity and the intensity of sectoral linkages, availability of technical and scientific infrastructure,

availability of finance and government economic and monetary policies. Other factors include the socio-economic needs of the country, the petrochemical sector's backward integration into the country's natural resources and its forward linkages into other sectors.

15. The pattern of development of the petrochemical sector in different developing regions therefore varies greatly. Countries like Brazil, Mexico, India and the Republic of Korea, produce almost the full range of petrochemical products. Other countries are still at an embryonic stage, having only a handful of plastics processing plants. The data on consumption and capacity given in annexes 1 and 2 show that with the exception of the small number of more advanced developing countries, the development of the industry focuses mainly on a few basic or end products.

16. UNIDO's contacts with developing country governments suggest that many are nevertheless watching the present situation closely. The construction boom in the Middle East is coming to end and China and India have gone along way in construction phase of their plans. Countries like Brazil, Mexico, Argentina and Saudi Arabia that already have their basic capacities in place, are supplementing and diversifying their industry. Others--such as Colombia, Egypt, Indonesia, Nigeria, Peru and Thailand--have yet to start realising their petrochemical plans. If the world economy continues to pick up growth, some of those that shelved their development plans during the recession are expected to reactivate their construction plans. These new production facilities would come on stream in the early 1990s.

Feedstocks

17. With new reserves still being discovered and the demand for some key petroleum products going down, oil and natural gas-based hydrocarbon resources will continue to dominate the petrochemical industry's feedstock picture into the 1990s and probably into the 21st century. In the short term, the soft market in petroleum has stabilized the prices of alternative gas and refinery products at relatively low levels, thus easing the pressure on producers and contributing to a transformation of their early 1980s losses into profits.25/

19. Within the general feedstock picture, straight-run naphtha--although continuing as the main feedstock for ethylene crackers--will decline slowly from its 54 per cent share in 1984, dropping to 48 per cent in 1989 and 46 per cent in 1994.26/ This is a natural consequence of the new ethane-based ethylene capacity in resource-rich areas (such as the Middle East and Canada) and of producers' interest in cracker designs that allow feedstock flexibility, i.e. cracking of a wide range of unbalanced refinery streams--ranging from heating oil to refinery gas. As petrochemical feedstocks, these unbalanced streams are expected to increase gradually--from 9 per cent in 1984 to 11 in 1989 and 13 per cent in 1994--with most of the growth coming from gas oils.27/ Naphtha prices are of course critical to this trend, which may have been slowed by their drop from a peak of $330 per ton (spot price) to around $230 in December 1984.28/ Most recently they have firmed up to $254 to $257 per ton.29/

20. But while naphtha will remain important, many producers consider that access to low-price gas feedstocks, i.e. ethane and LPG, will become a *sine qua non* for staying in the business in the 1990s.30/ When priced according to their opportunity cost (their value in the next most profitable end-use), gas feedstock costs to petrochemical producers vary considerably from region to region--ranging from very low in the Middle East, where until recently much associated gas was still being flared, to Western Europe where gas commands a premium as a clean, easily applied fuel. Nevertheless, because of transportation difficulties with natural gas, its the price pattern in 1984 31,32/ which will probably be maintained for several years, e.g.:

Gas price

(Dollars/ million Btu)

United States	3.40
Western Europe	4.00 to 4.50
Canada	2.00 to 2.75
Saudi Arabia	0.50

Such variations have a considerable impact on the economics of producing petrochemicals downstream. The high cost of transporting natural gas in the form of LNG will continue to limit its export, thereby maintaining the differentials.33/

21. In a petrochemical context, associated and natural gas are mostly used to provide ethane. This will remain a preferred feedstock for ethylene crackers, increasing its shar from 22 per cent in 1984 to 27 per cent in 1989 and 30 per cent in 1994.34/ Despite persistent overcapacity, the ongoing restructuring of ethylene production has not stopped the resource-rich countries from adding new capacity: new large-scale plants using ethane have recently been commissioned in both developing countries (Libyan Arab Jamahariya, Mexico, Qatar, Saudi Arabia, Malaysia and Trinidad and Tobago), and developed countries (Mossmorran in the United Kingdom). Further plants are under construction or planned in Argentina, Chile, China, India, Kuwait, Nigeria and Thailand.

22. Liquefied petroleum gas is limited on the quantity side by the level of oil production and on the price side by the price of naphtha. In the early 1980s, LPG prices thus peaked at $301 per ton, stabilizing at around $215 per ton in October 1984.35/. In volume terms, consumption as a petrochemical feedstock is also expected to decline, at least until the 1990s, when oil producers' local consumption of petroleum production begins to contribute significantly to the demand for crude, thereby making more LPG available. LPG's share of cracker feedstock will therefore drop--from 15 per cent in 1984 to 14 per cent in 1989 and 11 per cent in 1994.36/

23. In aromatics, some 70 per cent of the feedstocks for fibres (polyester and nylon), rubbers (styrene-butadiene), polyurethanes (toluene diisocyanate), paints and adhesives now come from the oil refining industry's BTX operations. Overall this depends on the price and availability of straight-run naphtha, but the balance between the major aromatics (benzene, toleuene and xylenes) can be adjusted by converting toluene to benzene and by trading surpluses from one region to another. Although, as noted, the price of naphtha has stabilized, the price of aromatics is increasingly determined by motor industry demand for them as octane enhancers needed in a growing number of industrialized countries' gasoline markets to replace the much cheaper, but increasingly forbidden, tetra-ethyl lead compounds.37/

24. Feedstock changes due to changes on the demand side take longer to work through and are consequently harder to predict. As an example, interplastic substitution could increase consumption of polypropylene at the expense of polyethylene and PVC, increasing the demand for propylene at the expense of

ethylene. Coupled with rising motor industry uses for propylene, this could make flexible or heavier feedstock more attractive than traditional ethane cracking. Whether or not such feedstocks remain available at low prices will depend on the results of restructuring in oil refining--brought on by the oil surpluses and said to be the most extensive in 50 years.38/ Technological innovation adds a further complication in the form of new competitive routes that enable gas feedstocks to produce cyclic and aromatics compounds. Plants in the United States, for example, are making maleic anhydride (a nylon intermediate) from n-butane instead of the more expensive (and toxic) benzene.39/

Basic petrochemicals

25. Of the four high tonnage basic petrochemicals, ethylene remains dominant despite higher growth rates in propylene and methanol. Current forecasts suggest this general picture will remain valid for the remainder of the decade:

	World capacity 1985[a] (million tons/year)	Annual growth 1970-1980 (per cent)	Annual growth 1980-1990 (per cent)
Ethylene	51.2	4.4	2.5[b]
Propylene	29.4	5.6	3.0[b]
Benzene	25.9	3.0	1.1[b]
Methanol	22.3	...	9.1[c]

[a] UNIDO Petrochemical Database (see annex 1)
[b] Chemical Engineering Progress 40/
[c] Chemical Week 41/

Production of two of these four basic materials--ethylene and methanol--is undergoing extensive restructuring, with old plants being shut down in the major consumer markets and new capacity coming on stream in resource-rich countries.

Ethylene

26. Although restructuring in ethylene has already brought some reductions in overcapacity, the process will continue throughout the 1980s. Between 1981 and 1983, industrialized countries contracted their capacity by 13 per cent while their production and consumption stagnated (see table 2). These rationalization measures were effective, however, in raising capacity utilization rates from 74 per cent to over 81 per cent.

27. Developing countries meanwhile expanded their capacities by 22 per cent, and their production and consumption by around 13 per cent. This meant that their capacity utilization, already low, dropped to 62.4 per cent. In most cases, the drop was due to new capacity running at less than full local load during commissioning. Globally, ethylene demand (see annex 1) peaked at 37.3 million tons in 1979, then declined in the early 1980s due to falling consumption in thermoplastics in industrialized countries. Supported by steadily increasing demand in developing countries, the 1979 peak was exceeded in 1984 and a major rise, reaching nearly 42 million tons, is expected this year. By 1990 developing countries could account for nearly 22 per cent of global consumption.

28. As the ethylene plants in the Middle East come fully on stream, a major jump in developing country production will increase their share to over 17 per cent this year. And if all developing countries' present plans are realized, they will exceed the Lima target of 25 per cent of global output already in 1990.42/ As a result of current expansion, Asia will overtake Latin America in capacity this year. By 1990, however, the positions will be reversed, with Latin America disposing of 5.4 million and Asia 4.5 million tons annually. The African region, where industrialization plans so far do not emphasize primary petrochemical production, will then have a capacity of just over 1 million tons/year. In the four industrialized regions, only Eastern Europe will continue to expand, reaching 7.2 million tons/year at the end of the decade. North America will reduce capacity to 17 million (compared to over 20 million in 1981), Western Europe will drop to 13.5 million (from 17.7 million in 1983), and Japan will remain at its current level of 4.3 million (compared to 6.2 million in 1981).

Table 2: World situation in Ethylene, 1981 - 1983
(Millions of tons/year)

Region	Production			Consumption			Capacity		
	1981	1983	Increase (per cent)	1981	1983	Increase (per cent)	1981	1983	Increase (per cent)
North America	14.4	14.2		14.3	14.2		20.3	17.2	
Western Europe	10.8	10.8		10.8	10.8		17.2	13.5	
Eastern Europe	3.6	3.8		3.6	3.7		4.6	4.9	
Japan	3.6	3.7		3.6	3.7		6.2	4.4	
Others	0.5	0.6		0.5	0.6		0.6	0.6	
Total industrialized countries	33.0	33.1	0.3	32.9	32.9	0.2	49.0	40.6	-13.0
Africa + Middle East	0.3	0.3		0.3	0.3		0.5	0.7	
Asia	1.4	1.6		1.6	1.7		2.2	2.5	
Latin America	1.5	1.8		1.4	1.7		2.2	2.8	
Total developing countries	3.3	3.7	13.1	3.4	3.8	12.6	4.9	5.9	22.2
Total World	36.3	36.8		36.2	36.8		53.8	46.6	
Share of developing countries (per cent)	9.0	10.1		9.4	10.5		9.0	12.8	

Source: Annex 1 and UNIDO Petrochemical Data Base

29. As the main building block of the petrochemical industry, ethylene is attracting the interest of an increasing number of small and medium-sized developing countries. Countries with populations of 50 million or more can anticipate sufficient demand to justify large-scale cracking operations.43/ Their problem is to finance plants that cost in the region of $1 billion to build. Thus, a number of the developing country plants presently projected might not materialize before 1990. Their delay would mean however that there would not be a surge in capacity like that in 1985 and demand may absorb the new capacity as it comes on stream. Asia, which has been near Latin America in volume, would take a clear lead.

Propylene

30. As a by-product of both oil refinery operations and ethylene cracking, and with competing uses in both petrochemicals and motor fuels, propylene supply and demand is particularly difficult to forecast.44/ Given continued low operating rates of ethylene and oil refinery crackers and the ongoing global trend to ethane (with relatively low propylene yields) rather than naphtha feedstocks, the short-term outlook is for further global shortages 45/ and, as in 1981-1982, further price increases.46/

31. Propylene's global growth rates are forecast at between 6 and 7 per cent annually.47/ This assumes, however, that the traditional price ratios (propylene/ethylene) will be maintained at 0.7 to 0.8--whereas during the 1981-1982 shortage they reversed to 1.2.48/ Here the trends in ethylene feedstocks and the availability of refinery propylene will be determining. Propylene/ethylene price ratios greater than 1 make heavier (high-propylene yield) feedstocks and flexible-feedstock ethylene cracker designs more attractive.49/ At these price levels, e.g. 16 cents/lb, petrochemical uses, i.e. polymer-grade propylene, cannot compete, however, with refinery uses for motor fuels.50/ Thus the nearly 50 per cent of all propylene coming from oil refining operations in 1990 will remain at risk from developments in the demand from the motor sector.51/

32. The main impact of these trends on developing countries (see annex 1), where propylene demand is comparatively late in developing, is likely to be that they make their production and export of propylene increasingly

attractive. Capacity will be built up (see annex 2) in Algeria, Argentina, Brazil, Ecuador, Egypt, India, the Islamic Republic of Iran, Kuwait, the Libyan Arab Jamahiriya, Mexico, Nigeria and Peru. As a group, developing countries will thereby move from a fairly balanced demand and supply position in all regions in the early 1980s to one of considerable surplus in 1990. By then, however, much of the surplus will be concentrated in one region, Latin America. Developing countries will then account for nearly 16 per cent of demand and nearly 20 per cent of global capacity.

Benzene

33. The trends in aromatics, represented here by benzene, present the same forcasting problems as propylene--sourcing in both oil refineries and petrochemical operations and demand for both petrochemicai and many other uses. Both petrochemical producers and oil refiners reform naphtha in BTX (benzene, toluene and xylene) units, which in most industrialized countries account for over half the aromatics capacity.52/ In addition oil refineries produce aromatics as a by-product of petrocoke and pyrolysis gasoline operations. The balance between benzene and toluene can be maintained by hydrodealkylation of toluene and by trading.53/

34. As the demand forecasts reflect (see annex 1), in industrialized countries many outlets for benzene and its derivatives 54/ are in mature industries like housing, textiles, and infrastructural development. Only in the area of engineering thermoplastics is there likely to be rapid growth and while their volumes remain small this will have limited impact on the total picture. At the same time, however, motor industry demand (with which petrochemical and other uses compete) fluctates seasonally and, as with propylene, can cause shortages on the petrochemical side and lead to considerable movements in price.55/

35. In developing countries, because the outlets noted above (housing, textiles and infrastructure) are still very immature, aromatics (benzene in particular) have enormous potential. In countries like India, small units with capacities of 5,000 tons/year have existed to supply local industry for many

years. Now they are moving into large-scale operations with capacities of 100,000 tons/year and upwards.56/ On both the demand and the supply side, therefore, developing countries' share has begun to rise, reaching 13.4 and 12.5 per cent respectively this year, and around 18 per cent for both in 1990 (see annex 1). In the next five years, Asia, the Middle East and Latin America will each add around 500,000 to 700,000 tons/year of capacity.

36. Globally this developing country investment will add to the present overcapacity situation and create further pressure to restructure production in favour of low feedstock cost producers.57/

Methanol

37. Among the four basic petrochemicals, methanol is the most problematic. Overcapacity has grown from around 3 million tons/year in 1980 to 7.3 million tons/year in 1985 (see anner 1), its present chemical markets, mostly in the industrialized countries, are growing at no more than 4 per cent annually, and its long-expected fuel applications have still to materialize.58/ For the resource-rich developing countries, however, methanol remains an easily produced material that is easily transported. It thus represents an attractive industrial use for associated gas that might otherwise go to waste.59/ Unless, therefore, fuel uses develop more rapidly than now seems likely, methanol producers world-wide face a period of major restructuring and sharp reductions in price.60/

38. Potential fuel uses for methanol include MTBE, gasoline blending, synthetic gasoline and synthetic diesel for internal combustion engines, power station fuel (both directly in specially-designed turbines and indirectly as metha-coal) and as a source of energy for fuel cells and household uses.61/ Of these only MTBE and gasoline blending are presently significant.62/ At concentrations considered safe (generally up to 5 per cent), methanol blending is practised in the Federal Republic of Germany and Austria, and France has permitted blends up to 3 per cent since 1983. In the United States, petrochemical producers are pressurizing the oil industry to follow suit.63/ A rapid build-up of other fuel uses is unlikely, however, because of the infrastructural developments and investment they entail.64/

39. It is against this background that developing countries are taking stock of their own plans for methanol. Algeria, Argentina, Bahrain, Burma, Chile, China, Indonesia, the Islamic Republic of Iran, the Libyan Arab Jamahiriya, Malaysia, Mexico, Saudi Arabia, Trinidad and Tobago and the United Arab Emirates, are constructing or planning capacity. Some countries have already cancelled their plans, however. This could result in developing countries' share in global production, which is already 20 per cent in 1985, not reaching the predicted level of 30 per cent in 1990.

40. One alternative would be for developing countries themselves to build up their own demand. In industrialized countries, polymer uses (adhesives, fibres and resins) account for over 50 per cent of consumption.65/ Within this a large number of applications are in construction, the potential for which in developing countries is enormous. Developing countries could also use methanol to reduce their gasoline consumption by blending, or, following the example of Brazil with agricultural ethanol, substituting for gasoline entirely in redesigned engines.

