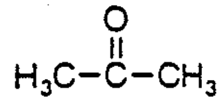
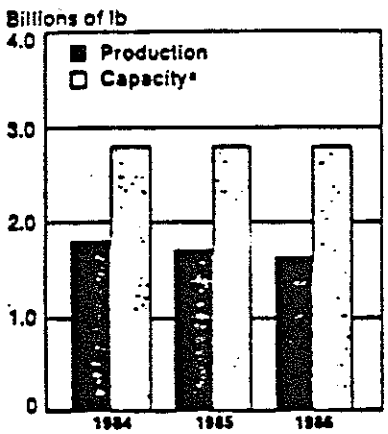
Key Chemicals



Acetone

- *Production off a bit*
- *Capacity on hold*
- *Prices steady*

PRODUCTION/CAPACITY



a First quarter, excludes about 300 million lb "on standby."

MAJOR PRODUCERS

Allied-Signal, Dow, General Electric, Shell, USS Chemicals

HOW MADE

Coproduction with phenol by oxidation of cumene (isopropyl benzene); dehydrogenation of isopropyl alcohol

MAJOR DERIVATIVES

Methyl and other methacrylates 35%, bisphenol A 10%, methyl isobutyl ketone 10%

MAJOR END USES

Solvents, alone or as derivatives, 50%, fabricated plastics 35%

FOREIGN TRADE

Exports—more than 100 million lb; Imports—about 100 million lb

PRICE

About 25 cents per lb

Production of acetone, one of the few major-volume organic chemicals heavily dependent on demand for a coproduct, in this case phenol, is continuing to slide. Acetone output will drop about 5% both this year and next, hitting 1.7 billion lb in 1985 and 1.6 billion lb in 1986; in 1984 production was more than 1.8 billion lb.

About 85% of U.S. acetone capacity is based on oxidation of cumene (isopropyl benzene), which also produces phenol. Demand for phenol depends on demand for housing that requires plywood and particle board as construction materials. Phenol's largest use is in adhesives for plywood and binders for particle board. Both of these are made by means of reactions with formaldehyde.

Two views on the outlook for housing are relevant to the outlook for acetone. One view holds that lower interest rates are causing a decline in the inventory of existing houses and, beginning in the spring of 1986, will cause an increase in demand for new housing. The other view is that changes in household formation, real income, and construction costs offset the effects of lower interest rates and will cause a flat to slightly reduced demand for new housing.

Both views suggest that plywood inventories will change. For example, as housing starts remained flat or declined during the second half of 1985, plywood inventories were cut for a variety of reasons, including savings in the cost of interest. Now, with inventories relatively low, prediction of an upswing in housing and to some extent in commercial construction in 1986 could result in an increase in inventories. Inventory building would push phenol demand, and in turn acetone production, more than actual growth in construction would.

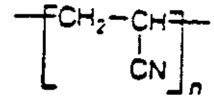
Some analysts argue, however, that there will be no significant rise in housing construction in the first half of 1986. If this happens, phenol demand could grow little or decline. Acetone production would then follow the same pattern as in 1985.

For marketers of acetone, the situation isn't necessarily bad. Because output was somewhat limited during 1985, prices improved. But late this year, prices, as usual, weakened, as demand for acrylates and solvents slowed with industrial production. Next year, if production also slows another 5% or so (100 million lb), prices might improve more than in 1985, as demand in various uses recovers.

The supply of acetone, however, will not get so tight that prices could rise quickly. Inventories and exports could be reduced to meet demand. Imports also could be increased. Those units that make acetone from isopropyl alcohol could be operated at higher rates to provide more product for the merchant market in contrast to supplying largely captive uses as they do at present.

More than a third of acetone consumed in the U.S. goes to make various methacrylates, about 80% of which is methyl methacrylate. Those methacrylates go into a number of fabricated polymer products such as sheets, coatings, fibers, and molded and extruded items. Some threat to acetone as the raw material for acrylates could come from isobutylene. The threat seems to be delayed now by the demand for isobutylene to make high-octane components for gasoline. This demand is spurred by the decrease in the amounts of lead alkyls allowed in gasoline. Demand for acetone to make acrylates will grow about 5% in 1986.

