3.1.2 OXO ALCOHOLS

Oxo alcohols are produced by reacting olefins with either a) syngas (1 H_2/1 CO) to form aldehydes which are hydrogenated to alcohols, or b) (2 H_2/1 CO) syngas to produce alcohols. These alcohols are used in solvent, plasticizer, and detergent range markets.

Technological change has recently affected oxo alcohol production. New and larger olefin plants have resulted in sharply increased quantities of olefins available. This supply situation has provided relatively low cost olefin feedstock for oxo producers. During this same period, substitution of a rhodium catalyst for the normal cobalt catalyst in the oxonation reaction has further improved the competitiveness of the oxo process.

Projected syngas requirements for oxo-alcohols are shown in Table 3.6.

3.1.2.1 SOLVENT ALCOHOLS

Solvent alcohols include n-propanol produced by oxo-processing of ethylene and normal and iso-butanol produced by oxo-processing of propylene. Most n-butanol is used in surface coatings, either directly as a solvent or via derivatives such as n-butyl acetate or glycol ethers. Ethylene is also oxo-processed to propionaldehyde for oxidation to propionic acid.

Growth prospects for solvent alcohols will be strongly influenced by legislation as well as displacement of existing solvent systems. Aromatic solvents have been restricted in solvent coating systems. The same legislation has exempted n-butanol and as a result its direct solvent use is expected to increase. The key growth performer in the solvent area is expected to be n-butyl acetates due to superior wear properties and production costs of interior and exterior latex coatings.

Table 3.4 summarizes projected n-butanol, i-butanol and propanol demand. Over the period 1978-1987, demand growth is projected at between 5% and 6% for each of these solvent alcohols. Capacity for propionic acid exceeds demand and is expected to throughout the ten year period.

Capacities for butanols and propanol are shown in Table 3.5. The information provided includes projection of specific plant expansions. Syngas requirements to meet solvent alcohol capacity expansions are shown in Table 3.6.

3.1.2.2 PLASTICIZER ALCOHOLS

Oxo alcohols in the C_6 to C_{13} range are used to produce plasticizers, primarily phthalates. The primary product, di-octyl phthalate (DOP), is produced from the major plasticizer alcohol, 2-ethyl hexanol (2-EH). Over the years DOP has been the general purpose plasticizer for both vinyl and rubber application. Since the early 1970's linear plasticizers have successfully displaced DOP due to superior low temperature flexibility and low volatility. Among the higher alcohols used in plasticizers, iso-nonanol is also expected to take market share from DOP. Iso-nonanol is used to produce di-isononyl phthalate (DINP) which is expected to grow faster than the total plasticizer market.

Table 3.7 summarizes plasticizer markets for oxo alcohols. Future capacity vs. demand balances are shown in Table 3.8. Two capacity additions are projected for the period 1978-1987.

3.1.2.3 DETERGENT ALCOHOLS

Oxo alcohols in the C_{10}-C_{20} range are referred to as detergent alcohols. Oxo technology competes in the detergent range with linear alcohols made by Ziegler technology and with natural alcohols produced by hydrogenation of fatty acids. Detergent-range alcohols are used in production of detergents and cosmetics. The major alcohol products, ether sulfates and ethoxylates, will become increasingly dependent on oxo technology. Ether sulfates perform better than the corresponding tallow alcohol sulfates in low and non-phosphate products. Alcohol ethoxylates are likewise replacing alkylphenol products. Table 3.9 summarizes expected demand for detergent range alcohols in the U.S. A 300 MM lb expansion is expected in the 1983-1987 period.

Table 3.4

DEMAND FOR SOLVENT ALCOHOLS
(MM lbs.)