Plastics

41. World demand for the five main thermoplastics (see figure 1), which now account for around 70 per cent of total plastics consumption, will surpass its 1979 peak this year and should continue to grow at least as fast as the average post-1975 rate.66/ In 1984 total consumption reached 47.4 million tons, giving an average growth of 6.1 per cent annually for the period 1980-1984, which is just over half the growth rate in the previous five years. In the period 1982-1987, average growth in these materials will be about 4.5 per cent overall and 6 to 9 per cent in developing countries.67/

42. Low density polyethylene (LDPE), which includes the newer linear low density polyethylene (LLDPE), overtook PVC in the early 1980s and is expected to maintain a small lead for the remainder of the decade. These leaders are followed by, at a fairly wide margin, high density polyethylene (HDPE) and polypropylene (PP), which overtook polystyrene (PS), also in the early 1980s. Growth in developing country demand (see also table 3) far exceeds that in

Figure 1

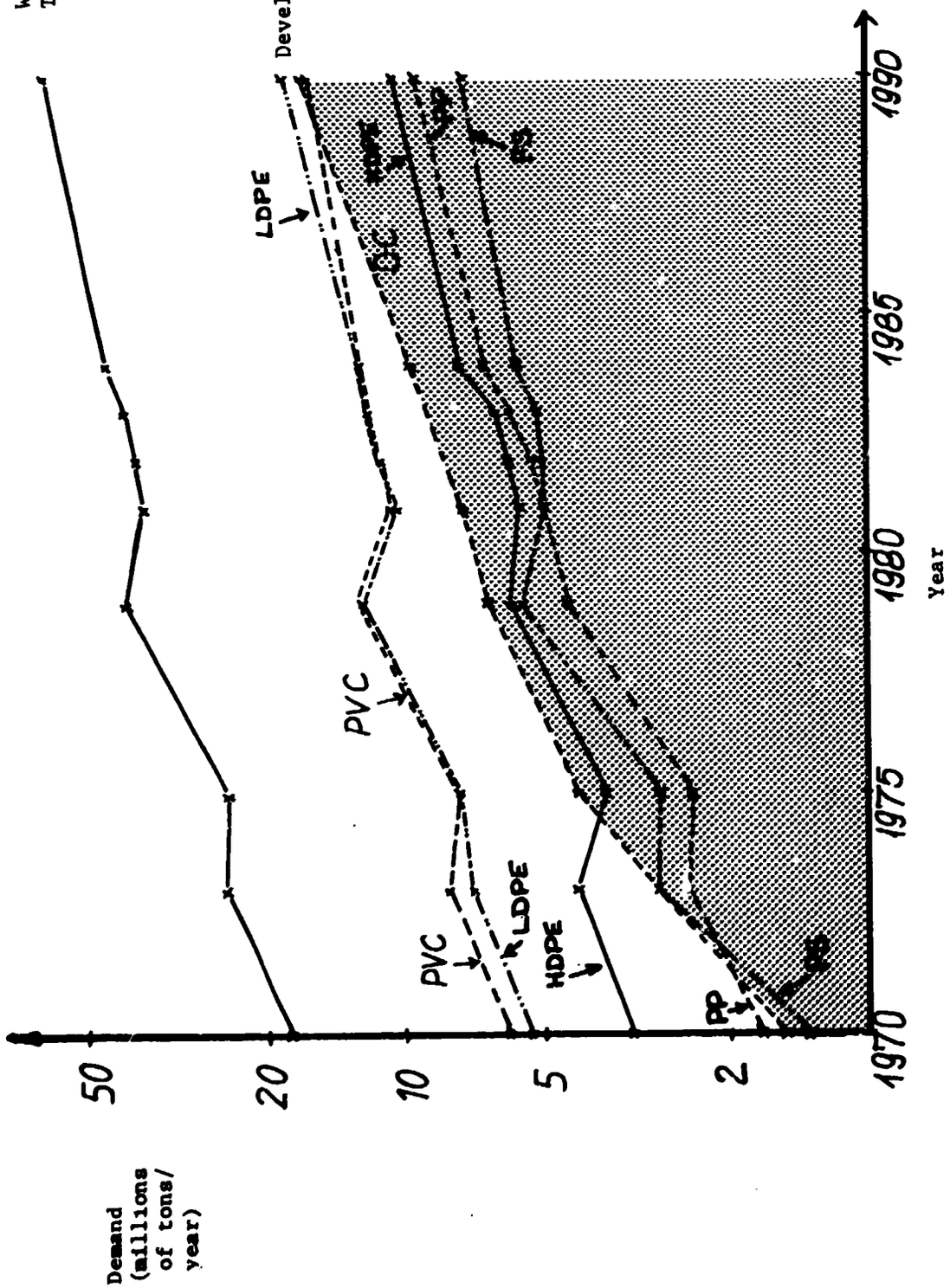


Fig. 1 World demand for commodity thermoplastics

Table 3: World situation in Thermoplastics, 1981 - 1983
(Millions of tons/year)

Region	Production			Consumption			Capacities		
	1981	1983	Increase (per cent)	1981	1983	Increase. (per cent)	1981	1983	Increase (per cent)
North America	12.6	13.6		11.3	11.9		16.8	16.8	
Western Europe	11.4	12.6		10.5	12.1		19.3	16.6	
Eastern Europe	3.5	4.7		3.4	4.7		5.4	6.4	
Japan	4.3	5.6		3.9	4.7		6.9	6.8	
Others	0.9	1.0		1.1	1.4		0.8	1..	
Total industrialized countries	32.7	37.4	14.3	30.1	34.8	15.7	49.2	47.9	-2.6
Africa + Middle East	0.3	0.3		1.0	1.5		0.3	0.6	
Asia	2.7	3.4		3.9	4.6		3.5	4.1	
Latin America	1.5	2.3		2.2	2.4		2.3	2.9	
Total developing countries	4.5	5.9	31.6	7.1	8.5	19.2	6.?	7.6	22.6
Total World	37.3	43.4		37.3	43.4		55.4	55.5	
Share of developing countries (per cent)	12.1	13.7		19.2	19.7		11.2	13.7	

Source: Annex 1 and UNIDO Petrochemical Data Base

industrialized countries. By 1983 they accounted for nearly 20 per cent of global consumption, and nearly 14 per cent of production and capacity. However, despite a major jump in capacity--over 22 per cent between 1981 and 1983, production grew somewhat less than the 14.3 per cent achieved in industrialized countries.

43. Developing countries are making good progress in plastics processing, with almost all countries, even least developed countries, having several processing plants. Countries like India boast 10,000 or so plastics processors; Jordan, Peru, Uruguay, Trinidad and Tobago, Tunisia are more typical with 50 to 100. 68/ Per capita consumption is nevertheless low. In 1983, it was 18 kg in Latin America, 3-5 kg in the Middle East and Asia, and only 1 kg in Africa--compared to 40 kg in the average industrialized country.69/ When they can overcome other difficulties related to developing their infrastructure, agriculture and construction industries, developing countries therefore have an enormous demand potential.70/

44. One indication of the demand potential for the five major thermoplastics in developing countries is their current consumption in different end uses in one major industrialized country:

Plastics consumption by end use a/

(per cent)

	LDPE	HDPE	PVC	PP	PS
Transportion	...	...	4	12	11
Packaging	64	52	10	14	27
Consumer goods	22	9	12	9	25
Furniture	...	...	2	1	2
Elecrical b/	2	2	9	...	9
Construction	6	13	57	2	17
Textiles	...	...	...	29	...
Other c/	6	34	6	33	16

Source: Modern Plastics International, January 1985, pp. 25-34.

a/ In the United States.
b/ Includes electronics.
c/ Largely exports.

Low density polyethylene (LDPE)

45. Global demand for LDPE (including LLDPE, see below) was 13.6 million tons in 1984. By 1990 (see annex 1) this will increase to 17.6 million tons, if the annual growth rate of 5.4 shown in the first half of the decade continues. However, this was already considerably reduced from the 10.3 per cent overaged in the previous five years, so a further decline is possible.

46. The LDPE sector continues to suffer from severe overcapacity, which was already the reason for considerable restructuring.71/ Some smaller industrialized countries even appear on the verge of moving out of its production altogether.72/ Prices, which are similar to those for PVC, dropped dramatically in Europe during 1984 with both LDPE and LLDPE reaching Dm 1.7/kg (compared to Dm 2.42 and Dm 2.47 respectively the previous November). This year they increased again to Dm 2.27 to Dm 2.30/kg.73/

47. LDPE has benefited considerably from technological developments in recent years, with producers switching to lower pressure, fluidized bed processing, which offers major production cost savings and higher quality product. The resulting linear LDPE (LLDPE) product has fewer branched chains in its structure and better physical properties. 74/. Inter alia, this permits material savings by designing with thinner wall sections and film gauges. As a result, in the United States some 50 per cent of low density material is produced as linear low density; in Western Europe LLDPE is still less than 20 per cent of total low density polyethylene.

48. The accessibility of technology for manufacturing both LDPE and LLDPE has meant that developing countries, which this year accounted for nearly a quarter of world demand also accounted for one fifth of production capacity (see annex 1).75/ LDPE is making great strides in the packaging sector, especially in densely populated areas. Other uses like pipes, hoses, extrusion-coating of paper are also taking off. With demand exceeding supply in all developing regions except Latin America,

many countries are planning new capacity, e.g. Algeria, Bolivia, China, Ecuador, Egypt, India, Indonesia, the Islamic Republic of Iran, Iraq, the Republic of Korea, Kuwait, the Libyan Arab Jamahiriya, Malaysia, Mexico, Nigeria, Philippines, Peru and Thailand. A number of these projects have been postponed, however, and few are likely to materialize before 1990.

49. In industrialized countries, LDPE is already a mature product, with applications largely in packaging, followed by consumer goods and electrical products. The main fabricated forms are film and injection mouldings.[76/] LDPE itself is declining as it is substituted by LLDPE.

Polyvinyl chloride (PVC)

50. Although overtaken by LDPE, PVC remains a versatile thermoplastic, with a wide range of end uses in pipes and other extruded forms, film, coated materials, sheet and moulded parts. World-wide demand in 1984 was around 13.3 million tons, giving a growth rate in the early 1980s of 3.7 per cent annually--less than half that realized in the previous five years. Continuing at this rate will give a global consumption of nearly 18 million tons in 1990, of which over one third (see annex 1) would be in developing countries. Thus, of the 3.5 million ton increase expected in the next five years, 2.2 million tons will be in developing countries.

51. With end products largely used in building and construction, followed by electrical and electronics industries, furniture, vehicles, consumer products and packaging, 77/ PVC is still expanding in developing countries many of which are planning major increa capacity. If realized, their addition of some 2.7 million tons/ by 1990 would raise their total share in world production to over 29 per cent. Those known to have such plans (see annex 2) include Algeria, Argentina, Brazil, China, Ecuador, Egypt, India, Indonesia, the Islamic Republic of Iran, Iraq, the Republic of Korea, Mexico, Nigeria, Philippines, Saudi Arabia and Thailand. Production can start with ethylene or (the approach adopted by Egypt for example) with either of PVC's internationally traded intermediates--vinyl chloride monomer or ethylene dichloride.78/

52. In industrialized countries PVC has faced market-maturity, oversupply and environmental problems for some time.79/ And although this has induced considerable restructuring, West European plants still failed to reach satisfactory operating rates. Thus a second round of restructuring to eliminate some of the 500,000 tons/year excess capacity is expected to start shortly.80/ In the United States, where supply and demand are generally in better balance, PVC was the only commodity thermoplastic in which production contracted in the first half of 1985.81/. Prices in these two markets behaved accordingly. In Western Europe, pipe-grade materials fell from Dm 1.90/kg in 1984 to Dm 1.50/kg this year. Paste-grade, in contrast, has been stable at Dm 2.10/kg since 1982. In the United States, all grades have stayed in the range 37-45 cents/lb.82/

High density polyethylene (HDPE)

53. Global demand for HDPE, currently around 7.5 million tons per year, i.e. about half that for LDPE, is still growing rapidly.83/ In the period 1980-1984 it averaged 12.4 per cent annually (compared to 5.4 per cent for low density) and although growth rates are expected to drop to around 6 per cent for the rest of the decade, total consumption would still exceed 11 million tons per year in 1990 (see annex 1).84/ Approximately one quarter of this will be consumed in developing countries.

54. Although HDPE does not suffer from the severe overcapacity problems of other commodity thermoplastics, in industrialized country markets it is under increasing pressure of interplastic subsitution--from PP on one side and linear LDPE on the other.85/ In response, producers are introducing higher molecular weight grades that, in film for example, permit 40 per cent thinner grocery bags with the same strength.86/ Such down-gauging is also the reason growth rates are expected to decline in the next five years, however.87/

55. On the production side, a projected capacity build-up in developing countries, from 1.8 million tons this year to 2.8 million tons/year in 1990, will reduce the amount of HDPE globally traded. A cut from 1 million tons/year in 1982 to 700,000 tons in 1990 would largely be at the

expense of producers in Western Europe and the United States, which presently supply 72 per cent of the traded volume.88/ The developing countries planning new capacity (see annex 2), include Argentina, Bolivia, China, Ecuador, India, Indonesia, the Islamic Republic of Iran, Iraq, Malaysia, Mexico, Qatar, Philippines, Saudi Arabia and Thailand. In most cases this is intended for packaging applications--film bottles, tubs, canisters and barrels.

56. Because of its properties and specialized end-uses, HDPE continues to command a premium over other polyethylenes. Within that range, injection and blow moulding grades tend to be cheaper.89/ Prices in Western Europe followed down those of LDPE in 1984, reaching Dm 1.95/kg for blow moulding grades and Dm 1.80/kg for injection moulding in early 1985. At this level they were said to be less than the cash cost of production.90/ Prices firmed again during the summer of this year, however, and, in comparison United States, prices remained fairly stable.91/

Polypropylene (PP)

57. As the least mature of the commodity thermoplastics, PP is still moving into new applications and finding new markets--not only as film and fibre but also in engineering applications that take advantage of the material's strength and thermal resistance.92/ Global demand is currently around 7 million tons annually, and with an average growth rate of 12.4 per cent since 1980 (compared to 15.1 per cent in the preceding five years) it has performed well despite the general recession. Expected growth for the rest of the decade is 8 per cent annually, bringing world consumption to over 10 million tons/year in 1990 (see annex 1). As with HDPE, nearly a quarter of this would be in developing countries.

58. Like HDPE, PP is not plagued by overcapacity problems, and by 1990 the excess demand in developing countries could even produce global shortages. Industrialized country producers are nevertheless engaged in restructuring moves that, by consolidating their resources, should ensure their competitivity and keep prices stable. An example is the merger of Hercules and Montedison's PP interests in the joint venture Himont.93/

59. PP, like low and high density polyethylene, has also benefited from technological improvements in recent years. Fluidized bed processing, which cuts energy requirements by 75 per cent, and third-generation catalysts will further contribute to keeping polymer production costs down.94/ Together with ready availability of propylene this would ensure continued inroads of PP in both plastics and non-plastics markets.

60. The volume of PP traded was around 900,000 tons in 1982, with 84 per cent coming from the United States and Western Europe, 10 per cent from Japan. This is expected to decline slightly to 800,000 tons by 1990 as developing countries build up their own capacity.95/ PP plants (see annex 2) are presently operating in Brazil, China, India, Indonesia, the Republic of Korea, Mexico, Singapore and Turkey. Last year these gave developing countries a 12.3 per share of world capacity. New capacity planned in Argentina, Bolivia, Chile, China, Colombia, India, the Islamic Republic of Iran, Iraq, the Libyan Arab Jamahiriya, Malaysia, Mexico, Nigeria, Pakistan, Peru, Philippines and Thailand, would raise this to 18.3 per cent.

61. In recent price trends, PP injection moulding grades, which run slightly higher than HDPE equivalents, rose during 1984 from Dm 2.20 to Dm 2.35/kg but dropped to Dm 2.15 at the beiginning of this year.96,97/ Copolymer PP followed a similar pattern at a slightly higher level.98/

Polystyrene (PS)

62. Being a mature product and based on benzene, which is relatively expensive compared to ethylene and propylene, polystyrene has shown only modest growth rates in recent years.99/ In the period 1980-1984, it averaged 5.7 per cent, bringing global consumption to 5.9 million tons, and continuation at 5 per cent annually will raise demand to only 8.4 million tons in 1990. By then (see annex 1) developing countries will account for over 21 per cent of consumption and 18 per cent of production capacity.100/

63. In industrialized countries, polystyrene stagnated during the recession, despite some increases in the demand for expanded polystyrene (EPS) from the insulation sector in response to increased energy prices. One indication of the problems facing producers is that the European price for general purpose crystal was lower in February this year than four years ago.101/ At Dm 2.35/kg this does not cover the material's cash costs.102/ Prices in the United States and for high impact grades generally, although higher, followed the same pattern.103/ The sector has thus been under pressure to restructure and some concentration of production has already occurred.104/ In future, the demand for polystyrene might be stimulated by improved properties obtained by incorporating p-methyl polystyrene.105/ Otherwise the polymerization technology remains fairly straightforward.

64. One reason why developing countries have had little interest in polystyrene so far is that the insulation applications of EPS are slower to develop in warmer climates. In addition, polystyrene's other applications can be substituted by more easily available materials. Demand is now beginning to pick up however (see annex 1) as packaging and refrigeration uses develop. On the production side, Asia recently overtook Latin America in capacity and with China, India, Philippines all adding further plants, the region will probably stay ahead. Other developing countries known to be planning new capacity (see annex 2) include Algeria, Egypt, the Islamic Republic of Iran, Kuwait, Libyan Arab Jamahiriya, Mexico, Saudi Arabia and Peru.

Fibres

65. Recent trends in world production, consumption and capacity of the three synthetic fibres--polyester, nylon and acrylic--that together account for around 90 per cent of consumption are shown in table 4.106/ Following annual growth rates of 18.5 per cent in the early 1970s, consumption slowed to a growth of around 4.0 per annually in 1975-1980 and 1.6 per cent between 1981 and 1983. Demand recovered in 1984, when output reached an an all-time high, and gave an average annual growth for the period 1980-1984 of 2.9 per cent. 107/

Table 4: World situation in Synthetic Fibers[a/] 1981 - 1983
(Millions of tons/year)

Region	Production			Consumption			Capacities		
	1981	1983	Increase (per cent)	1981	1983	Increase (per cent)	1981	1983	Increase (per cent)
North America	1.8	1.5		1.9	1.9		2.2	2.1	
Western Europe	1.3	1.2		1.1	1.1		1.8	1.7	
Eastern Europe	0.6	0.6		0.6	0.6		0.9	0.8	
Japan	0.7	0.7		0.5	0.5		0.9	0.8	
Others	0.0	0.0		0.1	0.1		0.02	0.0	
Total industrialized countries	4.9	4.1	9.6	3.9	3.9	0.2	5.9	5.9	3.6
Africa + Middle East	0.1	0.1		0.2	0.2		0.1	0.1	
Asia	1.3	1.7		1.7	1.8		1.3	1.4	
Latin America	0.6	0.3		0.4	0.4		0.3	0.4	
Total developing countries	1.7	2.2	32.5	2.3	2.4	3.8	1.8	1.9	6.1
Total World	6.2	6.3		6.2	6.3		7.7	7.4	
Share of developing countries (per cent)	26.6	34.7		37.3	38.2		23.3	25.9	

Source: Annex 1 and UNIDO Petrochemical Data Base

a/ Dates covers only the three main staple fibres--polyester, nylon and acrylics.