Other uses of acetone—for making bisphenol A and solvents such as methyl isobutyl ketone, methyl isobutyl carbinol, and aldol condensation products, and as a solvent itself—will increase more slowly, generally close to 2% per year. Because such uses are so large, the 1986 growth in demand for acetone will be about 2% overall. The growth probably can be handled without undue stress on the industry, even with an expected decline in production.

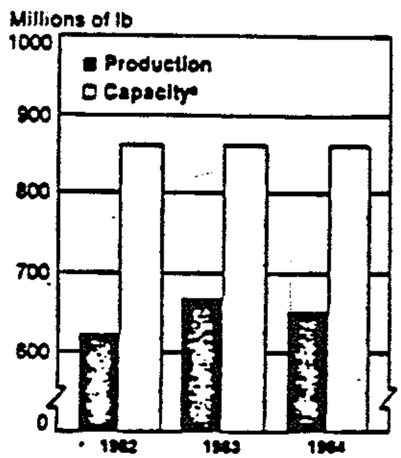


Polyacrylonitrile

Acrylic

- *Production off a bit*
- *Capacity on hold*
- *Prices steady*

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Polymerization of acrylonitrile, a product of the reaction of ammonia and propylene

MAJOR END USES (U.S.)

Apparel 65%, home furnishings 30%, industrial 5%

FOREIGN TRADE

Exports—to decline to under 150 million lb in 1984, imports—to rise to about 20 million lb

PRICES

3-denier staple for apparel 90 cents to $1.10 per lb; discounting significant

COMMERCIAL VALUE

$600 million for production, 1984

After a good recovery in 1983, acrylic fiber production will decline slightly in 1984. The major cause of this year's slump in production is the same as that for all of the synthetic fibers' production growth problems—imports of products of these fibers, mainly in the form of apparel. For acrylic fibers, rising imports of apparel and a decline in exports of the fiber itself combine to have a greater effect than for the other important synthetic fibers.

In 1984, production of acrylic fibers probably will be down 3% from its 1983 level to about 650 million lb. Most industry analysts expect this to be the top end of what will be produced this year. However, their forecasts of production range from 630 million to 670 million lb.

Capacity to make acrylic fibers generally is holding level. Minor debottlenecking is taking place but won't add significantly to capacity. Estimates of capacity range from 810 million to 870 million lb a year, depending on the fiber denier.

If capacity is about 860 million lb and if production reaches 650 million lb, then the average plant operating rate in 1984 will be more than 75%. This operating rate will be slightly below the average for the chemical industry this year. In addition, it will be well below the recent historical high for acrylic fibers of 91% in 1980 when production was more than 780 million lb from about the same capacity.

The operating rate in 1983 was a couple of percentage points higher at nearly 78%. This could be the best operating rate of the next few years, unless some major technical development or fashion change aids acrylic fibers, according to some industry observers. This low operating rate and the prospect of slowing demand could continue to put pressure on acrylic fiber prices.

Imports of apparel made of acrylic fibers are reducing domestic use and production of this fiber. Imported women's sweaters this year could account for half of U.S. sales, possibly as much as two thirds. Imported men's sweaters lag women's in their share of sales, making up one third to one half of the total U.S. market. Thus, imports may account for half of U.S. retail sweater sales in 1984. Sweaters currently account for about 15% of acrylic fiber use.

Fashion, too, is influencing demand for acrylic fibers in sweaters. Cotton is staging a comeback in sweaters as well as in many other apparel items, many of which don't contain acrylic fibers.

Gains in use of acrylic fibers in several areas of active or sportswear offset some of the losses in demand in sweaters caused by imports. Socks, long an important use of acrylic fibers, continue to be strong this year with good gains except for the lowest priced, so-called "tube" socks, which increasingly are being made of cotton. Demand for active wear is in even better shape because of the growing interest in sports and physical fitness.

Some of acrylic fibers' old standbys, however, aren't doing so well and may decline fairly rapidly in their share of the fiber use. Craft yarns, for example, are weak now for reasons that are unclear except for an assumption that today fewer people knit at home. Acrylic fiber blankets, long considered aesthetically pleasing substitutes for more expensive wool blankets, are in a slump, partly because of market capture by lower-cost polyester fiber blankets. Carpet use continues to decline because of competition from polyester and nylon fibers.