	1977	1982	1987
n-Butanol:			
Solvent	140	206	300
N-Butyl Acrylates	206	271	314
Glycol Ethers	112	134	291
Plasticizers	89	106	105
n-Butyl Acetate	66	94	115
n-Butyl Amine	9	9	12
Miscellaneous	33	49	55
U.S. Domestic	655	870	1192
Exports	90	90	90
Total	745	960	1282
i-Butanol:			
Isobutyl Acetate	28	38	55
Isobutyl Acrylate	14	17	19
Lube Oil Additives	23	35	44
Amines	43	62	75
Others	33	38	42
Exports	9	13	25
Total	150	203	260
n-Propanol (or equivalent):			
Solvent	142	157	220
Aldehyde for acid	73	83	120
Total	215	240	340

Table 3.5
CAPACITIES FOR BUTANOLS AND PROPANOL
(MM lbs.)

	1977	1982	1987
n-Butanol:			
Gulf Coast	573	814	1084
Other	338	371	491
Total	911	1185	1575
Less NBA for 2-EH and other	60	60	60
Available (@90%)	766	1012	1364
Surplus/(Shortfall)	21	52	82
	(Below - Listed for maximum Iso Conditions)		
i-Butanol:			
Gulf Coast	223	147	163
Other	133	126	144
Total	256	273	307
Available (@90%)	230	246	276
Surplus/(Shortfall)	80	43	16
n-Propanol capacity:			
East Texas	250	300	450
Available (@90%)	225	270	405
Surplus/(Shortfall)	10	30	65

Table 3.6

SYNGAS ADDITIONS FOR OXO ALCOHOLS
(MM SCFD)

	1978-1982			1983-1987		
	H_2	$1H_2/1CO$ Syngas	$2H_2/1CO$ Syngas	H_2	$1H_2/1CO$ Syngas	$2H_2/1CO$ Syngas
Butanols						
Gulf Coast	4.1	9.1	--	4.1	9.1	8.5
Other	--	--	--	4.1	9.1	--
Propanol						
Gulf Coast	1.1	2.6	--	3.2	7.8	--
Other	--	--	--	--	--	--
C_7-C_9 Plasticizer						
Gulf Coast	--	--	4.5	--	--	4.5
Detergent						
Gulf Coast	--	--	--	3.1	7.1	--

Table 3.7

PLASTICIZER MARKETS FOR OXO ALCOHOLS

	1977	1982	1987
2-EH			
Dioctyl Phthalate	276	301	332
Dioctyl Adipate	31	36	41
2-EH Acrylate	39	44	48
Others	31	35	40
U.S. Domestic	377	416	461
Export	15	18	18
	392	434	479
Linear Alcohols	222	282	360
Isodecyl Alcohol	105	129	157
Isononyl Alcohol	92	131	184
Other	68	79	91
Total	879	1055	1271

Table 3.8

PROJECTED CAPACITIES FOR PLASTICIZER OXO ALCOHOLS

	1977	1982	1987
2-EH			
Gulf Coast	240	240	240
Other	380	380	380
Total	620	620	620
Available (@90%)	558	558	558
Surplus/(Shortfall)	166	124	79
Other Plasticizers			
Gulf Coast	525	675	825
Other	90	90	90
Total	615	765	915
Available (@90%)	553	688	823
Surplus/(Shortfall)	66	67	31

Table 3.9

DEMAND AND SUPPLY FOR DETERGENT RANGE ALCOHOLS
(MM lbs.)

	1977	1982	1987
Alcohol Sulfates	140	175	225
Ethoxylates	115	180	220
Ether Sulfates	130	145	165
Viscosity Improvers	60	55	55
Other	100	140	200
Total	545	695	865
Available	850	850	850
Surplus/(Shortfall)	305	155	(15)

3.1.3 POLYURETHANES AND ANILINE

Polyurethanes are the newest, fastest growing and most versatile member of the plastics family.

The use of diisocyanates as a means of making polymers was begun in the U.S. in the mid-1950's for the manufacture of flexible foam. Urethane foam began its highly successful market replacement of latex foam cushioning in the late 1950's when polyether based polyols were reacted with toluene diisocyanate resulting in much more resilient foams.