66. In industrialized countries, the fibre sector has suffered from overcapacity for many years and, in response has been subjected to two concerted restructuring agreements--the so-called multifibre agreements (MFA).108/ Because of the early corrective actions these agreements permitted, the synthetic fibres industry has been able to operate at least somewhat profitably. The need for further correction is shown by the trends in the early 1980s. Although capacity untilization increased overall, it actually dropped in the United States, reaching 82 per cent, and rose only to 76 per cent in Western Europe. Only in Japan did load factors exceed 90 per cent.

67. Technological progress in developing countries includes innovations such as nylon 4-6 and high performance fibres.109/ As in plastics resins, the emphasis is mostly on consumer-oriented developments that, for example, make polyester feel more like silk or wool and nylon more like cotton.110/

68. Demand in developing countries, which already accounts for 38 per cent of the world total grew by 13.7 per cent in 1981-1983, far exceeding the 3.4 per increase in industrialized countries. Their capacity in this period rose however by 22.5 per cent (mostly in Latin America) and production by over 32 per cent (largely in Asia). Capacity utilization therefore rose in all developing regions, reaching (Africa excepted) around 90 per cent.

69. In many developing countries, synthetic fibre production and the associated textile industry are long-standing. Those with expansion plans include Algeria, Brazil, China, India, Hong Kong, Indonesia and Turkey (see annex 2).

Synthetic rubber

70. Although in recent years synthetic rubbers have accounted for a steady 62 per cent of total rubber consumption, their previous history featured violent fluctuations in both demand and price.111/ Key influences are the price of natural rubber, the cost of feedstocks and the overall demand for rubber, fluctuations in which tend to affect synthetics more than natural rubber. As a result (see table 5) both consumption and production declined in the early 1980s. However, although in industrialized countries, both consumption and production dropped by 3.6 per cent in 1981-1983, these countries were still increasing their capacity. Thus capacity utilization, already down to 71 per cent in 1981, dropped to 64 per cent in 1983. Developing countries, in contrast, increased their consumption by nearly 7 per cent and their capacity utilization rose from 68 to 72 per cent.

71. Looking ahead the forecasts for demand in developed market economies will remain sluggish:

Rubber consumption in
developed market economy countries
(Millions of tons)

	1982	1983	1984	1985[a/]	1988[b/]	1989[b/]
SBR	2.54	2.47	2.77	2.83	2.93	3.68
Polybutadiene	0.81	0.85	0.97	0.99	0.98	1.10
EPR	0.31	0.34	0.41	0.43	0.42	0.50
Polychloroprene	0.23	0.24	0.25	0.25	0.26	0.27
Nitrile	0.16	0.17	0.19	0.20	0.20	0.22
Other	0.76	0.74	0.81	0.84	0.83	0.95
Total synthetics	4.81	4.99	5.40	5.54	5.63	6.11
Share of synthetics[c/] (per cent)	61.8	61.6	62.0	62.1	61.9	62.3

a/ Estimates.112/
b/ Projected values.
c/ As a percentage of total rubber, including natural rubber.

Table 5: World situation in synthetic Rubbers, 1981 - 1983
(Millions of tons/year)

Region	Production			Consumption			Capacities		
	1981	1983	increase (per cent)	1981	1983	Increase (per cent)	1981	1983	Increase (per cent)
North America	2.5	2.2		2.2	2.1		3.4	3.4	
Western Europe	1.7	1.8		1.7	1.7		2.9	3.0	
Eastern Europe	2.5	2.5		2.4	2.4		2.9	3.5	
Japan	1.0	1.0		0.8	0.8		1.5	1.5	
Others	0.1	0.1		0.1	0.1		0.1	0.2	
Total industrialized countries	7.8	7.5	-3.6	7.4	7.1	-3.6	10.9	11.7	7.7
Africa + Middle East	0.0	0.0		0.0	0.1		0.0	0.0	
Asia	2.7	3.3		4.5	5.0		3.9	4.5	
Latin America	3.6	3.3		0.5	0.4		0.5	0.5	
Total developing countries	0.6	0.7	12.3	1.0	1.0	6.9	0.9	1.0	6.3
Total World	8.4	8.2		8.4	8.2		11.9	12.8	
Share of developing countries (per cent)	7.7	8.8		12.0	13.1		8.1	8.0	

Source: Annex 1 and UNIDO Petrochemical Data Base

72. These low average growth rates in developed market economies are attributed to recent developments in the tyre industry, where introduction of radial tyres and other improvements have dramatically extended tyre life--to 65,000 km now and 160,000 km in the near future.113/ In addition the average weight of car tyres has declined--from 13 kg in 1973 to 9.8 kg in 1983.114/ World-wide, synthetic rubber will perform slightly better than in the industrialized countries, with consumption growing at around 2.8 per cent annually.115/

73. All these setbacks, especially the contraction in consumption compared to the pre-1980 years have sparked off massive restructuring and rationalization measures.116/ So far this has not resulted in a major change in internationally traded material, however.117/

74. In developing countries, while many have rubber processing facilities, relatively few and only the larger ones undertake synthetic rubber production, e.g. Argentina, Brazil, China, India, the Republic of Korea, Mexico and Turkey. Because of the complexity of the technology this is unlikely to change in the short term. China, Colombia, the Republic of Korea, Mexico and Venezuela are planning new capacity, however.

III. SUPPLY AND DEMAND

75. As indicated in chapter II, the balance between supply and demand for a number of petrochemicals, notably among basic materials and commodity end products, has been poor, especially in industrialized countries, but also in some developing countries. The reasons why these overcapacities developed are largely five:

- o Lower-than-expected economic growth rates and business activity in industrialized countries;
- o Over-estimation of sector activity in critical economic sectors especially in housing and construction of new infrastructure;
- o Construction of export-oriented industries with a view to supplying large expected markets in developing countries;
- o A change in consumer purchasing patterns brought on by the recession;
- o Competitive construction of new capacity with little attention to market demand.

76. As a result, restructuring has been a painful experience in many countries, and it was aggravated in many cases when a long recession followed the completion of new capacities. Unless developing countries can absorb their potential production faster, probably more than a decade is still needed to stabilize the industry world-wide.

77. The overall situation, both world-wide and in developing countries for 1980 and 1985, and projected to 1990 is shown for the six most seriously affected basic petrochemicals and commodity thermoplastics in table 6. The 1990 imbalances in ethylene and propylene (around 14 per cent) may be manageable. That in methanol (over 30 per cent) is almost certainly not.

Basic petrochemicals

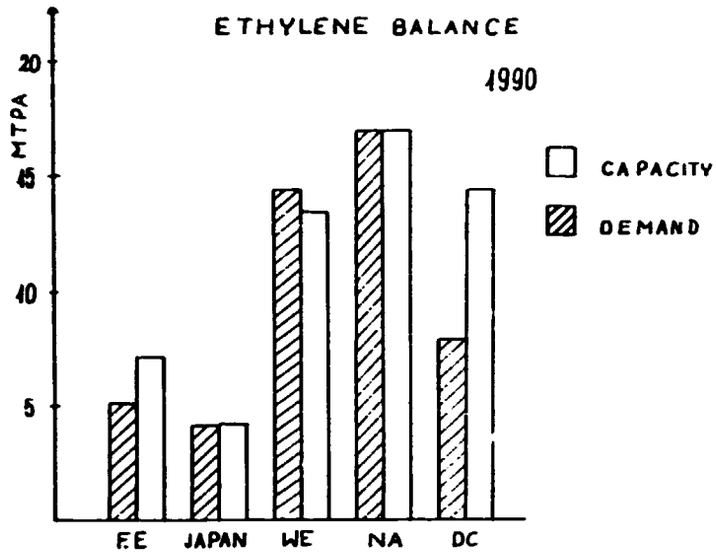
78. The situation in ethylene, earlier one of the most severely affected because many countries decided to build up this basic part of the industry and to utilize fully the available economies of scale, has improved since 1980 (see fig.2). This year Japan will be in balance, and both North America and Western Europe will reduce their surplus capacities. However, in some regions these restructuring moves came too late and in some areas capacities were even still increasing as late as 1981 and 1983. Nevertheless by 1990 with most industrialized countries generally in balance, there will be excess capacity

Table 6. Actual and projected excess capacity in major petrochemicals
(Millions of tons per year)

	Year			1990 imblance as share of capacity (per cent)
	1980	1985	1990	
		Global imbalances		
Ethylene	16.0	12.5	8.4	14.8
Propylene	8.4	4.9	7.2	20.9
Benzene	7.1	8.2	7.9	27.6
Methanol	2.4	7.3	9.2	31.6
LDPE	7.2	3.8	4.8	23.0
PVC	4.5	4.1	2.8	14.4
		Developing countries' imbalances		
Ethylene	1.3	4.4	7.1	49.3
Propylene	0.4	1.4	2.6	45.9
Benzene	0.1	0.3	2.2	42.1
Methanol	0.2	2.6	7.0	72.0
LDPE	0.9	0.3	1.0	16.3
PVC	-0.3	0.2	0.1	1.8

Source: annex 1

Figure 2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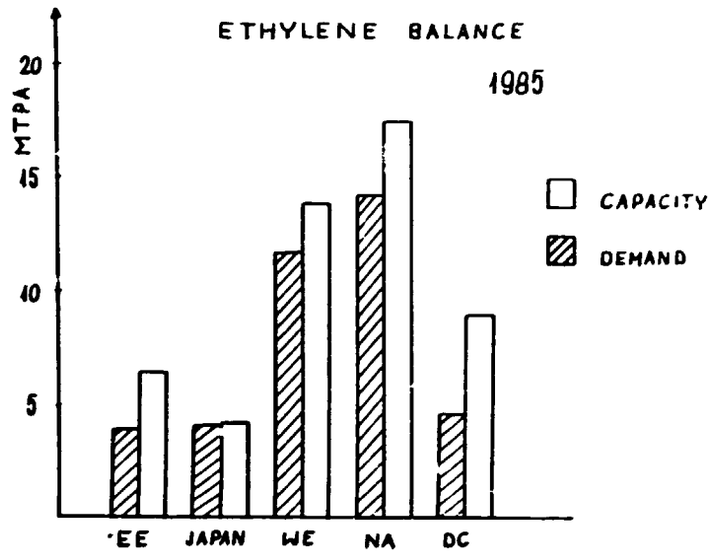
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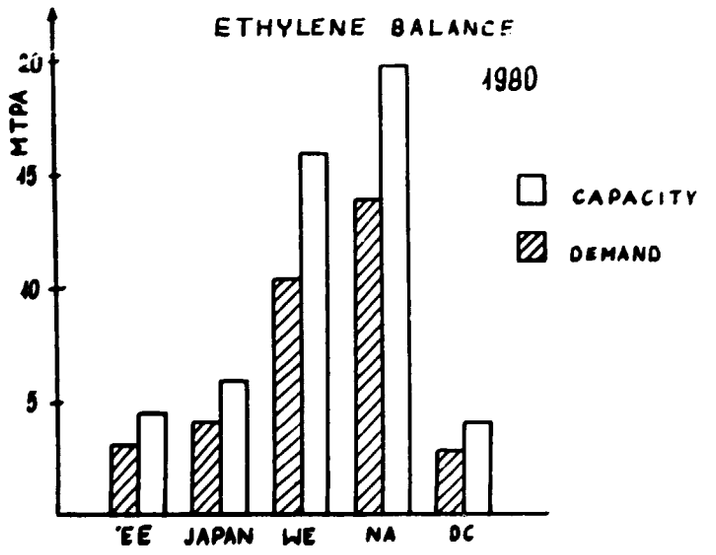
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only in Eastern Europe and the developing countries. And while it is also evident that not all the intended capacities in developing countries will materialize, a certain amount of overcapacity--over and above that needed to give production and market flexibility will remain.

79. In propylene (fig. 3) the situation has also improved slightly since 1980--despite the fact that oil refineries in addition to petrochemical producers are supplying the market. The excess capacity in both Western Europe and North America, the two main surplus areas, has been reduced, but this was partly offset by increases in the developing countries' surplus. Up to 1990 both trends will continue, but it is unlikely that the shortages once feared will appear before the end of this decade.

80. Because of fluctuating seasonal demand for benzene from the motor sector, some excess supply over demand is inevitable. Benzene producers face much larger surpluses than in the past five years, especially in Western Europe and North America, where the situation has worsened (see fig. 4). Nor will things immprove in the near future. Up to 1990, the small reductions planned for the industrialized countries' surpluses will be more than offset by increases in capacities in developing countries.

81. With methanol, as noted in chapter II, there is considerable concern over increases in capacity in the resource-rich countries that want to exploit their low-cost feedstocks at a time when potential fuel applications for methanol have not yet materialized. In the past five years (fig. 5), while Western Europe has reduced its surplus and Japan has become a net importer, Eastern Europe, North America and the developing countries have generated large surpluses. By 1990, in fact, these trends will produce a global surplus broadly equal to developing countries' entire production, making methanol the worst-placed of all the commodity petrochemicals. If this has its expected affect on prices, price cuts should encourage new applications, however, especially in the fuel sector.