Clearly, what acrylic fibers need is some fashion or technical development to make them the preferred fiber, regardless of cost, in present or new uses. These fibers also need some relief from imports of apparel. As a result, the small decline in production in 1984 could be repeated next year and each year thereafter for some time unless acrylic fibers get a new market to spur their use.

Key Chemicals

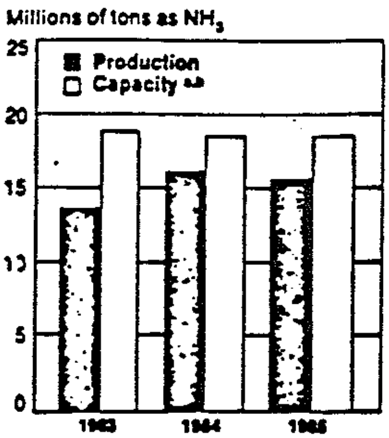
$CH_4 + 2O_2 \rightarrow CO_2 + ...$ NH_3

Ammonia

$N_2 + 3H_2 \Rightarrow 2NH_3$

- *Demand uncertain*
- *Capacity holding*
- *Prices steady*

PRODUCTION/CAPACITY



a First quarter. b Some capacity shut down.

MAJOR PRODUCERS

CF Industries, Columbia Nitrogen, Farmland, Union Oil, Williams Cos. (Agrico)

HOW MADE

Catalytic reaction of nitrogen from air and hydrogen from natural gas

MAJOR DERIVATIVES (U.S.)

Ammonium nitrate 20%, urea 20%, ammonium phosphates 15%

MAJOR END USES (U.S.)

Fertilizers 80%, fibers and plastics 10%, explosives 5%

FOREIGN TRADE

Exports—declining to about 400,000 tons for 1985, imports—rising to nearly 4 million tons for 1985

PRICES

List prices about $150 per ton on Gulf Coast

Ammonia producers can expect this year to be much like 1984, with little change in production or consumption. At most, demand may rise slightly and production decline a bit.

Currently, demand for ammonia is holding steady, neither high nor low by recent standards, as the planting season gets under way in the warmer sections of the U.S. Most ammonia plants in this country are operating now, ammonia inventories are believed to be about normal, and prices are at about the level they were a year ago. Whether these circumstances will continue throughout 1985 will strongly influence industry profits.

Consumption of ammonia as a fertilizer or in making fertilizers used on U.S. fields probably will be slightly below or equal to that of 1984, depending on money and weather conditions. Feeds and industrial uses could be down perhaps 2 to 5% from their 1984 patterns.

Chemical nitrogen includes both fertilizer and nonfertilizer nitrogen. (Examples of nonfertilizer-nitrogen-containing end products are nylon and melamine.) Total chemical nitrogen consumption during 1985 might be up by a small amount—1 to 2%. That gain would result from higher exports of nitrogen fertilizers, especially diammonium phosphate.

However, an increase in consumption will not necessarily increase ammonia production in the U.S.; output most likely will decrease as much as 5% from last year's 16 million tons or so. Instead, the increased consumption will be supplied from rapidly rising imports, even as U.S. production of ammonia declines. Ammonia exports are relatively small compared to imports and are expected to decline in 1985. Thus a larger deficiency in U.S. nitrogen production relative to consumption will result. Other imported chemical nitrogen fertilizer materials will offset exports of such materials and go largely to fertilizer use.

The export-import situation for ammonia alone makes many in the industry uncertain about the outlook for 1985. Other unknowns such as weather, grain prices, grain export demand, and farm financial conditions make many industry sources admit that their forecasts are no more than educated guesses. But a rough consensus developed from a number of these sources is that U.S. ammonia production will drop less than 5% from 1984 to about 15.5 million tons. Most large-sized plants—those with capacities of 1000 tons per day—will operate most of the year with about 30 days downtime for routine maintenance. Smaller plants that survive because of special marketing situations generally will run as much as needed to keep their market and to maintain a reasonable inventory. As a result, the average operating rate for U.S. plants this ye[ar] will come to about 85% of namepla[te] capacity.