Isocyanates are produced in existing plants by reduction of nitrocompounds to amines followed by phosgenation. There are three key isocyanate products:

- Toluene Diisocyanate (TDI)
- Polymethylene Polyphenylene Diisocyanate (Polymeric MDI)
- 4,4-Methylenediphenyl Diisocyanate (Refined MDI)

3.1.3.1 MARKETS FOR MDI (PURE AND POLYMERIC)

MDI depends heavily on the insulation market for rigid foams. The insulation market accounts for over half of domestic shipments. Insulation applications for rigid polyurethane foam fall in four categories: roofs, walls, tank and pipe, and walk-in coolers. Roof insulation is used in board stock form (75%) and spray-in-place form (25%). Wall insulation applications are about half the size of the roof market. All other categories of rigid foam insulation are significantly smaller than roof and wall markets. Polyurethane manufacturers have established a strong market position in insulation. The rapid rise of energy costs plus likely energy conservation financial incentives are expected to push the rigid foam insulation market at a near term growth rate of about 15%.

The refrigeration, transportation and other rigid foam markets collectively amount to about 80% of the insulation market. Foam has penetrated about 50% of the residential refrigeration market. Continued displacement of fiberglass in this market is expected.

In the transportation markets, polyurethane foam is used to insulate railroad cars, truck trailers, truck bodies, containers, tank trucks, etc. Truck, trailer and container applications account for about 70% of the rigid foam consumption in transportation. Growth in refrigeration, transportation and other markets is expected to be over 10%.

The major isocyanates application in the adhesives area is in foundry binders based on alkyds and phenolics. Textile bonding also consumes isocyanates. A growth rate of nearly 15% is expected in the adhesives area on a relatively small base of 20 million pounds in 1977.

The most dramatic growth area for MDI is expected to be microcellular elastomers. This growth will be due almost entirely to application in automotive fascia. By 1982, penetration in fascia could be as high as 30% of U.S. passenger cars.

Exports are expected to be a declining market as U.S. energy prices rise to parity with world prices, eliminating the present U.S. feedstock cost advantage. However, the substantial foreign position in U.S. isocyanates production is expected to moderate any trend to a rapid build-up of offshore isocyanate plants.

Projected MDI markets are shown in Table 3.10.

3.1.3.2 MARKETS FOR TDI

TDI markets are shown in Table 3.11.

Flexible foam applications account for about 70% of total 1977 TDI markets. Four key flexible foam markets exist -- transportation, furniture, bedding, and carpet cushioning.

Table 3.10

SUMMARY MARKET INFORMATION FOR MDI
(MM lbs.)

	1977	1982	1987
Rigid Foams			
Insulation	120	250	450
Refrigeration	40	80	125
Transportation	30	50	75
Other	30	45	90
Adhesives	20	45	80
Elastomers	17	40	80
Flexible Foams	18	30	50
Exports	125	100	100
Total	400	640	1050

Table 3.11

SUMMARY MARKET INFORMATION FOR TDI
(MM lbs.)

	1977	1982	1987
Flexible Foam			
Transportation	120	130	140
Furniture	150	175	200
Bedding	45	70	100
Carpeting	85	120	170
Other	50	60	70
Rigid Foam	25	45	70
Other	20	50	75
Export	130	125	125
Total	625	775	950

Passenger cars account for about 80% of the transportation market. Seat bottoms and seat backs account for the large volume use in passenger cars. Downsizing of cars to meet federal gasoline mileage requirements is expected to virtually eliminate the growth in the transportation market for flexible foams.

Household furniture dominates the flexible foam applications in the furniture market. The furniture market is expected to grow at less than 3% annually as the rate of new housing starts moderates.

The bedding market for flexible foam should grow at about 8% over the next ten years. The solid foam core mattress, which accounted for less than 20% of all mattresses sold in 1977, is expected to continue to replace innersprings to an ever-increasing extent.