Figure 3

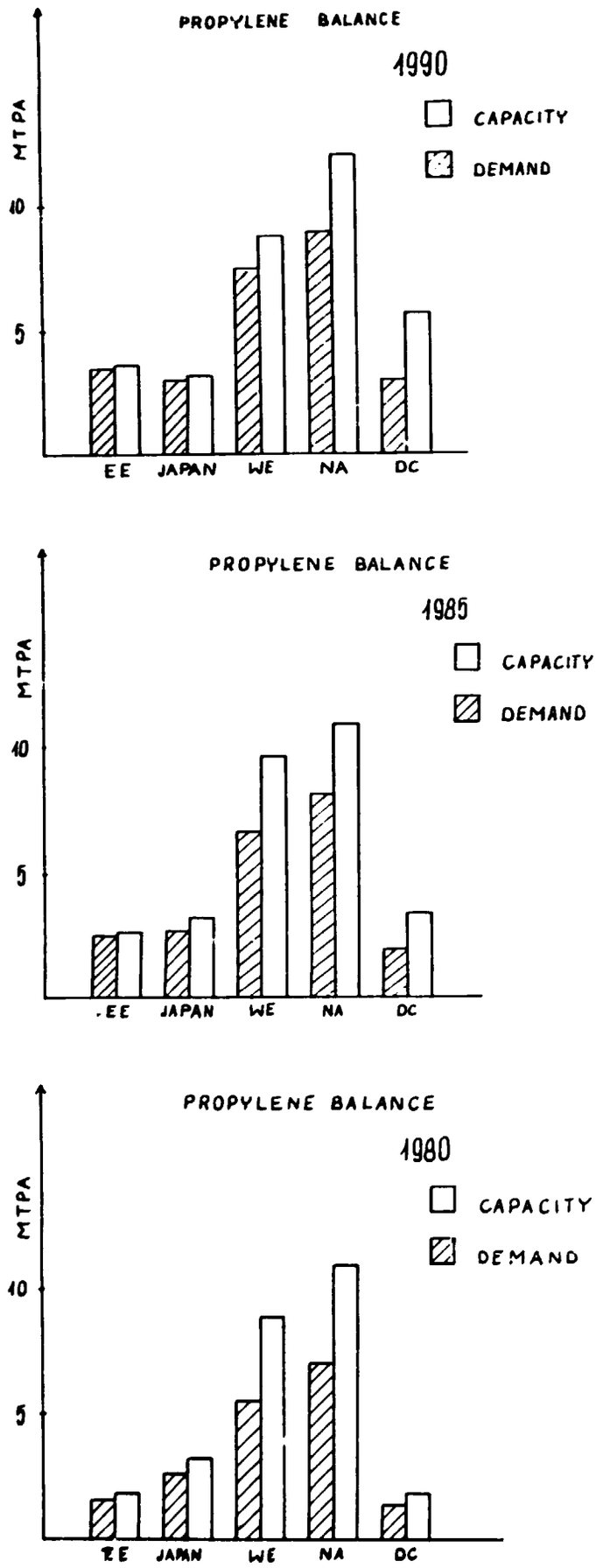
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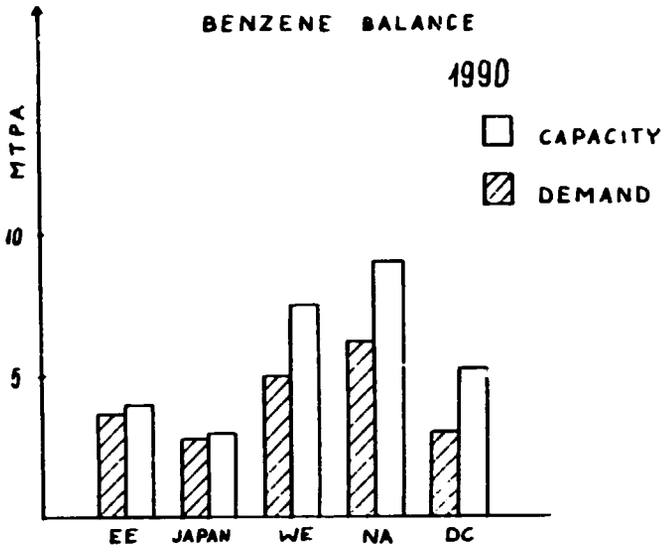
Figure 4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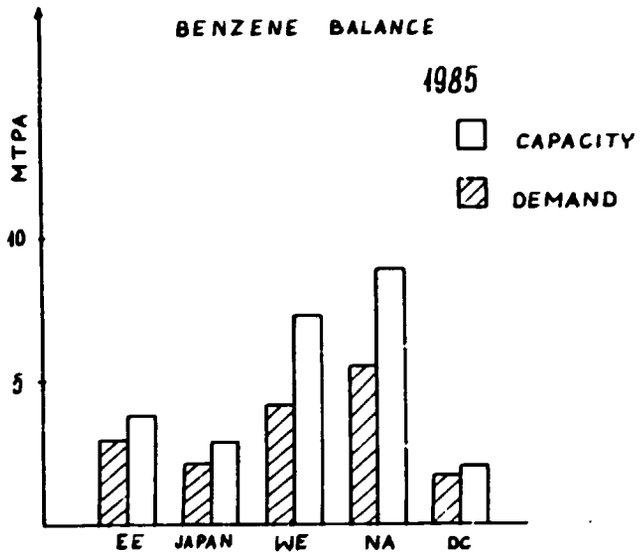
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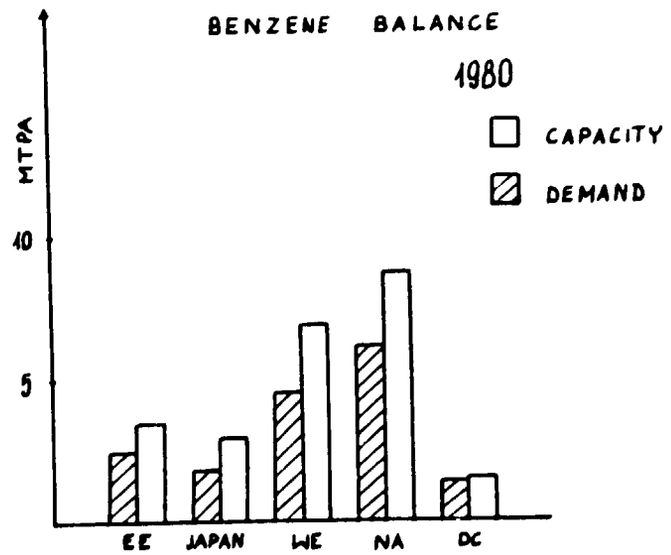
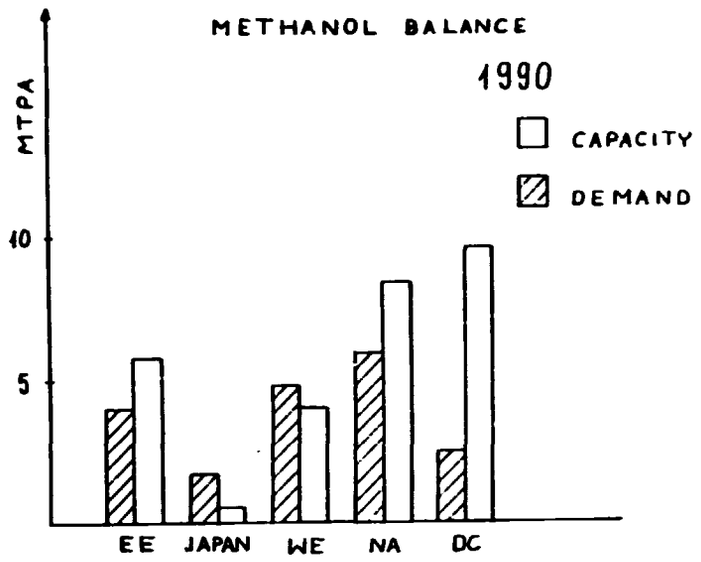
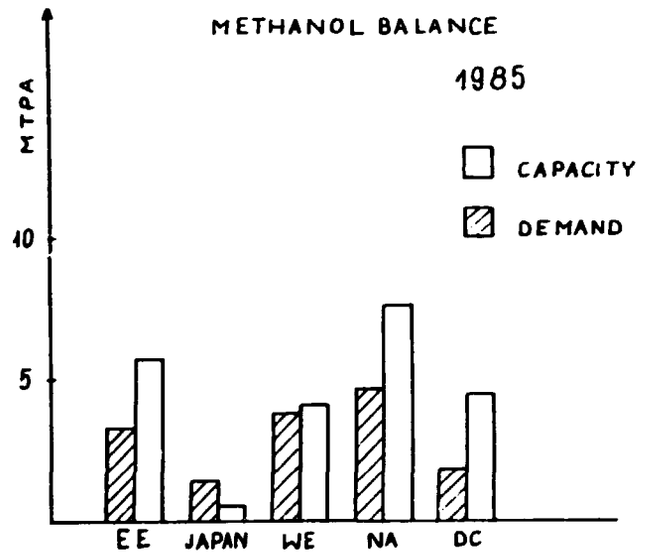
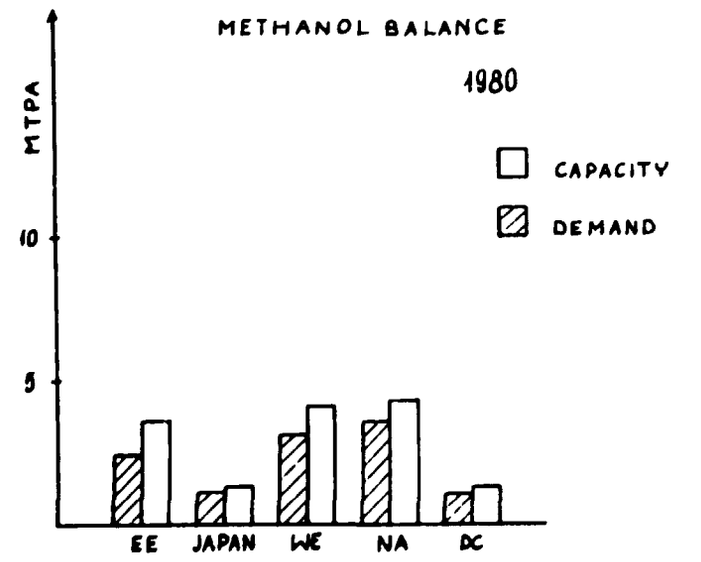

BENZENE BALANCE
1980
CAPACITY
DEMAND
MTPA
10
5
EE
JAPAN
WE
NA
DC

Figure 5


METHANOL BALANCE
1990
CAPACITY
DEMAND
MTPA
10
5
EE
JAPAN
WE
NA
DC


METHANOL BALANCE
1985
CAPACITY
DEMAND
MTPA
10
5
EE
JAPAN
WE
NA
DC

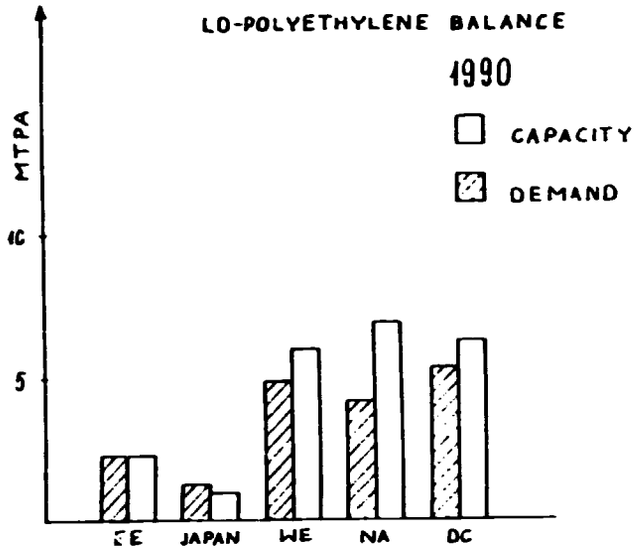

METHANOL BALANCE
1980
CAPACITY
DEMAND
MTPA
10
5
EE
JAPAN
WE
NA
DC

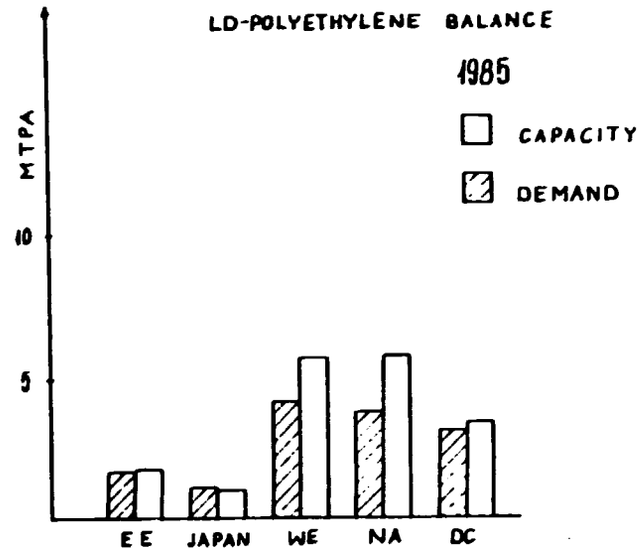
Commodity thermoplastics

82. Low density polyethylene (fig. 6) has been one of the most heavily affected by overcapacity. Together with changes in process technology to permit production of LLDPE, this has already lead to major restructuring moves. As a result, Japan has eliminated its surplus and become a net importer, and Western Europe has cut its surplus in half. The overcapacity in North America has increased, however, and developing countries' supply now exceeds their demand. Assuming present trends continue, the situation will look much the same in 1990: North American and developing country surpluses will be slightly larger, those in Western Europe slightly smaller.

83. Polyvinyl chloride weathered the recession better than most commodity plastics, partly because demand comes from several sectors that did not all suffering cutbacks at the same time. Thus with the exception of Western Europe, the need for restructuring has not been so great as for other materials. As already noted, Western Europe's surplus has been considerably reduced (see fig. 7), but North America's slightly increased. By 1990, both will be reduced still further. By then, developing country demand, which is already comparable to that in Europe and North America, will constitute PVC's largest market.

Figure 6


LD-POLYETHYLENE BALANCE
1990
CAPACITY
DEMAND
MTPA
10
5
EE
JAPAN
WE
NA
DC


LD-POLYETHYLENE BALANCE
1985
CAPACITY
DEMAND
MTPA
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JAPAN
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DC

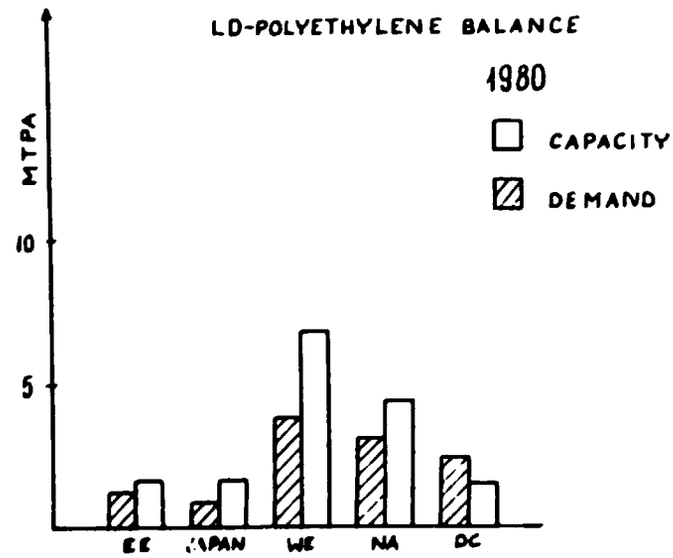
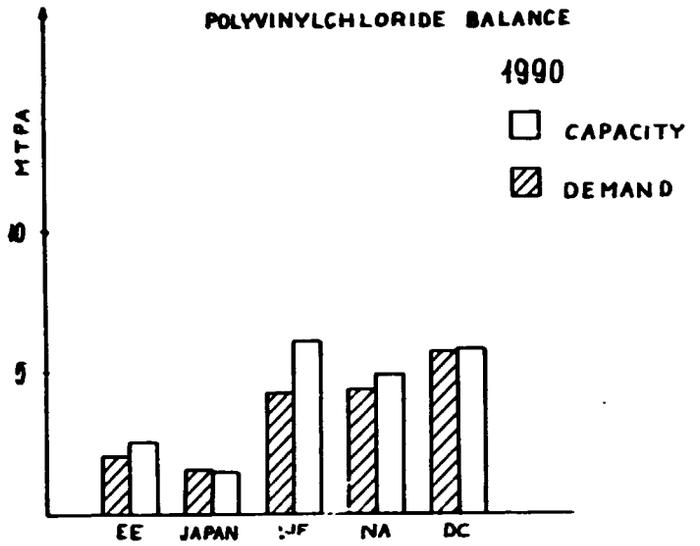
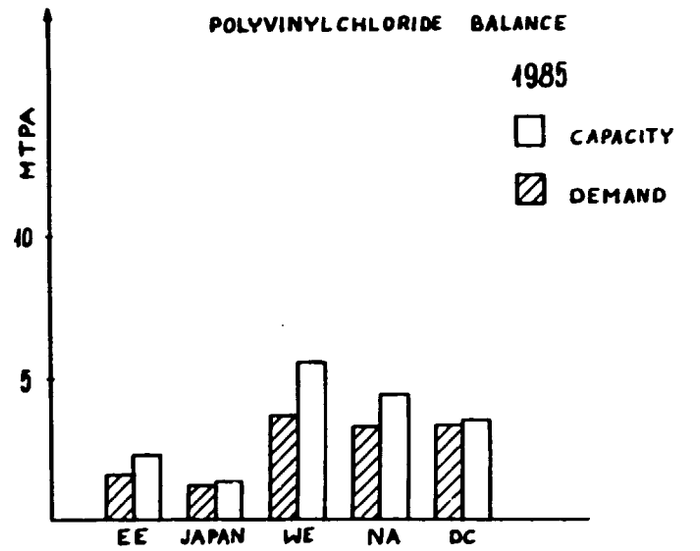

LD-POLYETHYLENE BALANCE
1980
CAPACITY
DEMAND
MTPA
10
5
EE
JAPAN
WE
NA
DC

Figure 7


POLYVINYLCHLORIDE BALANCE
1990
CAPACITY
DEMAND
MTPA
10
5
EE
JAPAN
WE
NA
DC


POLYVINYLCHLORIDE BALANCE
1985
CAPACITY
DEMAND
MTPA
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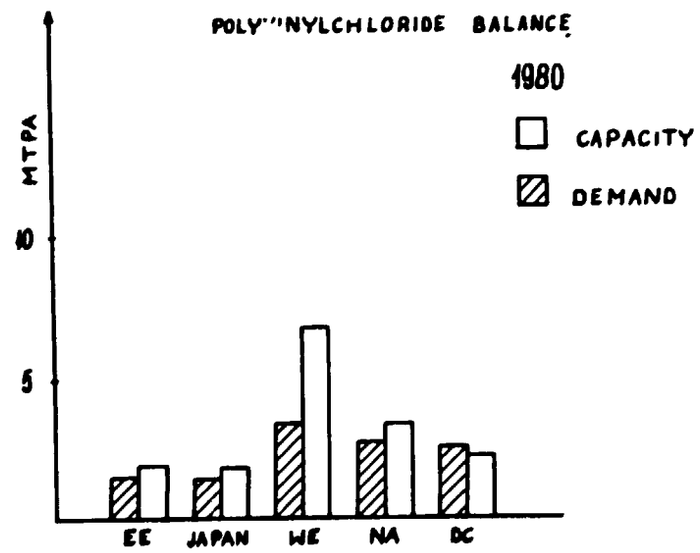
POLYVINYLCHLORIDE BALANCE
1980
CAPACITY
DEMAND
MTPA
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JAPAN
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NA
DC

IV THE REGIONAL AND COUNTRY SITUATION

84. The ability of developing countries to manufacture petrochemicals for their own needs and to build up export earnings increases with every plant commissioned. Just how rapidly this ability is accelerating is indicated in annex 2--a time series of actual and projected production capacity in selected countries from each region. Many countries with zero or only a few plants in the early 1970s are already full-fledged multiproduct producers; in addition each region will be more than self-sufficient in at least some key petrochemical materials by 1990. Petrochemical producers, of course, export where and when they can, and a region such as the Middle East inevitably engages in extensive interregional trading. A regional analysis of supply and demand (the subject of this chapter) nevertheless provides a measure of the relative progress in the four developing regions considered. It can also give useful criteria on which to base region-wide planning for the sector.

Africa

85. Four countries in Africa are making solid progress: Algeria, Egypt, the Libyan Arab Jamahiriya and Nigeria. Taken as a whole, the region saw a 400,000 ton/year jump in ethylene demand this year and it will double again by 1990. By then, also, supply will also have caught up, making the region self-sufficient in this basic building block for other petrochemicals. In propylene, Africa has recently commissioned new capacity especially in the Libyan Arab Jamahiriya. This has lead to an overcapacity situation that will reach 100,000 tons/year at the end of the decade. Benzene consumption and production are very small compared to other developing regions and will remain so until 1990. By then, however, the small surplus in benzene will also have disappeared. Methanol, in contrast, is already a large export business and with new capacity in the pipeline it could become even larger if markets are found.

86. In thermoplastics even if present construction plans materialize and all plants run at nameplate capacity, Africa will remain a net importer of LDPE, PVC and HDPE, HDPE import potential will grow to 250,000 tons/year by 1990. By then net imports of PP, currently 100,000 tons annually, will rise to at least 250,000 tons/year. However, polystyrene, all currently imported, will be in balance at a consumption rate of 150,000 tons/year.