Ammonia's consumption pattern in 1985 will be similar to that of recent years, with no new uses of any size expected. None of the nonfertilizer uses of ammonia and its derivatives—which account for about 20% of total U.S. demand—are large enough to have a major impact on the total use, even if consumption should change greatly. Industrial uses, such as those in making acrylic and nylon fibers, explosives, and many small chemical intermediates and their end products, could show minor variations in ammonia demand as their production is influenced by such matters as garment imports, reduced mining activity and changes in preferred explosives, and industrial operations.

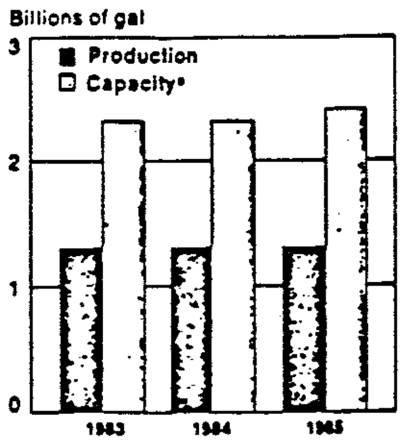
If these early forecasts prove accurate, ammonia will have almost as good a year as it did in 1984. But in the face of rising imports from countries with low-cost gas feedstocks, ammonia production in the U.S. is facing the unpleasant prospect of a conti[nu]ing decline in the next several years unless U.S. natural gas prices drop drastically.

Key Chemicals

Benzene

- *Production flat*
- *Capacity holding*
- *Prices firming*

PRODUCTION/CAPACITY



a First quarter.

MAJOR PRODUCERS

Amoco Oil, Arco Chemical, Coastal Corp., Exxon Chemical, Gulf Oil Products, Shell Oil, Sun Oil

HOW MADE

Separated from aromatic streams from refineries, olefin plants, coke ovens; dealkylation of toluene

MAJOR DERIVATIVES (U.S.)

Ethylbenzene 50%, cumene 20%, cyclohexane 15%, aniline 5%

MAJOR END USES (U.S.)

Styrenic plastics 35%, phenolic resins 20%, nylons 15%

FOREIGN TRADE

Exports—small, remaining at about 20 million gal in 1985; imports—slipping to 150 to 160 million gal in 1985

PRICES

List price $1.17 per gal

The best news to come to benzene producers this year is a slight firming of prices. Beyond that, it's a pretty ho-hum outlook for benzene: Production probably will not grow appreciably, nor will capacity rise further following the addition of a new Sohio plant at the end of 1984.

The price firming, however, may not do enough for benzene producers. Spot prices for benzene, reflecting only a part of total sales, increased in small increments beginning in January. By early March, they were above the list price, which had dropped significantly in 1984.

These spot prices reflect mainly demand factors and feedstock conditions beyond those in the chemical industry. The spot price rise went along with firming of gasoline prices, and was related to the value benzene has in gasoline, both as a volume component and as an octane contributor to the total pool octane value. Some minor effect was felt from the drawdown of benzene inventories in 1984 and from anticipated improved demand for some end products of benzene.

During 1984, benzene prices fell more than 30 cents a gal, or nearly 20%, because of stagnant demand, lower prices for some derivatives, large inventories, and declines in crude oil prices. Spot prices ranged slightly below list prices during the second half of the year, further hurting profits from recovery and selling of benzene.

That situation changed during the first quarter of 1985. Now, questions are developing as to whether these price increases, small as they are, will hold for the rest of the year. Benzene demand in the second quarter probably will be as good as in the first quarter. Later on, demand may weaken, pulling down production as inventories build.

Benzene production for all of 1985, therefore, likely will end up about the same as in 1984, at 1.3 billion gal. This hold on production could mean that a slight decline will occur in the operating rate for total nameplate capacity, but it essentially will remain at about the same 55% rate that it has been the past two years.

Nameplate capacity, much of which is in or closely attached to refineries, long has been considered to be well overstated. If sufficient aromatics streams could be obtained, then the nameplate capacity might nearly be reached. But even so, capacity still could be overstated because of units, long shut down at steel mills and small refineries, which are not expected ever to be run again. In addition, several relatively large benzene units currently are shut down, with questions about future operation concerning some of them.