The carpet cushioning market utilizes flexible foam for carpet underlay and integral carpet backing. Rubber latex is presently cheaper than urethane foam, however foam has significant abrasion resistance, compression resistance, and tear resistance advantages. The price differential of foam vs. latex is expected to decline resulting in further penetration of the carpet cushioning market. An overall growth rate of over 7% is projected for the period 1978-1987.

Exports are the second largest general market for TDI. This TDI end-use is expected to be stagnant as large TDI plants are built outside the U.S. No serious deterioration of this market is expected.

Rigid foam and other TDI applications such as lamination uses in textiles, and general packaging should grow from less than 10% of the TDI market to about 15% by 1987.

3.1.3.3 ANILINE

Aniline is currently made by the catalytic hydrogenation of vaporized nitrobenzene. Aniline capacity also exists as a by-product in the production of iron oxide.

Over half of 1977 aniline production was used for production of pure and polymeric MDI, a polyurethane intermediate. Currently all MDI production technology requires aniline. New technology has recently been announced, however, which uses nitrobenzene as a raw material rather than aniline. MDI has accounted for a high proportion of aniline growth over recent years. Therefore, the future direction of MDI technology will be the major factor in future aniline requirements. The aniline market information presented in Table 3.12 projects a split of approximately 2:1 between existing MDI technology and new technology in future MDI capacity expansion.

Aniline and some of its first-generation derivatives are the basic raw materials for many cyclic rubber-processing chemicals. Aniline is used in two key classes of rubber chemicals: accelerators/activators/and vulcanizing agents, and antioxidants/antiozonants/and stabilizers. The complex interaction of high energy costs affecting rubber for transportation uses and changing demographics is expected to result in a 4% annual growth of rubber chemicals/aniline use during the 1977-1987 period.

Dyestuffs were one of the earliest commercial applications for aniline. The general trend expected for aniline use in dyestuffs is a reduction in finished dyestuffs use and an increase in intermediate use for dimethylaniline. Overall, very little growth is expected in the dyes market.

Part of U.S. hydroquinone production is based on aniline. Most of the aniline-based hydroquinone capacity is used for photographic chemicals. Monomer inhibitors and rubbers chemicals are also important. Environmental problems with the conventional curing agent for castable urethane elastomers could open up a new market for hydroquinone.

Multiple uses for aniline exist in the drugs, pesticides and other category. A major herbicide used for corn and soybeans has developed into a key market for aniline in the past ten years. The projections in Table 3.12 assume continued expansion of acres planted in corn and soybeans and also an increase in the number of acres treated. Cyclohexylamine is a small but rapidly growing market for aniline. Applications include rubber chemicals and water treatment. Pharmaceuticals and fine chemicals represent only a modest market for aniline in the production of sulfur drugs, analgesics, antipyretics, and fungicides.

3.1.3.4 SUPPLY/DEMAND BALANCES AND H_2/CO REQUIREMENTS

Effective capacity for MDI production was about 425 million pounds in 1977. Effective production capacity is expected to increase to 650 million pounds by 1982. Further effective production capacity of 400 million pounds is expected by 1987.

Effective capacity for U.S. TDI production was about 750 million pounds in 1977 with production for domestic and export uses at about 625 million pounds. During the period 1978-1982, some small, inefficient capacity will be shutdown and, therefore, capacity additions will be required. Approximately 200 million pounds of production capability will be required in the 1983-1987 period.

Incremental CO requirements for TDI and MDI are projected as follows (MMSCFD):

	1978-1982	1983-1987
TDI	2.2	3.3
MDI	5.8	9.9

Table 3.12

SUMMARY MARKET INFORMATION FOR ANILINE
(MM lbs.)