Asia

87. Several countries in Asia--China, India and the Republic of Korea--already have long traditions in petrochemical production. Others, for example Malaysia, Indonesia and Thailand, have potentially large markets but production is still at a low level because their oil and gas exploitation has only just reached a point where investment in large-scale petrochemical operations would be justified. The region thus has good potential for building up a large industry. In this connection, its one special case, Singapore, whose petrochemical operations are necessarily almost entirely for export, will be watched with interest.

88. Although Asia currently enjoys a 380,000 ton/year surplus capacity in ethylene, at a 90 percent operating rate this only just balances present demand. Given the time needed for planning and commissioning new crackers, a deficit of some 3 million tons/year in 1990 seems inevitable. In propylene the situation is similar: demand currently slightly exceeds supply capacity, and at the end of the decade the 390,000 ton/year surplus will require better than 90 percent capacity utilization for supply to meet demand. Demand for benzene in Asia is forecast to rise to 2.2 million tons in 1990, indicating some regional shortages. At present there is a 220,000 ton/year surplus, but this would be accomodated by oprating at 80 percent capacity utilization. And as elsewhere the surplus in methanol (presently 650,000 tons/year) will increase by 1990 to 850,000 tons/year.

89. In thermoplastics Asia as a whole enjoys minor surpluses in PVC (130,000 tons/year) and polystyrene (250,000 tons/year). High density polyethylene is currently only nominally in balance and the region remains a major net importer of LDPE (610,000 tons/year) and polypropylene (465,000 tons/year). By 1990 PVC will also be in deficit (220,000 tons/year), but the deficit in LDPE and polypropylene will be smaller--around 200,000 tons. Polystyrene and HDPE at the end of the decade will be practically in balance. In both materials however, if actual operating rates fall below 90 percent, the need for imports will re-emerge.

Latin America

90. Compared to other developing regions, Latin America is presently the most advanced, partly due to its proximity to the large North American market. In particular, Brazil and Mexico have built up major industries and both will be supplementing them in coming years. However, although good progress is also being made in several other countries, financing these capital-intensive developments has been one reason why the whole region is sufferring from indebtedness problems. Thus finance will become a prime restraining factor for future development.

91. Regionally, Latin America is a major exporter of basic petrochemicals and its present excess capacity in all four considered here will increase. Ethylene, currently 710,000 tons in surplus could be available in quantities up to 2.6 million tons annually by 1990. Similarly propylene (now 450,000 tons) will rise to 1.3 million tons, benzene's 540,000 tons surplus will become 760,000 tons and the excess methanol, presently 290,000 tons, will rise to 3.7 million tons. To some extent these surpluses may be reduced by low operating rates, but given Latin American producers' long experience in petrochemicals, they suggest considerable scope for further downstream units as well as exports.

92. Latin America's present mixed position in thermoplastics will become generally balanced by the end of the decade. Currently there are very minor regional surpluses in PVC (100,000 tons annually), LDPE (250,000 tons), and polystyrene (170,000 tons); there are deficits in high density (200,000 tons) and polypropylene (150,000 tons). By 1990, the LDPE excess will increase to 310,000 tons/year; in the other commodity thermoplastics, the region will move into a position of self-sufficiency.

The Middle East

93. The oil-producing countries' long-planned petrochemical investments are now beginning to materialize. In addition, Turkey has a long tradition in the sector. Both should therefore benefit as world recovery and petrochemical demand picks up. Except for Turkey, downstream integration is still small and the industry is largely oriented towards world markets.

94. As a whole the Middle East has large surpluses in ethylene (1 million tons/year) and methanol (1.4 million tons). Benzene and propylene are more or less in balance. By 1990, regional demand for ethylene will reduce its surplus to 700,000 tons/year, but the surpluses in benzene and methanol will increase to 540,000 tons and to 2.2 million tons/year respectively.

95. In thermoplastics, the Middle East is a major net importer of all thermoplastics, notably PVC, polystyrene and polypropylene, supply and demand for high density polyethylene are broadly in balance, but following recent investments, low density has a surplus of up to 570,000 tons/year. By 1990 the region will be able to export substantial surpluses in two materials: the LDPE surplus will rise to 710,000 tons exeeess; in high density, the present balance will shift to a 200,000 tons/year surplus. In polystyrene the present deficit will be replaced by an up to 100,000 ton/year surplus. PP capacity will be able to meet projected demand with operating rates of 75 per cent. PVC producers will have deficit of at least 80,000 tons/year.

V. SUMMARY AND CONCLUSIONS

96. Seen globally, the petrochemical sector can still be viewed as an emerging industry, one that enjoys considerable growth potential compared to mature industries like steel and oil refining. Compared to these industries, in fact, petrochemical production has fared relatively well during the early 1980s. The sector's innovations and new products are still capable of changing everyday life in all societies, contributing better materials with applications ranging from packaging to housing, and from clothing to transportation. In developing countries these changes are often still at an embryonic stage, and the potential there is all the greater.

97. In recent years the sector's development has suffered from two major oil price adjustments, the second of which was followed by a major world-wide recession. In the final analysis, however, these may be seen to dented rather than permanently diminished overall long-term growth. The slowness of some industrialized country producers to respond to the developing situation has meant, nevertheless, that producers everywhere faced losses, capacity cuts, abrupt cost-cutting measures and finally mergers and other forced rationalization moves. The sector will therefore continue to suffer some overcapacity and oversupply in some products for the rest of the decade.

98. In this context, two trends are evident: (1) increasing use of low-priced feedstocks, together with greater internationalization of production as capacity is redeployed towards those feedstocks; and (2) rapid development of new technologies backed by a massive R and D effort in the customer service area.

99. Oil- and gas-producing developing countries are benefiting particularly from the first of these trends. Either independently or in co-operation with foreign partners they are rapidly building up local petrochemical production. Others planning petrochemical operations intend capitalizing on their huge potential markets for petrochemical products. Both groups are hampered, however, by obstacles such as lack of finance, incomplete access to the latest technology, poorly developed technological infrastructures of their own, difficulties in penetrating world markets, and difficulties in building up demand in their domestic markets. Developing country expectations are therefore mixed. Some already have considerable experience not only with plant operations and marketing, but also with process design and product

development. Others recognize that they have reached a threshold where their national income, market size and increasing technological capability allow them to take advantage of the simpler technologies in petrochemical production and downstream processing.

100. During the 1980s the sector's feedstock position has changed radically, firstly because of the trend to greater utilization of low-cost gas feedstocks, and secondly because of lower crude oil prices. The former gave savings throughout the production chain leading to lower end-product prices, improved competitivity and new applications. The latter vastly improved the economics of naphtha-based operations. However it also improved the profitability of existing plants and caused potential new producers to re-evaluate their options.

101. In basic petrochemicals, although ethylene capacity is now better balanced with downstream demand, benzene, propylene and methanol are subject to uncertain market developments largely outside the petrochemical industry. Motor industry demand for benzene fluctuates seasonally and may swing essentially balanced markets from oversupply to severe shortage. Downstream demand from polypropylene operations, especially in connection with polypropylene's rapidly developing engineering applications, looks like being sustained. By 1988, in fact, there could be a severe shortage because of industrialized country producers cutbacks on refinery propylene and the trend to ethane as a feedstock for ethylene crackers. Developing countries' ability to make up the difference is limited similarly by their own preference for exploiting ethane and difficulties in financing further large-scale development. Methanol faces the reverse situation: overcapacity is already the result partly of developing country decisions to use this as the route for exploiting their natural gas resources. Even if chemical uses such as MTBE (an octane enhancer for the motor industry) take off, it will still require direct use of methanol as a fuel to solve the oversupply problem in the medium term.

102. Plastics in the 1980s have benefited from a series of technological innovations that enhanced their competitive edge over traditional materials. However these same developments gave rise to an increased interplastic substitution which destabilized the equilibrium in the demand for individual plastics. Although a new equilibrium may not be established until the 1990s, three commodity thermoplastics seem likely to benefit:

polypropylene, high density polyethylene and linear low density polyethylene. Their use in packaging applications also virtually guarantees them expanding markets in developing countries.

103. Synthetic fibres, production of which has already been subjected to several rounds of restructuring, are likewise benefiting from consumer-oriented quality improvements. These should help them maintain reasonable growth rates for the forseeable future. Conversely, synthetic rubber is suffering from technological innovation that, by increasing product durability, is cutting into its growth and capacity utilization. Further restructuring in industrialized countries therefore seems unavoidable. In developing countries the outlook is better, with gradually increasing production.

104. While recent trends in the global supply and demand for volume petrochemicals have not particularly favoured developing countries as new producers, the situation should improve by 1990. In the early 1980s new developing country capacity faced a competitive environment in which established producers were in the throes of restructuring, markets were depressed by the long world recession and too many producers were building up capacity on the basis of access to low-cost feedstocks. Extensive price fluctuations are one natural consequence. Another is that some potential developing country producers have postponed their construction plans.

105. Of the four basic petrochemical considered, the world overcapacity in two--benzene and methanol--remains problematic. And, as noted above, propylene could be in short supply. Much depends on the development of the world economy, however. If growth rates in industrialized countries pick up and if their protectionist tendencies are reigned in, the overcapacity problems will disappear. Efforts to stimulate demand in developing countries would pay off similarly. In the long run, rapidly growing developing country demand is essential in another context. At present regional and even global capacities in most products are still not large enough to provide an adequate buffer to absorb the supply of each additional large plant. Price and supply disturbances as each one comes on stream are therefore inevitable.

106. The four developing regions in this context have different prospects. Asia seems likely to take the lead in capacity terms as its markets develop swiftly. In Latin America, where markets are already fairly well developed

will emphasize diversification and supplementation of existing capacity--in so far as restrictions on financing such industrial development permit. The Middle East and Africa will remain with small domestic markets. Production will therefore be largely export oriented, especially towards Europe in adjacent countries.

Conclusion

107. The foregoing analysis of the current situation in petrochemicals, particularly how it affects developing countries' prospects reveals the very different problems facing producers in the North and in the South. In the North there is often too much capacity and it is badly placed to take advantage of low-cost feedstocks. In the South there is often too little demand either in relation to the size of economically-viable plants or the availability of low-cost resources such as associated gas or in relation to the size of the population. This suggests several courses of action:

(1) North and South should maintain continuous dialogue with a view to managing the introduction of new capacity for the benefit of all parties. The aim would be an equilibrium in which the global market is supplied from the most economic sources. Where mutually advantageous, such production could result from jointly-operated plants.

(2) Producers in the North and South should co-operate in building up demand in developing countries, with the aim of rapid increases in per capita consumption of downstream products. In petrochemicals, foreign partners could provide assistance by building up local R and D capability to develop products specifically for local applications.

(3) The existing excess capacity and potentially low operation rates for some plants indicate considerable scope for regional and even interregional co-operation in downstream production. As the examples in the Middle East and South East Asia indicate this could be North-South or South-South co-operation --with benefits including swifter global restructuring to accomodate the new production sources and easier access for the South to the best technology and world markets for their output. Given the experience of some producers in the more advanced developing countries, it could also procede by way of South-South co-operation, as shown by plants under consideration in the ASEAN group.

(4) Some developing countries could use the global surplus petrochemicals in ways that would force new development patterns--patterns, perhaps quite different from those in industrialized countries, but suited to their own real needs. Fibre production, for example could emphasize the latest polypropylene fibres alongside benzene-based materials such as polyester and nylon. In the energy area, methanol has many potential operations that in some developing countries would not be inhibited by an existing infrastructure geared to traditional fuels. These and similar directions could be explored in co-operation with UNIDO.

108. In summary, the development of the petrochemical industry will certainly proceed best if there is co-operation between all parties concerned, i.e. actors from both developing and developed countries.

Notes

1. See "Report of the Second Consultation on the Petrochemical Industry, Istanbul, Turkey, 22-26 June 1981" (ID/203).

2. Estimates of supply and demand for petrochemicals at global and regional levels were presented in chapter 1 of the "Second World-wide Study of the Petrochemical Industry" (ID/WG.336/3).

3. To help developing countries identify investment opportunities in the petrochemical sector and to improve the transparency of the market, UNIDO has initiated preparation of a supply/demand data base. Data on the more important petrochemical products is solicited by direct contact with companies, professional organizations, government organizations and other sources in both developing and industrialized countries. It is hoped that the data base, together with the survey of developing countries' technological capabilities, will become an authentic source of reference for the sector, providing an important tool for identifying potential partners for co-operation. See also "Issue No.1: Long-term Arrangements for The Development of the Petrochemical Industry in Developing Countries" (ID/WG.468/2) para. 25.

4. An Expert Group on Opportunities for Co-operation between Industrialized and Oil- and Gas-producing Developing Countries for the Development of Downstream Petrochemical Industries in Other Developing Countries was established by UNIDO in response to an issue suggested for consideration by the Third Consultation, see ID/273, para. 73.

5. See for example OECD Observer, No. 133, March 1985, p.8, and Chemical Week, 15 May 1985, p.7.

6. In the United States and Western Europe alone, employment in the petrochemical sector in the period 1980-1984 dropped by over 10,000 in large firms see Chemical & Engineering News, 10 June 1985, p.48.

7. Reported losses by West European petrochemical companies in the early 1980s averaged $1 billion annually, see Chemical Engineering, June 1982, p.20h; Middle East Economic Digest, 21 October 1983, p.12. In North America, Canadian producers' combined losses ran to $244 million in 1982, see Chemical Week, 29 June 1983, p.3.

8. Typical process improvements are described in Chemical Week, 28 March 1984, p.3.

9. Energy-saving measures are described in Chemical Marketing Reporter, 8 April 1985.

10. Rationalization moves are reviewed in Chemical Week, 8 September 1982, p.36, European Chemical News, 26 July 1985, p.22, and The Economist, 17 August 1985, p.64.

11. Whereas petrochemical growth rate in industrialized countries barely reached 2 or 3 per cent in most cases, in developing countries consumption grew at 8 per cent or more, see for example Chemical Economy and Engineering Review, December 1984, p.8. The impact of the general economic recession on developing countries petrochemical investment plans is also discussed in Chemistry & Industry, 17 December 1984.

12. See Chemical Economy and Engineering Review, April 1985, p.14.

13. For a discussion of changes in petrochemical trade flows in North America, see Chemical Week, 4 July 1985.

14. According to one forecast, during the period 1984-1987, the three major petrochemical producing areas will lose exports of ethylene and derivatives totalling 3.1 million tons--1.6 million tons from the United States, 0.8 million from Western Europe, and 0.7 million from Japan, see Chemical Marketing Reporter, 8 April 1985.

15. See Manufacturing Chemist, May 1985, p.41.

16. See Chemical Economy and Engineering Review, April 1985, p.14.

17. Ibid., p.16; Chemical Insight, No. 386, September 1985; Chemical and Engineering News, 22 July 1985, p.36.

See "World changes in the structure of the petroleum industry, 1980-1983 " (ID/PC.123), pp.19-20.

18. See Chemical Economy and Engineering Review, April 1985, p.14.

19. See Petroleum Economist, July 1985, p.238.

20. See Chemical Economy and Engineering Review, April 1985, p.14.

21. The recovery in developed market economies' petrochemical sectors is reflected in their producers' return on assets:

	Year		
	1980	1982	1984
Chemical producers	3.8	2.1	5.5
Oil producers	3.3	-6.6	4.7

Source: Petroleum Economist, July 1985, p.238.

22. In the United States market, plastics shipments in 1984 showed growth rates ranging from negative to plus 23 per cent (e.g. for cladding materials used in construction. Between 1972 and 1982, however, plastics overall expanded by an average rate of 25.3 per cent annually (in current dollars), see Chemical Week, June 1985, p.20, and Plastics World, July 1985, p.83.

23. See Chemical Economy and Engineering Review, April 1985, p.13.

24. See "Development of Petrochemical Industries in Developing Countries," OPEC, March 1983, pp. 37-45.

25. "The Petrochemical Industry," OECD 1985, p.45-70; Chemical Engineering Progress, Februrary 1984, p.25.

26 Chemical & Engineering News, 3 June 1985, p.14

27. European Chemical News, 3 June 1985, p.14.

28. European Chemical News, 14 June 1982, p.13; ibid., 17 December 1984, p.8. For the 1980-1985 trend in naphtha prices see also Financial Times, 22 August 1985, p.3.

29. European Chemical News, 9 September 1985, p.8.

30. Chemical Marketing Reporter, 1 August 1985.

31 South, September 1985, p.249.

32. Chemical Insight, No. 308, December 1984.

33. Petroleum Economist, May 1985, p.163.

34. Chemical & Engineering News, 3 June 1985, p.14.

35. See World Gas Report, 26 September 1983, p.11; Petrochemical News, 15 October 1984, p.3.

36. European Chemical News, 3 June 1985, p.14.

37. Chemical & Engineering News, 23 September 1985, p.17.

38. The increase in ethane at the expense of naphtha as a cracker feedstock will outpace the increase in the use of heavier refinery feedstocks and tend to diminish the overall availability of propylene from this source, see Euromoney, September 1985, p.66

39. Chemical Engineering Progress, December 1984, p. 26.

40. Chemical Engineering Progress, April 1984, p. 21.

41. Chemical Week, 14 December 1983, p. 22.

42. The Lima target of 25 per cent as the developing countries' share of world industrial production in the year 2000 was agreed internationally at the UNIDO Second General Conference held in Lima, Peru in 1975, see "Lima Declaration and Plan of Action on Industrial Development and Co-operation" (A/10112), chapter IV. In 1963 their share was around 8 per cent and by 1982 it had risen to only 11 per cent, see ID/CONF.5/3, p.9.