Some small amounts of capacity have been scrapped, but during the fourth quarter of 1984, Sohio Chemical started up its new unit with a nameplate capacity of 115 million gal a year. The actual net gain in capacity for 1985 operation is hard to pin down, but probably at least two thirds of Sohio's new unit capacity should be added to the total.

Part of benzene capacity is attached to steam crackers where benzene is separated from the pyrolysis gasoline fraction of the product stream. Typically, benzene produced in steam crackers has accounted for about 25% of production, or a bit more. The other part of benzene supply—imports—could decline a bit in 1985 unless domestic prices rise. As U.S. selling prices decline during 1984, imports also decline because of little or no profit to traders in benzene. This year, imports could supply at least 10% of U.S. benzene demand, but certainly not more than 15%.

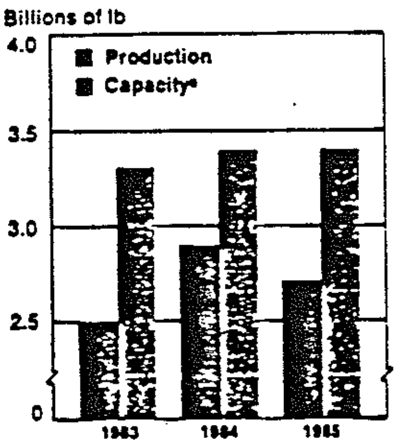
None of the major uses of benzene will show much gain in demand during 1985. One—styrene—because of imports of polymers, could decline slightly. The result, then, for benzene will be a year of minor change in production and a struggle to squeeze a bit of profit from a slight price firming.

C

Carbon black

- *Demand slowing*
- *Capacity declining*
- *Prices may drop*

PRODUCTION/CAPACITY



a First quarter.

MAJOR PRODUCERS

Ashland Chemicals, Cabot, Columbian Chemicals, J. M. Huber, Phillips Petroleum

HOW MADE

Partial oxidation of heavy petroleum fractions

MAJOR END USES (U.S.)

Tires 65%, other fabricated rubber products 25%, colorant and filler for plastics, inks, etc. 10%

FOREIGN TRADE

Exports—small, may reach 75 million lb in 1985, imports—rising, may exceed 150 million lb in 1985

PRICES

Range from 29 to 39 cents per lb, depending on grade

Production of carbon black has slowed this year after staging a two-year recovery from the recession. Output in 1985 could total 2.7 billion lb, down about 7% from 1984 production of just less than 2.9 billion lb. Even so, this decline would leave production ahead of the 2.5 billion lb in 1983.

The pigment's lag in production began in the first quarter of 1985 and accelerated in the second quarter. Predominant among the causes is the well-known increasing life-span of passenger car and light truck tires. This trend, which reduces demand for carbon black, is expected by many in the rubber and tire industries to continue in the next several years.

Capacity to make carbon black has declined this year. At the beginning of the second quarter, about 100 million lb of capacity located near Conroe, Tex., was shut down by Columbian Chemicals. An additional 150 million lb per year is on stand-by. The small expansions expected this year will add only 25 million to 50 million lb to the nameplate capacity total.

The net in-place capacity at the beginning of this year totaled a bit more than 3.4 billion lb. At the beginning of 1986, this capacity will have declined to 3.3 billion lb, with stand-by capacity almost unchanged. At that time, the operating capacity is expected to be about 3.2 billion lb.

Throughout 1985, nameplate capacity will average 3.3 billion lb, with operating capacity about 3.15 billion lb. If production does reach 2.7 billion lb, the operating rate will be 82% of nameplate capacity and 86% of effective capacity. These rates, although not as high as in some years of the 1970s, are well above recession levels.

In view of this operating rate, carbon black producers likely can't do much to increase their profits, especially with rising imports. Actual prices for carbon black could decline if crude oil prices decline. Consumers of carbon black are similar to consumers of all other products made from petroleum in that they expect raw material cost reductions to be passed on to them immediately if not before the cost declines.

Producers also face a short-term decline in demand for carbon black because of a decline in the production of tires, caused by the lower sales of replacement tires as tire life is increased. Another decline in the amount of rubber sold in tires for new cars has largely ended with the nearly complete use of the small-size spare tires or inflatable spare tires. The drop in replacement tire demand results from consumer willingness to buy better tires—particularly radial tires, which have much greater tread life. In addition, a trend toward better care of tires and the higher inflation pressures are helping extend tread life.