	1977	1982	1987
MDI	310	445	730
Rubber Chemicals	155	185	235
Dyes	45	49	53
Hydroquinone	29	36	47
Drugs, Pesticides, Other	60	85	110
Demand	599	800	1180
Effective Capacity	605	1090	1090
Excess Capacity	6	290	(90)

Incremental H_2 requirements for reduction of dinitrotoluene to toluenediamine (TDA) in TDI production and for aniline in MDI production are projected as follows (MMSCFD):

	1978-1982	1982-1987
TDA	8.8	13.3
Aniline	3.5	10.5

Effective capacity for aniline production was about 605 million pounds in 1977. Production capability is expected to increase to 1090 million pounds by 1982. Further effective capacity of about 125 million pounds will be required by 1987.

Incremental hydrogen requirements for aniline are expected to be about 19.4 MMSCFD in the 1978-1982 period and 4.7 MMSCFD in the 1983-1987 period. Excluding the isocyanate requirements, the net hydrogen requirements for aniline are expected to be 12.1 MMSCFD for the 1978-1987 period.

3.1.4 FIBERS

3.1.4.1 GENERAL OVERVIEW OF U.S. FIBERS MARKETS

A complex competitive situation exists between the segments of the U.S. fibers industry. Competition involves those fiber intermediates presently consuming H_2 and those that could become future H_2, CO, syngas users in the event that new technology develops.

Because of the large quantities of intermediates involved in the production of synthetic fibers for U.S. markets, a detailed overview of the competitive fiber situation is required. Figure 3.2 summarizes the potential role of new chemical intermediates in fibers manufacture. Also, the latter period covered by Section 3.2 on future chemical industries H_2/CO/syngas capacity requirements, 1988-2000, is heavily dependent on the outlook for fiber intermediates developed in this section. The basis for market projections over that time period is covered in a general overview of U.S. fiber consumption in the next section.

Individual markets analyses on key fiber intermediates - ethylene glycol, terephthalic acid, hexamethylenediamine, acetic anhydride, and adipic acid are provided.

Figure 3.2

OVERVIEW OF EXISTING AND POTENTIAL H_2, CO USE IN FIBERS MANUFACTURE
(pounds H_2, CO per pound intermediate)

Fiber		Polyester		Cellulose Acetate	Nylon		
Intermediate		Ethylene Glycol	Terephthalic Acid	Acetic Anhydride	Adipic Acid	Hexamethylene-Diamine	Caprolactam
New Technology	H_2	+0.18#/#	--	--	--	--	--
	CO	+1.7#/#	+0.25#/#	+0.34#/#		--	--
Existing Technology	H_2	--	--	--	0.57#/#	0.07#/#	0.08#/#
	CO	--	--	--	--	--	--

3.1.4.1.1 U.S. FIBER CONSUMPTION

Consumption of fibers in the United States began to increase at an accelerated pace after 1960, coincident with the development and rapid acceptance of synthetic fibers. Most of the early part of this growth was spearheaded by nylon followed by the emergence of polyester, which became the leading man-made fiber in the 1970's.

In 1950, the natural fibers, cotton and wool, represented 78% of the total U.S. consumption; by 1976, the natural fibers accounted for less than 30% of the total. In 1950, the important man-made fibers were based on cellulose, i.e., rayon and acetates, which essentially accounted for the rest of the fibers consumed. By 1976, the demand for cellulosic fibers had experienced several years of steady decline and now represents less than 10% of the total; while the synthetic fibers--led by polyester and nylon, with acrylics and polyolefins also occupying sizeable niches--have become the major class of fibers consumed. Within this time period, the overall consumption of fibers had doubled by 1973; however, during the recessionary years of 1974-75, overall fiber consumption experienced a setback, which was followed by a partial recovery in 1976.

These historical trends are illustrated in Figure 3.3. This figure is based on production data because reliable historical data on consumption of specific fibers are not available. With the exclusion of the significant volume of cotton fibers that is exported, the figure is considered to be a reasonably accurate description of fiber consumption in the United States.