43. Developing countries known to be actively considering ethylene cracking include Colombia, Egypt, Indonesia, Nigeria, Malaysia, Peru, Philippines and Thailand.

44. Refinery uses of propylene include alkylate, propylene dimer, polygasoline, LPG and refinery fuel gas. Major non-refinery uses in the United states (see Chemical & Engineering News, 25 March 1985, p.24) are polymers 35 per cent, acylonitrile 20 percent, and cumene and propylene oxide 10 per cent each. Acrylonitrile has five major markets: acrylic fibres, ABS resins, hexamethylene diamine (a nylon intermediate), nitrile rubber and styrene-acrylonitrile resins. Cumene is a major intermediate for phenol and phenol derivatives such as caprolactam (also a nylon intermediate) and adhesives. Propylene oxide is used mainly in polyols, i.e. as a stepping stone for polurethane processing. In this analysis, processed plastics (e.g. PP, ABS, SAN) accounted for 50 per cent of propylene demand, and fibres and solvents 15 per each.

45. See European Chemical News, 3 December 1984, p.18.

46. See Chemical Engineering Progress, April 1983, p.11.

47. See Chemical Engineering Progress, February 1984, p.28.

48. See Chemical Engineering Progress, April 1983, p.11.

49. Measured as a percentage of the C-2/C-3 olefine stream, ethane as a cracker feedstock yields only 2-4 per cent propylene, naphtha yields 26 to 29 per cent, and gas oils 29 to 41 per cent of the total C-2+C-3 olefines, see Chemical Engineering Progress, April 1984, p.21.

50. See Chemical Week, 28 August 1985, p.33.

51. See Chemical Engineering Progress, April 1984, p.22.

52. In the United States, pyrolysis gasoline accounts for around half of all aromatics produced and is gradually decreasing, see Chemical Engineering Progress, April 1984, p.22, and Manufacturing Chemist, March 1985, p.23.

53. During the late 1970s BTX trading reached 1.25 million tons globally, see Hydrocarbon Processing, March 1980, p.84. Among benzene derivatives, styrene is increasingly traded as developing countries build up their capacities.

54. In the United States the major derivates of benzene are currently ethyl benzene (50 per cent), cumene (20 per cent), cyclohexane ((15 per cent), aniline (5 per cent), see Chemical & Engineering News, 25 March 1985, p.26; benzene's major petrochemical end uses are styrenic resins (35 per cent), phenolic resins (20 per cent) and nylons (15 per cent), see ibid., p.26. Primary derivatives of benzene are considered as ethyl benzene, cyclohexane, styrene and phenol; secondary derivatives are maleic anhydride, polystyrene, ABS, SAN, SBR, caprolactam, adipic acid, TDI, DMT, TPA and phthalic anhdyr de, see Hydrocarbon Processing, March 1980, p.83.

55. During 1984, United States benzene prices slumped 20 per cent from their long-standing level of around $450/ton, see Chemical & Engineering News, 25 March 1985, p.26. They firmed up again during the summer of 1985, see European Chemical News, 12 August 1985, p.9.

56. Algeria, Argentina, Bolivia, Brazil, China, Colombia, Ecuador, India, Indonesia, the Islamic Republic of Iran, the Republic of Korea, Kuwait, Mexico, Nigeria, Philippines, Peru, Saudi Arabia, Turkey, Trinidad and Tobago are either operating or planning benzene-based operations (see annex 2).

57. See Chemical Week, 18 July 1984, p.10; European Chemical News, 10 June 1984, p.11; Manufacturing Chemist, November 1984, p.67.

58. See Hydrocarbon Processing, November 1983, p.15.

59. Associated gas is natural gas released during oil extraction, which, unless collected and distributed to users, is largely flared at the well head. For an earlier survey of the potential industrial uses of this material resources in developing countries, see (ID/PC.11)

60. Prices recently stabilized in Europe at $163-$167/ton (spot) and in the United States at $125-$128/ton, (see European Chemical News, 12 August 1985, p.9). However a typical contract prices for large volumes in the United States is reportedly around $105/ton, which would barely cover the cash cost when using natural gas feedstock at $2.50/ million Btu (Chemical & Engineering News, 4 February 1985, p.13.

61. Chemical & Engineering News, 4 February 1985, pp.12-13. For further discussion of the need to develop methanol's fuel uses, see Manufacturing Chemist, Februrary 1984, p.22, and European Chemical News, 19 December 1983, p.12.

62. In industrialized countries, methanol's main chemical uses are accounted for by formaldehyde (30-50 per cent), acetic acid (5-10 per cent), chloromethanes (5-10 per cent) and MTBE (10 per cent). Other outlets include DMT, methylamine and methyl methacrylate, see Chemical Economy & Engineering Review, June 1984, p.37.

63. Chemical Week, 14 December 1983, p.22.

64. According to some sources, these more complex fuel uses of methanol could take more than a decade to build up the necessary infrastructure (see Chemical & Engineering News, 11 June 1984, p.14, and Chemical & Engineering News, 16 July 1984, p.14.

65. See Chemical & Engineering News, 4 February 1985, pp.12-13.

66. On the basis of the way they can be processed, e.g. moulded, and whether or not they can be thermally re-shaped, plastics are divided into two broad classes, thermoplastics and thermosets. Although slower growing, thermosets made inroads in engineering applications, especially where higher temperature

and electrical resistance were called for. During the past decade some of these engineering uses and many newer ones have been taken over by the group of so-called engineering thermoplastics. These include ABS, polycarbonate, polymethyl methacrylate, nylon, polacetals, PTFE, polybutylene terephthalate, polysulfones, polyamide imides and polyphenyl sulphides, different grades of which are developed with reinforcing fibres and fillers for specific applications. See Chemical Week, 11 July 1984, p.28.

67. "The development of petrochemical industries in developing countries," (ID/WG.448/3), p.4.

68. Ibid., p.6,13.

69. Ibid., pp.9-10.

70. Ibid., p. 6.

71. "World changes in the structure of the petrochemical industry, 1980-1983," UNIDO working paper, pp.1,19.

72. A Swedish LDPE/HDPE plant, which had no upstream links and difficulties in large-scale marketing was recently taken over by a Finnish concern, see Modern Plastic International, September 1983, p.10.

73. For trends in United States LDPE/LLDPE prices see Chemical & Engineering News, 25 June 1984, p.14, and Plastics World, July 1985, p.80. European trends are noted in European Chemical News, 22 July 1985 p.9 and 18 March 1985, p.32.

74. In one recent count 38 different technologies were available for LDPE manufacture, see Chemical Engineering Progress, April 1983, pp.86-87.

75. In the United States, packaging accounts for 44 per cent, consumer goods 19 per cent, electrical products 17 per cent and building and construction 3 per cent (see Plastics World, July 1985, p.83). Some 65 per cent of all LDPE and LLDPE is consumed as film, 10 per cent as injection mouldings (see Chemical & Engineering News, 25 June 1984, p.14.)

76. LLDPE is manufactured at relatively low pressure using fluidized bed processing first introduced in the mid-1970s to make HDPE (see Chemical Insight, March 1981, p.4. Product quality has also been improved by including different comonomers (see European Chemical News, December 1984, p.23).

77. PVC consumption in the United States is accounted for by building and construction, 44 per cent, electrical and electronics, 15 per cent, furniture, 13 per cent, vehicles and transportation, 9 per cent, consumer products 8 per cent and packaging 5 per cent (see Plastics World, July 1985, pp.82,83). Some 65 per cent is extruded to make pipes, cables and profiles, 10 per cent is calendered as sheet or blown as film, 5 per cent is injection or blow mouided, see Chemical & Engineering News, 25 June 1984, p.15.

78. European Chemical News, 17 October 1983, p.31.

79. Petrochemical News, 31 January 1983, p.3

80. Among others, ICI and Enichem in Italy are to consolidate their VCM and PVC operations, see Chemical Week, 25 September 1985, pp. 6-7.

81. See Chemical & Engineering News, 26 August 1985, p.4.

82. Trends in PVC prices in Europe and the United States are discussed in Petrochemical News, 31 January 1983, p.3, and Chemical Week, 25 September 1985, pp.6-7.

83. Although both are polymerized from ethylene in (using the latest technology) broadly similar plants, high density and low density polyethylene are very different materials with few overlapping applications. HDPE, which has a higher molecular weight and better strength properties is particularly used to make paper-like film, large blow-moulded containers and injection moulded parts where good mechnical properties are required. In less demanding applications it is under pressure from linear LDPE which, like HDPE, has few branched chains in is structure, see Plastics World, April 1984, p.8, and Chemical Economy and Engineering Review, October 1982, p.25.

84. See Chemical Engineering Progress, July 1985, p.17.

85. See Plastics World, February 1983, p.4.

86. See Plastics World, June 1982, p.42.

87. The breakdown of applications for HDPE differs considerably from region to region. In the United States. The major fabricated forms are blow moulded items (48 per cent), injection moulded parts (25 per cent), extruded pipes and conduits (10 per cent), see Chemical & Engineering News, 25 June 1984, p.16. In Europe the share going to pipes and conduits is probably greater.

88. See European Chemical News, 16 January 1984, p.11. The third major contibutor to world trade in HDPE is Eastern Europe, with 15 per cent of the total, see Plastics World, August 1985, p.10.

89. See European Chemical News, 12 September 1984, p.15.

90. See European Chemical News, 18 March 1985, p.43,32.

91. See Plastics World, August 1985 p.12.

92. See Plastics World, April 1984 p.8.

93. See European Chemical News, 16 January 1984, p.11.

94. See European Chemical News, 18 April 1983, p.4, and Oil and Gas Journal, April 1985, p.10. The first PP plant using the low-energy technology went on stream in the United States this year, see Chemical & Engineering News, 1 April 1985, p.10. Another new technology in the offing would produce propylene from other petrochemicals, e.g. ethylene, see Oil and Gas Journal, 16 September 1985, p. 100.

95. See European Chemical News, 16 January 1984, p.11, and Plastics World, August 1985, p.10.

96. Chemical Marketing Reporter, 5 August 1985.

97. See European Chemical News, 18 March 1985, p.43.

98. See European Chemical News, 17 September 1985, p.15. In the United States, 1984 list prices for large volumes were in the range 40-47 cents/lb for copolymer (Chemical & Engineering News, 25 June 1984, p.17); general purpose and injection moulding homopolymer in 1985 cost 35-38 cents/kg (Chemical Marketing Reporter, 5 August 1985.)

99. The product maturity problems of polystyrene are discussed in Manufacturing Chemist, November 1984, p.67. In the United States, polystyrene's penetration of major markets held by thermoplastics remains high however, e.g. 21 per cent of their consumption as consumer goods, 14 per cent of electrical goods, 13 per cent of packaging, and 18 per cent of all plastics used in furniture, see Plastics World, July 1985, p.82. The major fabricated forms are injection moulded parts (40 per cent), extruded items (35 per cent) and expandable bead (15 per cent), see Chemical & Engineering News, 25 June 1984, p.18.

100. See European Chemical News, 16 January 1984, p.11.

101. See European Chemical News, 18 March 1985, p.43.

102. See European Chemical News, 18 March 1985, p.32.

103. In the United States, actual selling prices dropped from 44 cents/lb in 1979 to 37 cents/lb. in 1985. List prices are higher. See Chemical Marketing Reporter, 28 January 1985, and Plastics World, August 1985, p.121.101.

104. "World changes in the structure of the petrochemical industry, 1980-1983, op.cit., p.12; Chemical Marketing Reporter, 2 September 1985.

105. Chemical Business, 7 February 1983, p.17 and 2 September 1985, p.18.

106. See Chemical Engineering, 16 April 1984, p.21. Some smaller volume synthetic fibres, such as polypropylene, are also increasing their market share, see Chemical Week, 27 April 1983, p.35.

107. Both 1980 and 1982 were poor years in fibres. In 1984 consumption of staple fibre and filament yarn amounted to a record 12 million tons, see Chemical & Engineering News, 11 March 1985, pp. 11-12.

108. Three Multifibre Agreements have been signed to date, the last being due to expire in July 1986 (The Economist, 18 May 1985, p.18, Financial Times, 9 September 1985). For restructuring aspects see also European Chemical News, 13 August 1984, p.5.

109. Output of high-performance fibres, only 500 tons in 1983, is expected to reach 13,000 tons annually in the year 2000, see Modern Plastics International, March 1984, p.6.

110. For polyester developments, see Business Week, 4 March 1985, p.58; cotton-like nylon is made by blending nylon-6 and polydioxa-amide, see Chemical Week, 1 May 1985, p.40.

111. Synthetic rubbers include not only styrene-butadiene and polybutadiene, which account for most of the demand, but also ethylene-propylene rubber (EPR), butyl rubber (BR), nitrile rubber (NR), isoprene and chloroprene. EPR in particular has been gaining momentum in recent years. Of these, only SBR and PB are currently followed in the UNIDO Petrochemical Database.

112. Rubber consumption and forecasts for developed market economies are reported in Petrochemical News, February 1985, p.3, and Manufacturing Chemist, June 1984, p.25.

113. Chemical Week, 26 March 1985, p.28.

114. Chemical & Engineering News, 30 April 1984, p.46.

115. Petrochemical News, January 1985, p.3.

116. See Business Week, 23 April 1984, p.50, and Financial Times, 3 July 1985. Capacity in industrialized countries peaked in 1983 at around 9 million tons/year, dropping in 1984 by 200,000 tons/year (Chemical & Engineering News, 30 April 1984, p.38.)

117. For several years trade plateaued at around 2 million tons, see Rubber Bulletin, March 1984, p.30.

ANNEX 1

Capacity and Demand, 1970 - 1990

Ethylene

Propylene

Benzene

Methanol

PVC

LDPE

HDPE

PP

PS

WORLD ETHYLENE CAPACITY[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	22000	33200	46200	48300	47950	46800	42900	42200	42000
NORTH AMERICA	9800	13100	19600	20200	19600	18000	18000	17400	17000
WESTERN EUROPE	6750	12400	16000	17500	17500	17700	14400	14000	13500
EASTERN EUROPE	1550	2500	4600	4600	4600	4900	5500	6500	7200
JAPAN	3900	5200	6000	6000	6250	6200	5000	4300	4300
DEVELOPING COUNTRIES	400	1340	4230	4900	4950	5800	6370	9000	14430
ASIA	140	540	2010	2180	2180	2480	2750	3420	4470
MIDDLE EAST	30	60	370	370	370	370	370	2220	3480
AFRICA	-	-	120	120	120	120	450	450	1050
LATIN AMERICA	230	740	1730	2250	2280	2830	2900	2910	5430
WORLD TOTAL	22400	34540	50430	53200	52900	52600	49270	51200	56430
SHARE OF DEVELOPING COUNTRIES %	1.8	3.9	8.4	9.2	9.4	11.0	12.9	17.6	25.6

a) Rounded figures.
b) UNIDO estimates.

WORLD ETHYLENE DEMAND[a]
(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	19100	22600	32000	31700	29500	32000	33400	34900	41000
NORTH AMERICA	8600	9500	14000	14300	12000	14000	14400	15000	17000
WESTERN EUROPE	6300	7800	10500	10400	10500	10800	11000	11600	14500
EASTERN EUROPE	1200	1900	3200	3400	3500	3700	3800	4100	5200
JAPAN	3000	3400	4300	3600	3500	3500	4200	4200	4300
DEVELOPING COUNTRIES	280	1050	2900	3200	3500	3900	4300	6940	11400
ASIA	75	375	1400	1470	1760	1830	2200	3040	5200
MIDDLE EAST	15	75	100	160	180	200	200	1200	2300
AFRICA	-	-	60	80	90	100	100	500	1100
LATIN AMERICA	190	600	1340	1350	1470	1770	2000	2200	2800
WORLD TOTAL	19380	23650	34900	34900	33000	35900	37700	41840	52400
SHARE OF DEVELOPING COUNTRIES %	1.5	4.4	8.3	9.2	10.6	10.9	11.4	16.6	21.8

a) Rounded figures.
b) UNIDO estimates.

WORLD PROPYLENE CAPACITY[a]
(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	11600	18300	25100	25750	26450	27100	25800	26300	28700
NORTH AMERICA	4400	7100	11000	11350	11750	12200	10600	10800	12000
WESTERN EUROPE	4000	6900	8900	9300	9500	9600	9700	9700	10000
EASTERN EUROPE	1000	1500	1700	1900	2000	2100	2300	2600	3500
JAPAN	2200	2800	3500	3200	3200	3200	3200	3200	3200
DEVELOPING COUNTRIES	200	770	1850	1970	1970	1970	2200	3150	5670
ASIA	40	330	850	970	970	970	1130	1530	2040
MIDDLE EAST	20	80	100	100	100	100	100	320	500
AFRICA	-	-	-	-	-	-	-	300	600
LATIN AMERICA	140	360	900	900	900	900	978	1300	2530
WORLD TOTAL	11800	19070	26950	27520	28320	29070	28000	29450	34370
SHARE OF DEVELOPING COUNTRIES %	1.7	4.2	7.4	7.7	7.4	7.3	8.5	12.0	19.8

a) Rounded figures.
b) UNIDO estimates.

WORLD PROPYLENE DEMAND[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	8600	11500	16400	16950	16500	17650	18500	19200	21200
NORTH AMERICA	3050	4100	6700	7100	6200	6900	7500	7700	8500
WESTERN EUROPE	2800	4100	5500	5500	5800	6100	6100	6300	6900
EASTERN EUROPE	600	1000	1550	1800	1900	2000	2200	2400	3200
JAPAN	2150	2300	2650	2550	2600	2650	2700	2800	3000
DEVELOPING COUNTRIES	70	560	1390	1430	1560	1700	2000	2700	4000
ASIA	20	250	750	770	850	930	1150	1600	1900
MIDDLE EAST	-	30	40	40	40	40	40	230	400
AFRICA	-	-	-	-	-	-	-	40	500
LATIN AMERICA	50	280	600	620	650	690	780	850	1200
WORLD TOTAL	8670	12060	17790	18380	18060	19350	20500	21900	25200
SHARE OF DEVELOPING COUNTRIES %	0.8	4.6	7.8	7.8	8.6	8.8	9.8	12.3	15.9

a) Rounded figures.
b) UNIDO estimates.