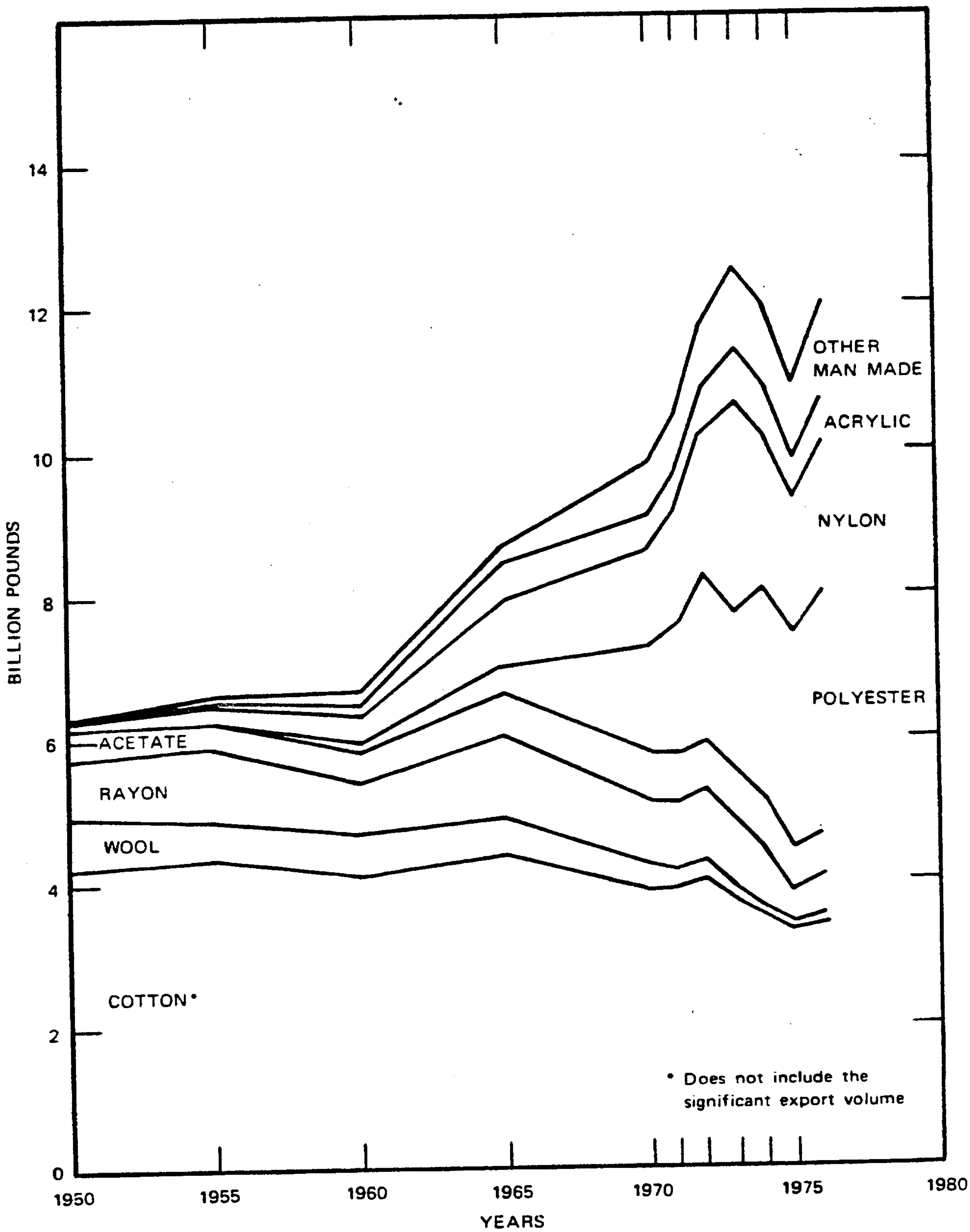

FIGURE 3.3 FIBER PRODUCTIONS IN U.S. 1950-1976

The general reasons that account for the trends shown in Figure 3.3 are as follows:

- The advent of synthetic fibers was accompanied by the development of a host of new fabrics and other textile products having advantages over traditional textiles ranging from superior performance to heretofore unattainable properties. This led to new markets as well as to the expansion of established markets, which were enhanced by an increasingly style- and fashion-conscious public.
- The evolving technology of synthetic fibers resulted in a continuing flow of new products concurrent with decreasing unit cost.
- Unlike synthetic fibers, which can respond to increasing demand by the construction of new plants, the availability of natural fibers is fixed by available land, for which they must compete with other uses. Natural fibers therefore are a rather inelastic resource.

Figure 3.3 also shows that the economic disruption associated with the oil crises has led to reduced levels of fiber consumption since 1973. Future consumption will be affected by a set of factors and conditions that did not exist before the oil crises, and forecasts of future demand must contend with the uncertainties associated with these changes. The projections in this section take into account the increasing cost of synthetic fibers (reversing the pre-1973 trend) <u>and</u> the different impacts of these increasing costs on the various fibers. The projections are constructed primarily by microeconomic analysis of each major market; in markets where different fibers compete, the effect of the changes in manufacturing economics on the degree of fiber substitution is considered. The linkages of fiber demand to macroeconomic parameters are beyond the scope of this section; therefore, for example, the way in which the projected personal consumption expenditure might be related to fiber consumption will not be discussed.

3.1.4.1.2 SUMMARY OF STATISTICAL DATA

In this section, the data compiled are summarized in a number of ways to facilitate review and reference. Discussion and analysis are provided in later sections.

The total fiber demand from 1977-1987 by market and by fiber is shown in Table 3.13.

Table 3.13

PROJECTED U.S. CONSUMPTION OF FIBERS, 1977-1987

	Consumption (millions of pounds)			1977-87 Average Growth Rate (percent/year)
	1977	1982	1987	
Market				
Apparel	4,930	5,816	6,391	2.4%
Home furnishings	1,609	1,883	1,958	1.8
Carpet	2,130	2,654	3,202	3.8
Tire cord	545	565	580	0.6
Other industrial use	341	436	487	3.3
Other uses	2,065	2,314	2,544	1.9
Total	10,810	13,668	15,162	3.1
Fiber				
Cotton	3,040	2,860	2,620	(1.3)
Wool	141	132	132	(0.6)
Rayon	603	722	695	1.3
Acetates	564	539	542	(0.4)
Acrylics	652	742	877	2.7
Nylon	2,395	2,700	3,210	2.7
Polyester	3,620	5,050	6,050	4.8
Polypropylene	605	923	1,036	5.0
Total	10,810	13,668	15,162	3.4

Although the actual projections were not based on uniform linear growth rates for the entire period of study, the average growth rates by market and by fiber were calculated over the period 1977-1987 for the purpose of comparing the relative change between the various uses and fibers.

The estimated consumption of fibers in each of the markets for 1977, 1982, and 1987 are given in Table 3.14.

3.1.4.2 ETHYLENE GLYCOL

Ethylene glycol is produced commercially in the U.S. by successive oxidation and hydration of ethylene. Technology for production of ethylene glycol from synthesis gas has been under development for a number of years. This section defines potential syngas requirements for glycol production.

Ethylene glycol production was approximately 3,600 million pounds in 1977. Exports accounted for about 200 million pounds of that production.

Market requirements in 1977 amounted to an effective capacity utilization of about 73%. This utilization figure is based on a nameplate capacity of 5,775 million pounds and an effective capacity figure of 85% of nameplate. Capacity utilization will rise over the period 1978-1982 to a 1982 figure of about 83% assuming one new grass roots plant, one expansion and one offshore shutdown due to olefin feedstock problems. This information is shown in Table 3.15. Without further plant expansion in the 1983-1987 period, 1987 demand would amount to a 95% effective capacity utilization figure. Therefore, new capacity is expected late in the period 1983-1987.