WORLD BENZENE CAPACITY[a]
(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985 [b]	1990 [b]
DEVELOPED COUNTRIES	14150	18200	21900	22500	22600	22000	22200	22700	23400
NORTH AMERICA	5750	6400	8700	9100	9200	8700	8600	8800	9200
WESTERN EUROPE	4000	5800	6900	7100	7100	7100	7200	7200	7200
EASTERN EUROPE	2000	3300	3300	3300	3300	3200	3400	3700	4000
JAPAN	2400	2700	3000	3000	3000	3000	3000	3000	3000
DEVELOPING COUNTRIES	550	900	1560	1570	1590	2100	2300	3240	5220
ASIA	350	500	890	900	920	1070	1200	1520	2290
MIDDLE EAST	10	15	20	20	20	20	20	380	1040
AFRICA	-	-	-	-	90	90	90	130	130
LATIN AMERICA	190	360	650	650	920	990	990	1210	1760
WORLD TOTAL	14700	19100	23460	24070	24190	24100	24500	25940	28620
SHARE OF DEVELOPING COUNTRIES %	3.7	4.7	6.6	6.5	6.6	8.7	9.4	12.5	18.2

a) Rounded figures.
b) UNIDO estimates.

WORLD BENZENE DEMAND[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	9400	10250	14950	13150	12000	13500	14200	14700	17700
NORTH AMERICA	4150	3700	6100	5100	4400	5000	5200	5300	6200
WESTERN EUROPE	2650	3200	4500	3700	3200	3900	4000	4200	5000
EASTERN EUROPE	1150	1800	2500	2600	2700	2800	2900	3000	3700
JAPAN	1450	1550	1850	1750	1700	1800	2100	2200	2800
DEVELOPING COUNTRIES	460	740	1300	1310	1560	1720	1890	2270	3900
ASIA	300	400	700	750	900	1000	1100	1300	2200
MIDDLE EAST	10	10	40	40	70	80	90	200	500
AFRICA	-	-	10	20	30	40	50	100	200
LATIN AMERICA	150	330	550	500	560	600	650	670	1000
WORLD TOTAL	9860	10990	16250	14460	13560	15220	16090	16970	21600
SHARE OF DEVELOPING COUNTRIES %	4.7	6.7	8.0	9.1	11.5	11.3	11.7	13.4	18.1

a) Rounded figures.
b) UNIDO estimates.

WORLD METHANOL CAPACITY[a)]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b)]	1990[b)]
DEVELOPED COUNTRIES	8300	11700	13250	13750	14050	14000	16350	17800	19400
NORTH AMERICA	3200	4000	4300	4800	5100	5700	7500	7700	8400
WESTERN EUROPE	2300	3800	4100	4100	4100	4000	4000	4000	4000
EASTERN EUROPE	1750	2500	3600	3600	3600	3600	4200	5700	6600
JAPAN	1050	1400	1250	1250	1250	700	650	400	400
DEVELOPING COUNTRIES	210	420	1220	1250	1270	2200	3700	4460	9720
ASIA	610	290	750	780	800	800	1650	1650	2350
MIDDLE EAST	-	-	-	-	-	600	1250	1600	2400
AFRICA	-	-	110	110	110	440	440	440	770
LATIN AMERICA	50	130	360	360	360	360	750	770	4200
WORLD TOTAL	8500	12100	14500	15000	15300	16200	20000	22300	29100
SHARE OF DEVELOPING COUNTRIES %	2.5	3.5	8.4	8.3	8.3	13.6	18.5	20.0	33.4

a) Rounded figures.
b) UNIDO estimates.

WORLD METHANOL DEMAND[a]
(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	6000	6700	10200	10600	11000	11600	12900	13350	16500
NORTH AMERICA	2200	2300	3600	3900	3700	3900	4600	4700	6000
WESTERN EUROPE	1800	1900	3100	3000	3300	3500	3800	3900	4800
EASTERN EUROPE	1100	1750	2400	2500	2900	3000	3100	3300	4000
JAPAN	860	780	1100	1200	1100	1200	1400	1450	1700
DEVELOPING COUNTRIES	250	520	1080	1150	1230	1390	1540	1710	2430
ASIA	140	300	650	700	750	850	950	1000	1500
MIDDLE EAST	10	30	50	60	80	100	120	150	200
AFRICA	10	30	50	50	50	60	70	80	100
LATIN AMERICA	90	160	330	340	350	380	400	480	630
WORLD TOTAL	6300	7200	11300	11800	12200	13000	14500	15000	19000
SHARE OF DEVELOPING COUNTRIES %	4.0	7.2	9.6	9.8	10.1	10.7	10.6	11.4	12.8

a) Rounded figures.
b) UNIDO estimates.

WORLD PVC CAPACITY[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	7700	10800	12800	13200	13100	13500	13700	13400	13700
NORTH AMERICA	2000	2600	3400	3700	3800	3900	4100	4200	4800
WESTERN EUROPE	3600	4700	5300	5600	5100	5400	5700	5500	5000
EASTERN EUROPE	700	1500	2000	2000	2300	2300	2300	2300	2500
JAPAN	1400	2000	2100	1900	1900	1900	1600	1400	1400
DEVELOPING COUNTRIES	660	1420	2220	2220	2470	2680	3060	3070	5680
ASIA	470	1020	1420	1420	1540	1680	2050	2230	3280
MIDDLE EAST	30	30	50	50	50	60	60	160	620
AFRICA	-	-	60	60	120	120	120	180	500
LATIN AMERICA	160	370	690	690	760	820	830	900	1280
WORLD TOTAL	8400	12200	15000	15400	15600	16200	16800	16500	19400
SHARE OF DEVELOPING COUNTRIES %	7.9	11.6	14.8	14.4	15.8	16.5	18.2	18.6	29.5

a) Rounded figures.
b) UNIDO estimates.

WORLD PVC DEMAND[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	5450	6400	9100	8600	8650	9200	9800	10300	11600
NORTH AMERICA	1500	1700	2500	2600	2400	2700	3100	3300	3800
WESTERN EUROPE	2500	2800	3700	3300	3500	3700	3800	3900	4100
EASTERN EUROPE	450	800	1500	1500	1450	1600	1700	1800	2200
JAPAN	1000	1100	1400	1200	1300	1200	1200	1300	1500
DEVELOPING COUNTRIES	750	1380	2450	2580	2790	3150	3510	3900	6100
ASIA	350	700	1250	1400	1500	1750	2000	2100	3500
MIDDLE EAST	100	130	250	280	290	300	310	500	700
AFRICA	100	200	250	300	350	400	450	500	600
LATIN AMERICA	200	350	700	600	650	700	750	800	1300
WORLD TOTAL	6200	7800	11600	11200	11500	12400	13300	14200	17700
SHARE OF DEVELOPING COUNTRIES %	12.1	17.7	21.1	23.0	24.3	25.4	26.4	27.5	34.5

a) Rounded figures.
b) UNIDO estimates.

WORLD LDPE CAPACITY[a)]
(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985 b)	1990 b)
DEVELOPED COUNTRIES	7300	10100	13050	13550	13750	13600	13550	13850	14450
NORTH AMERICA	2600	3200	4500	5000	5700	5800	5700	6000	6200
WESTERN EUROPE	3200	4900	5600	5600	5000	4900	4800	4800	4800
EASTERN EUROPE	600	700	1350	1450	1550	1700	1750	1750	2150
JAPAN	900	1300	1600	1500	1500	1200	1300	1300	1300
DEVELOPING COUNTRIES	240	540	1490	1900	1950	2290	2410	3350	6110
ASIA	70	180	810	810	810	810	930	990	2620
MIDDLE EAST	30	30	30	170	170	170	170	910	1210
AFRICA	-	-	50	50	50	50	50	100	470
LATIN AMERICA	140	330	600	870	920	920	1260	1350	1810
WORLD TOTAL	7540	10640	14540	15450	15700	15890	15960	17200	20560
SHARE OF DEVELOPING COUNTRIES %	3.2	5.1	10.2	12.3	12.4	14.4	15.1	19.5	29.7

a) Rounded figures.
b) UNIDO estimates.

WORLD LDPE DEMAND[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	5100	6300	9000	8700	9100	9800	10500	10900	12600
NORTH AMERICA	1800	2200	3100	3150	3200	3500	3750	3900	4300
WESTERN EUROPE	2200	2600	3800	3500	3650	3900	4100	4200	4800
EASTERN EUROPE	500	700	1200	1250	1300	1400	1600	1700	2200
JAPAN	600	800	900	800	950	1000	1050	1100	1300
DEVELOPING COUNTRIES	550	1120	2170	2450	2620	2800	3050	3440	5000
ASIA	200	350	1000	1200	1300	1400	1500	1600	2400
MIDDLE EAST	50	120	150	170	200	250	300	340	500
AFRICA	50	100	250	280	290	300	350	400	600
LATIN AMERICA	250	450	770	800	830	850	900	1100	1500
WORLD TOTAL	5700	7400	11200	11200	11700	12600	13600	14300	17600
SHARE OF DEVELOPING COUNTRIES %	9.6	15.1	19.4	21.9	22.4	22.2	22.4	24.0	28.4

a) Rounded figures.
b) UNIDO estimates.

WORLD HDPE CAPACITY[a)]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b)]	1990[b)]
DEVELOPED COUNTRIES	3200	4850	7100	7550	7350	7300	7350	7400	9100
NORTH AMERICA	1200	1700	3000	3300	3400	3300	3400	3600	4200
WESTERN EUROPE	1400	2000	2600	2700	2300	2200	2100	2100	2900
EASTERN EUROPE	100	250	600	650	650	800	850	1000	1300
JAPAN	500	900	900	900	1000	1000	1000	700	700
DEVELOPING COUNTRIES	40	80	630	690	690	950	1250	1680	2900
ASIA	30	30	400	400	400	600	900	1000	1500
MIDDLE EAST	-	-	-	-	-	-	-	130	400
AFRICA	-	-	-	-	-	-	-	50	250
LATIN AMERICA	10	50	230	290	290	350	350	500	750
WORLD TOTAL	3200	4900	7700	8200	8000	8300	8600	9100	12000
SHARE OF DEVELOPING COUNTRIES %	1.3	1.6	7.7	8.4	8.6	11.4	14.5	18.4	24.2

a) Rounded figures.
b) UNIDO estimates.

WORLD HDPE DEMAND[a)]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b)]	1990[b)]
DEVELOPED COUNTRIES	1800	2550	4650	4680	4800	5550	5950	6300	8300
NORTH AMERICA	750	1200	2300	2300	2300	2800	2900	3000	3900
WESTERN EUROPE	650	850	1400	1300	1350	1500	1600	1700	2400
EASTERN EUROPE	150	200	400	500	550	650	750	850	1200
JAPAN	250	300	550	580	600	600	700	750	800
DEVELOPING COUNTRIES	190	370	1070	1100	1270	1390	1520	1800	2800
ASIA	100	150	530	600	700	800	850	1000	1400
MIDDLE EAST	20	40	80	80	90	90	100	120	200
AFRICA	20	50	110	120	130	150	170	180	500
LATIN AMERICA	50	130	350	300	350	350	400	500	700
WORLD TOTAL	2000	2900	5700	5800	6100	6900	7500	8100	11100
SHARE OF DEVELOPING COUNTRIES %	9.5	12.8	18.8	19.0	20.8	20.1	20.3	22.2	25.2

a) Rounded figures.
b) UNIDO estimates.

WORLD PP CAPACITY[a)]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b)]	1990[b)]
DEVELOPED COUNTRIES	1750	3650	6500	6800	7000	6600	6800	6900	8100
NORTH AMERICA	600	1500	2600	2700	2800	2500	2600	2800	3500
WESTERN EUROPE	500	900	2400	2500	2500	2300	2300	2300	2500
EASTERN EUROPE	50	200	300	400	500	600	600	700	900
JAPAN	600	1050	1200	1200	1200	1200	1300	1100	1200
DEVELOPING COUNTRIES	-	100	650	650	700	800	950	1100	2250
ASIA	-	100	400	400	400	500	650	635	1200
MIDDLE EAST	-	-	-	-	-	-	-	60	200
AFRICA	-	-	-	-	-	-	-	100	250
LATIN AMERICA	-	-	250	250	300	300	300	300	600
WORLD TOTAL	1750	3750	7150	7450	7700	7400	7750	8000	10350
SHARE OF DEVELOPING COUNTRIES %	-	2.6	9.1	8.7	9.1	10.8	12.3	13.8	21.7

a) Rounded figures.
b) UNIDO estimates.

WORLD PP DEMAND[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	1500	2300	3850	4200	4300	5000	5550	5850	7600
NORTH AMERICA	450	800	1400	1600	1700	2100	2200	2300	3100
WESTERN EUROPE	550	700	1350	1350	1400	1550	1800	1900	2300
EASTERN EUROPE	150	250	300	350	380	400	450	500	800
JAPAN	350	550	800	900	850	950	1100	1150	1400
DEVELOPING COUNTRIES	190	380	890	980	1160	1470	1580	1870	2450
ASIA	130	300	500	600	700	950	1000	1100	1400
MIDDLE EAST	10	20	50	60	70	80	100	120	150
AFRICA	20	50	100	120	140	160	180	200	300
LATIN AMERICA	30	120	240	200	250	280	300	450	600
WORLD TOTAL	1700	2700	4750	5200	5500	6500	7100	7700	10050
SHARE OF DEVELOPING COUNTRIES %	11.2	14.1	18.7	18.8	21.1	22.6	22.3	24.3	24.4

a) Rounded figures.
b) UNIDO estimates.

WORLD PS CAPACITY[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	4400	6850	7450	7450	7450	7540	7300	7650	8500
NORTH AMERICA	1300	2500	2750	2750	2850	2950	2650	2800	3100
WESTERN EUROPE	2000	2600	2400	2400	2300	2300	2300	2500	3000
EASTERN EUROPE	250	500	900	900	900	900	950	950	1000
JAPAN	850	1250	1390	1390	1390	1390	1390	1390	1420
DEVELOPING COUNTRIES	120	410	850	890	890	990	990	1290	1900
ASIA	20	160	400	400	400	500	500	700	800
MIDDLE EAST	-	20	20	20	20	20	20	20	250
AFRICA	-	-	-	-	-	-	-	-	150
LATIN AMERICA	100	230	430	470	470	470	470	570	700
WORLD TOTAL	4500	7300	8300	8300	8300	8500	8300	8900	10400
SHARE OF DEVELOPING COUNTRIES %	2.7	5.6	10.2	10.7	10.7	11.6	11.9	14.5	18.3

a) Rounded figures.
b) UNIDO estimates.

WORLD PS DEMAND[a]

(thousands of tons/year)

REGION	1970	1975	1980	1981	1982	1983	1984	1985[b]	1990[b]
DEVELOPED COUNTRIES	2000	3550	4100	4050	4000	4800	4900	5050	6600
NORTH AMERICA	1100	1300	1600	1650	1550	1900	1950	2000	2500
WESTERN EUROPE	1200	1350	1400	1400	1350	1700	1750	1750	2200
EASTERN EUROPE	200	300	470	500	550	570	600	650	900
JAPAN	600	600	650	500	550	600	600	650	1000
DEVELOPING COUNTRIES	160	350	680	710	800	920	1010	1170	1800
ASIA	50	150	300	310	380	450	500	550	800
MIDDLE EAST	20	40	50	60	80	90	100	120	150
AFRICA	10	20	50	60	70	80	90	100	150
LATIN AMERICA	80	160	280	280	290	300	320	400	700
WORLD TOTAL	2200	3900	4800	4800	4800	5700	5900	6200	8400
SHARE OF DEVELOPING COUNTRIES %	7.3	9.0	14.2	14.8	17.1	16.1	17.1	18.9	21.4

a) Rounded figures.
b) UNIDO estimates.