Table 3.16 compares projected economics for syngas vs. conventional ethylene oxide routes to ethylene glycol. As the table shows, conventional technology is expected to be the least cost route for plant start-up in 1982 and 1987. No syngas market is projected for ethylene glycol. The table also contains other technology comparisons which are discussed in later sections.

Table 3.14

PROJECTED U.S. FIBER CONSUMPTION FOR YEARS, 1977, 1982 AND 1987
(Millions of Pounds)

	Cotton	Wool	Rayon	Acetate	Acrylics	Nylon	Polyester	Polypropylene	Total
1977									
Apparel	1,500	92	123	205	470	405	2,130	5	4,930
Home furnishings	778	15	150	43	66	75	432	50	1,609
Carpet	12	15	--	--	100	1,465	238	300	2,130
Tire cord	--	--	39	--	--	236	270	--	545
Other industrial uses	35	--	26	1	1	108	80	90	341
Other uses	715	19	265	315*	15	470	470	160	2,065
Total	3,040	141	603	564	652	2,395	3,620	605	11,620
1982									
Apparel	1,400	90	164	177	535	445	3,000	5	5,816
Home furnishings	760	11	198	32	85	82	653	61	1,883
Carpet	8	12	--	--	100	1,790	345	490	2,654
Tire cord	--	--	40	--	--	235	290	--	565
Other industrial uses	27	--	21	--	2	118	114	154	436
Other uses	665	19	299	330**	20	120	648	213	2,314
Total	2,860	132	722	539	743	2,700	5,050	923	13,668
1987									
Apparel	1,250	90	165	160	640	480	3,600	6	6,391
Home furnishings	700	11	185	22	110	90	775	65	1,958
Carpet	5	12	--	--	100	2,150	400	535	3,202
Tire cord	--	--	30	--	--	225	325	--	580
Other industrial uses	25	--	15	--	2	135	140	170	487
Other uses	640	19	300	360***	25	130	810	260	2,544
Total	2,620	132	695	542	877	3,210	6,050	1,036	15,162

Notes: Acetate split between fibers and cigarette tow as follows (MM lb)
* 11 fibers, 304 cigarette tow
** 10 fibers, 320 cigarette tow
*** 10 fibers, 350 cigarette tow

Table 3.15

ETHYLENE GLYCOL SUPPLY/DEMAND PROJECTIONS

	1977	1982	1987
Antifreeze	1650	1800	1970
Polyester Fiber	1413	1950	2190
Polyester Film	115	175	275
PET Bottles	10	185	300
Industrial Uses	222	285	365
Exports: Net	210	250	300
Total	3620	4645	5400
Effective Capacity	4910	5760	5760
Capacity Required	(1290)	(1115)	(360)

Table 3.16

COMPARISON OF EXISTING AND NEW TECHNOLOGY PRODUCT PRICES*
(1978 Dollars)

	Per Pound Start-Up Price	
	1982	1987
Acetic Anhydride		
(New) Carbonylation	32¢	35¢
Ketene	36¢	41¢
Ethylene Glycol		
(New) Syngas	40¢	42¢
Ethylene	34¢	37¢
Terephthalic Acid		
(New) Carbonylation	29¢	32¢
Direct Air Oxidation	37¢	38¢
Ethanol		
(New) Syngas	22¢	25¢
Ethylene Hydration	18¢	20¢
Adipic Acid		
(New) CO/Butadiene	32¢	32¢
Cyclohexane	36¢	38¢

*Note: All olefin and aromatics price projections used in the comparison of existing and new technology are based on the original JPL (1978) price projections. No revisions were made in the Task IV revised energy scenario work.