ANNEX 2

Evolution of petrochemical capacity in selected countries

Algeria
Libyan Arab Jamahirya

China
Indonesia
Republic of Korea
Other Asia
Singapore

Argentina
Brazil
Chile
Colombo
Mexico
Peru
Venezuela

Qatar
Saudi Arabia
Turkey

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
AFRICA																	
Algeria																	
Ethylene				120	120	120	120	120	120	120	120	120	120	120	120	120	120
Propylene																	235
Benzene									90	90	95	95	95	95	95	95	95
Xylene									247	247	247	247	247	247	247	247	247
Methanol				110	110	110	110	110	110	110	110	110	110	110	110	110	110
PVC						35	35	35	35	35	35	35	35	35	35	35	135
HDPE																	75
LDPE						48	48	48	48	48	48	48	48	48	48	48	128
Libya																	
Ethylene											330	330	330	330	330	330	330
Propylene												172	172	172	172	172	172
Butadiene												60	60	60	60	60	60
Methanol								330	330	330	330	330	660	660	660	660	660
PVC									60	60	60	60	60	60	60	60	60
HDPE												51	51	51	80	80	80
LDPE												52	52	52	130	130	130
PP												68	68	68	68	68	116

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
ASIA																	
China																	
Ethylene	30	65	134	303	380	380	540	690	690	690	950	1285	1285	1285	1800	1800	1900
Propylene	50	90	100	200	200	230	230	289	289	289	410	480	480	480	480	480	480
Benzene	200	200	200	200	200	400	400	400	430	430	500	550	550	550	550	550	600
Butadiene		57	57	57	100	100	100	100	100	100	130	130	130	130	220	220	220
Xylene					30	50	100	100	100	100	210	210	210	210	400	400	464
Methanol	100	180	180	180	260	260	260	260	260	260	400	400	400	400	400	800	800
Styrene				150	150	150	200	250	250	250	250	250	250	250	250	250	250
Acetaldehyde							50	50	50	50	110	170	170	170	170	170	170
EO							35	35	35	35	35	35	35	195	195	195	195
ACN		10	10	10	10	10	60	60	60	60	60	60	60	60	110	110	110
DMT/TPA			25	25	113	113	113	113	113	113	377	377	377	377	377	377	377
PVC	130	300	300	300	300	400	400	400	400	400	600	600	600	600	1080	1080	1080
HDPE	5	5	35	35	35	35	183	183	183	323	603	603	603	603	603	603	883
LDPE		60	60	264	264	264	264	264	264	264	264	324	324	405	600	600	1080
PP		20	20	20	20	120	133	133	133	133	133	133	160	300	300	300	300
PS		6	6	6	6	20	40	40	40	40	40	133	133	133	133	133	230
SBR		23	23	23	23	30	30	30	30	30	110	110	110	110	110	110	110
PB															50	50	50
Polyamide			10	10	10	10	64	64	64	64	64	64	64	64	64	64	64
Acrylics		20	20	20	20	30	30	30	30	30	30	30	30	100	150	150	150

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
India																	
Ethylene	75	111	111	111	214	214	214	241	241	241	241	349	449	449	449	794	794
Propylene	41	41	41	41	119	119	119	119	119	119	119	148	148	148	148	148	208
Benzene	95	95	95	95	131	131	151	151	151	151	151	237	237	237	237	237	502
Butadiene	32	32	36	36	54	54	58	58	58	58	58	67	83	83	83	83	83
Xylene	41	41	41	41	41	41	41	41	41	41	41	41	41	41	96	96	96
Methanol			36	43	44	44	44	77	135	135	135	135	135	135	135	135	135
Styrene		33	33	35	35	35	35	35	35	35	35	35	35	35	35	35	35
EO	12	12	12	12	12	28	28	28	28	28	28	28	28	28	28	300	300
VCM	60	80	80	80	80	80	80	80	87	93	150	253	253	253	253	253	253
ACN						24	24	24	24	24	24	24	74	74	74	74	74
Caprolactam	20	20	20	20	20	20	20	20	20	20	20	25	20	65	65	115	115
DMT/TPA	24	24	24	24	24	24	24	24	24	69	90	90	100	100	100	100	240
PVC	66	98	98	98	98	132	132	132	132	132	187	187	187	187	187	376	376
HDPE	20	20	30	30	30	30	30	30	30	45	45	45	45	45	45	170	170
PP					30	30	30	30	30	30	55	55	55	55	55	55	115
PS	18	24	24	24	24	24	24	24	24	24	24	24	24	24	49	49	49
SBR	30	30	30	30	30	30	30	38	38	38	63	63	63	63	63	63	63
PB						20	20	20	20	20	20	20	20	20	20	20	20
Polyester	5	35	35	35	35	39	39	39	39	39	49	49	49	49	49	49	49
Polyamide		20	20	20	20	40	40	40	40	40	40	40	40	40	141	141	141
Acrylics		1	1	1	1	16	16	16	16	16	16	16	16	16	16	16	16

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Republic of Korea																	
Ethylene		100	100	100	155	155	505	505	505	505	505	505	505	755	755	755	755
Propylene		58	58	58	80	80	268	268	268	268	268	268	268	268	268	268	268
Benzene	56	56	56	56	56	130	130	130	130	130	130	214	250	250	250	250	250
Butadiene		24	24	24	24	24	74	74	74	74	74	74	74	74	74	74	124
Xylene	88	88	88	88	88	118	118	118	118	118	118	331	331	331	331	331	627
Methano'		45	330	330	330	330	330	330	330	330	330	330	330	330	330	330	330
Styrene					80	80	80	80	80	80	80	180	260	260	260	260	260
Acetaldehyde		24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
EO							80	80	80	80	80	80	80	80	80	80	80
VCM		60	60	60	60	210	210	210	210	210	210	210	410	410	410	410	410
ACN		27	27	27	75	75	77	77	77	77	77	77	77	77	77	77	230
Caprolactam		33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	83
DMT/TPA							160	160	160	160	160	160	160	160	320	320	320
PVC	86	86	236	236	236	236	236	236	236	355	405	555	555	605	605	605	605
HDPE			50	50	50	120	140	140	140	140	140	140	140	140	220	220	220
LDPE		50	50	50	50	150	150	150	150	150	150	150	230	230	320	310	310
PP		45	45	45	105	185	185	185	185	185	185	185	185	185	262	262	262
PS		30	30	50	117	117	147	147	167	167	167	312	312	327	327	327	357
SBR		25	50	50	70	70	75	100	100	100	100	100	100	100	100	100	100
PB							25	25	25	25	25	25	25	50	50	50	50
Polyester		171	171	171	171	271	271	271	271	271	271	271	271	271	271	271	271
Polyamide		44	44	44	44	91	91	91	91	91	180	180	180	180	180	180	180
Acrylics		75	75	75	75	114	114	114	114	114	114	114	114	114	114	114	114

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Other Asia																	
Ethylene	100	200	200	340	690	690	690	690	690	690	920	953	953	953	953	953	1075
Propylene		140	140	140	230	230	230	290	290	290	490	490	490	490	490	490	490
Benzene		34	34	34	34	200	200	200	200	350	350	350	450	450	450	450	450
Butadiene		45	45	45	80	80	145	145	145	205	205	205	258	258	258	258	258
Xylene		100	100	100	150	150	150	277	277	330	330	330	330	330	330	330	330
Methanol		45	45	45	45	116	116	116	136	136	202	202	202	202	202	202	602
Styrene		100	100	100	100	100	100	100	200	200	200	200	200	200	200	200	200
Acetaldehyde							50	50	50	50	50	90	90	90	90	90	90
EO							100	100	100	110	110	110	120	120	120	120	120
VCM		106	106	106	106	106	346	346	346	346	566	566	566	566	566	566	566
ACN		66	66	66	132	132	132	132	132	132	132	132	132	132	132	132	132
Caprolactam		50	50	50	50	50	100	100	100	100	100	100	100	100	100	100	100
DMT/TPA				52	52	175	175	190	360	400	400	400	400	400	400	400	400
PVC	100	400	400	470	470	470	470	470	470	612	612	612	612	612	612	612	612
HDPE			30	30	30	50	50	50	50	170	170	200	200	200	200	200	200
LDPE	35	35	100	140	140	215	215	215	215	215	215	215	215	215	460	460	460
PP						50	50	50	50	120	240	240	240	240	240	240	240
PS		10	10	10	10	55	55	55	55	178	178	178	178	178	178	178	178
SBR		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
PB											42	42	42	42	42	42	42
Polyester		353	353	353	353	353	353	353	353	353	373	453	453	453	453	453	453
Polyamide		120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Acrylics		70	70	70	70	91	91	91	91	91	91	91	91	91	91	91	91

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Singapore																	
Ethylene											300	300	300	300	300	300	300
Propylene											160	160	160	160	160	160	160
Benzene											59	59	59	59	59	59	59
Butadiene											45	45	45	45	45	45	45
Xylene											29	29	29	29	29	29	29
EO												80	80	80	80	80	80
PVC		33	33	33	33	33	33	33	33	33	33	33	33	33	33	33	33
HDPE											80	80	80	80	80	80	80
LDPE											120	120	120	120	120	120	120
PP											100	100	100	100	100	100	100
PS						15	15	15	15	15	15	15	15	15	15	15	15
Polyester		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Polyamide		8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
LATIN AMERICA																	
Argentina																	
Ethylene	55	55	55	55	55	173	173	173	253	253	253	253	253	253	253	253	840
Propylene	20	20	20	20	20	20	20	20	20	20	80	176	176	176	176	176	336
Benzene	58	58	58	140	140	140	140	140	157	157	157	157	157	157	157	157	157
Butadiene	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	35	112
Xylene		65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
Methanol		36	36	36	36	36	36	36	36	36	36	36	32	32	716	716	716
Styrene	34	50	50	50	50	50	50	50	50	50	50	75	75	75	75	75	75
EO		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
VCM	36	36	36	36	36	36	36	36	36	36	36	36	266	266	266	266	266
Caprolactam							60	60	60	60	60	60	60	60	60	60	153
PVC	33	60	60	60	60	60	60	60	60	60	60	60	160	160	160	160	160
HDPE								20	20	20	20	100	100	100	100	100	100
LDPE	32	32	32	32	32	32	32	32	175	224	224	224	224	224	310	310	310
PS	25	56	56	56	57	57	57	57	57	57	57	57	57	57	57	57	57
SBR	55	55	55	55	55	62	62	62	62	62	62	62	62	62	62	o2	62
Polyester		38	38	38	38	38	38	38	38	38	38	38	38	38	38	38	30
Polyamide		37	37	37	37	37	37	37	37	37	37	37	37	37	37	37	37
Acrylics		7	7	7	7	15	15	15	15	15	15	15	15	15	15	15	15

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Brazil																	
Ethylene	20	300	300	320	370	750	802	1222	1251	1311	1381	1381	1381	1381	1381	1381	1500
Propylene	60	225	225	225	255	409	409	460	460	460	460	683	683	683	683	683	900
Benzene	40	140	140	140	175	215	330	330	421	421	421	544	544	544	544	544	544
Butadiene	30	115	115	115	115	168	168	168	168	168	168	234	234	234	234	234	234
Xylene		44	44	44	44	158	158	158	158	158	158	166	166	166	246	246	246
Methanol	20	58	102	117	117	140	153	153	153	153	153	170	170	170	210	210	210
Styrene	10	60	60	60	120	235	235	235	235	235	235	235	235	235	235	235	260
Acetaldehyde						55	55	55	55	55	110	160	160	160	160	160	210
EO		36	36	36	50	140	140	140	140	140	140	140	140	140	140	140	155
VCM	50	178	178	178	250	250	314	314	314	314	384	384	384	534	534	534	534
ACN						60	60	60	60	60	72	72	72	72	72	72	72
Caprolactam				35	35	35	35	35	35	35	35	35	35	35	70	70	70
PVC	40	140	160	160	311	354	354	354	354	354	354	354	354	354	524	524	524
HDPE	10	50	50	50	50	110	130	170	170	170	170	170	170	170	170	170	170
LDPE	80	160	160	240	240	320	328	443	443	443	543	543	543	543	543	543	543
PP						90	100	100	166	166	166	166	166	166	166	166	166
PS	36	83	136	136	136	185	194	231	231	231	231	231	231	231	231	231	231
SBR	75	110	165	165	165	165	165	234	234	234	314	314	314	314	314	314	314
PB	28	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76
Polyester	22	92	92	123	132	132	132	132	132	132	132	144	144	144	144	144	144
Polyamide	34	58	75	75	82	97	97	102	102	108	108	108	108	108	108	108	108
Acrylics	4	17	23	23	23	23	24	24	24	24	24	24	24	24	24	24	24

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Chile																	
Ethylene		45	45	45	45	45	45	45	45	45	45	45	45	45	45	45	60
Propylene																	40
Benzene	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Methanol															760	760	760
VCM		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
PVC		15	15	15	15	15											
LDPE		20	24	40	40	40	40	40	40	40	40	40	40	40	40	40	40
PS	7	7	7	7	7	7	2	2	2	2	2	5	5	5	5	5	5
Polyester	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Polyamide	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Colombia																	
Ethylene		16	16	16	16	16	16	115	115	115	115	115	115	115	115	115	446
Propylene		10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	24
Benzene		43	43	43	43	43	43	43	43	43	43	43	43	43	43	43	50
Xylene	42	42	42	42	42	60	60	60	60	60	60	60	60	60	60	60	
VCM	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Caprolactam		18	18	18	18	18	18	18	18	20	20	20	20	20	20	20	20
PVC	15	44	44	44	44	44	44	44	44	44	44	44	44	44	44	44	50
LDPE		15	15	15	15	40	40	40	40	40	40	40	40	40	40	40	40
PS	12	12	12	12	12	12	13	13	13	13	13	13	13	13	13	13	15
Polyester	20	22	33	33	33	30	30	30	30	30	30	30	30	30	30	30	30
Polyamide	12	12	12	12	35	35	35	35	35	35	35	35	35	35	35	35	75

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Mexico																	
Ethylene	100	300	300	300	300	435	435	435	500	932	932	940	940	940	1840	1840	1840
Propylene	60	100	120	150	150	150	324	324	324	324	404	404	404	531	908	908	908
Benzene	90	116	116	119	119	119	124	124	299	299	299	423	423	423	723	723	723
Butadiene	55	55	55	55	55	55	55	55	55	55	100	100	100	100	255	255	355
Xylene	82	120	150	224	224	224	224	224	224	224	352	352	352	352	957	957	957
Methanol	32	32	32	32	171	171	171	171	171	171	171	171	171	171	825	825	1822
Styrene	33	33	33	33	33	33	33	33	187	187	290	440	440	440	440	440	440
Acetaldehyde	44	44	44	44	80	80	180	180	180	180	230	230	230	230	380	380	380
EO		28	28	28	128	128	128	128	128	128	328	328	528	528	528	528	528
VCM		70	70	70	70	70	70	70	100	100	270	290	290	290	590	590	590
ACN		24	24	24	74	74	74	74	74	74	174	174	174	174	334	324	324
Caprolactam		47	47	47	47	47	47	47	47	47	147	147	147	147	147	147	147
PVC	50	104	115	115	115	134	136	136	208	267	277	349	349	349	449	449	449
HDPE						100	100	100	100	100	100	100	100	100	200	200	300
LDPE	30	99	99	99	99	99	99	99	99	99	339	339	339	339	579	579	579
PP				154	154	154	154	154	154	154	154	154	154	154	354	354	354
PS	25	62	70	70	98	98	114	114	114	114	114	201	201	201	300	300	300
SBR	50	84	84	84	84	90	90	105	105	115	115	125	125	125	200	200	200
PB		30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Polyester		115	156	172	172	172	172	172	172	172	172	172	172	172	172	172	172
Polyamide		41	45	45	45	49	49	49	49	49	49	49	49	49	100	100	100
Acrylics		46	67	67	67	69	69	69	69	69	69	69	69	69	69	69	69

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Peru																	
Ethylene	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	255
Propylene																	147
Benzene																	125
VCM	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	35
ACN																	40
PVC	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	33
Polyester		10	13	13	13	13	13	13	13	13	6	6	6	6	6	6	9
Polyamide	6	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Acrylics		18	18	12	14	16	20	24	28	24	24	28	28	28	28	28	40

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Venezuela																	
Ethylene			150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Propylene				94	94	94	94	94	94	94	94	94	94	94	94	94	94
VCM							56	56	56	56	56	56	56	56	56	56	78
PVC				40	40	40	40	40	40	40	40	40	40	40	40	40	60
HDPE										60	60	60	60	60	60	60	60
LDPE				50	50	50	50	50	58	58	58	58	58	58	58	58	58
PS		40	40	40	40	40	49	49	49	49	49	49	49	49	49	49	49
Polyester		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Polyamide	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
THE MIDDLE EAST																	
Qatar																	
Ethylene							280	280	280	280	280	280	280	280	280	280	280
LDPE								140	140	140	140	140	140	140	140	140	140
HDPE																	70
Saudi Arabia																	
Ethylene												1611	1611	1611	1611	1611	1611
Benzene												245	245	245	245	245	245
Xylene												187	187	187	187	187	187
Butadiene															124	124	124
Methanol										600	1250	1250	1250	1250	1250	1250	1250
Styrene												295	295	295	295	295	295
EO												300	300	300	300	300	300
VCM													300	300	300	300	300
DMT																	150
PVC													200	200	200	200	200
HDPE												91	91	91	91	91	195
LDPE											260	590	590	590	590	590	590
PS																	140
Ethanol											281	281	281	281	281	281	281

EVOLUTION OF PETROCHEMICAL CAPACITY

(thousands of tons/year)

Countries	1970	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Turkey																	
Ethylene	30	55	55	55	55	55	55	55	55	55	55	367	367	367	367	367	367
Propylene	22	40	40	40	40	40	40	40	40	40	40	199	199	199	199	199	199
Benzene	10	13	13	13	18	18	18	18	18	18	18	139	139	139	139	139	139
Xylene												187	187	187	187	187	187
Butadiene		32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Styrene		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
EO												54	54	54	54	54	54
VCM	27	55	55	55	55	55	55	55	55	55	55	172	172	172	172	172	172
ACN											70	70	70	70	70	70	270
Caprolactam		25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
DMT/TPA				30	30	30	30	30	30	30	30	100	100	100	100	100	100
PVC	26	26	52	52	52	52	52	52	52	52	52	152	152	152	152	152	152
HDPE												40	40	40	40	40	40
LDPE	27	27	27	27	27	27	27	27	27	27	27	177	177	177	177	177	177
PP												60	60	60	60	60	60
PS		15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	30
SBR		32	32	32	32	32	32	32	32	32	32	38	38	38	38	38	38
PB		14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
Polyester	27	69	69	73	73	73	73	73	98	107	107	107	107	107	107	107	107
Polyamide		23	23	23	23	23	23	23	23	23	40	40	40	40	40	40	40
Acrylics		13	40	47	47	50	52	52	60	60	92	92	192	192	192	192	192