Other uses of rubber in cars and trucks also are showing little growth. The reasons are similar to those that are causing lower use of rubber in tires—smaller sized vehicles, which reduces the amount of weather stripping and gasketing per unit. Some competition from plastics may be reducing rubber demand slightly, but most of the market capture by plastics is over.

Nonautomotive uses of rubber and carbon black are relatively small. Their prospects are diverse. Use in industrial belting and hoses depends directly on heavy industrial operations, which generally seem to be experiencing little if any growth. One application is growing rapidly from a small base: that of single-ply roofing made of ethylene-propylene-diene rubber. This product continues to be improved and to be demonstrated as more cost effective than are other kinds of roofing.

A number of other uses of carbon black, such as in inks, paints, and plastics, all are small and are growing at low rates. None will significantly affect the total demand for carbon black, which leaves the developing roofing application as the best prospect to offset the declines in demand for automotive uses of the product.

Key Chemicals

$2H_2O + NaCl \rightleftarrows Cl_2 + 2NaOH + H_2$

$2H_2O + 2e^- \rightleftarrows 2OH^- + H_2$

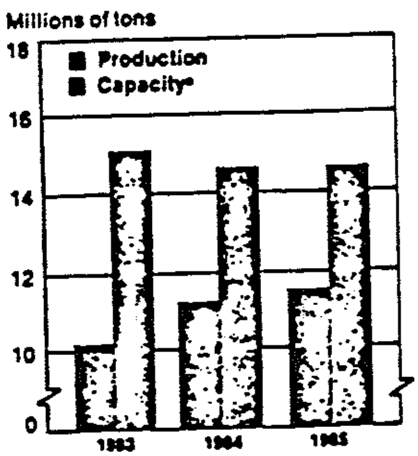
$Cl^- \rightleftarrows Cl_2 + 2e^-$

NaOH

Caustic soda

- ***Production rising***
- ***Capacity stable***
- ***Prices stronger***

PRODUCTION/CAPACITY



* First quarter.

MAJOR PRODUCERS
Diamond Shamrock, Dow Chemical, Occidental Chemical, Olin, PPG Industries, Vulcan Materials

HOW MADE
Electrolysis of NaCl brine

MAJOR DERIVATIVES (U.S.)
None taking more than 5% of consumption

MAJOR END USES (U.S.)
Chemical manufacture 50%; pulp and paper manufacture 20%

FOREIGN TRADE
Exports—declining to about 1.1 million tons, imports—rising to about 500,000 tons in 1985

PRICES
List prices at Gulf Coast plants $175 per ton; prices higher at other locations

In addition to the obvious coproduct situation, caustic soda production is rising for many of the same economic reasons as chlorine. Strength in the economy increases the demand for chemicals that are made using caustic, either as a source of sodium ions or as a processing aid, such as in neutralization.

Production growth for finished caustic in 1985 will be slightly less than will be reported for chlorine. Caustic output will be up less than 3% to 11.5 million tons, after a 10% rise in production during 1984.

The difference in the growth between chlorine and caustic is caused by the differences in their sources and in their final processing. Although different processes and brines can be used to make chlorine, caustic soda comes almost entirely from electrolysis of sodium chloride brine. Not all of the caustic soda in solution from the electrolysis cells is finished or concentrated to the usual commercially available solutions of 50% or 70% or made into dry caustic. This unfinished caustic is used as a neutralizing agent in other units at the same plant site where it is made.

Capacity to produce caustic is greater than capacity to produce chlorine because of the stoichiometry of the electrolysis. But it is not changing at all, other than as a result of efficiency improvements to the cells. (Chlorine capacity changes slightly more than does caustic capacity because of sources of chlorine other than sodium chloride brine.) Because exports of caustic—now slowing—are a proportionately larger part of demand, less pressure to expand capacity exists than that for chlorine.

Plant operating rates this year will be nearly the same as 1984: about 78% of nameplate. This includes some small amount of capacity shutdown. At this level, it seems unlikely that any shutdown capacity will be restarted anytime soon or that any new capacity will be built.

The export markets for caustic, accounting for about 10% of production, are a special cause for concern to chlor-alkali producers. The export business rebounded in 1983 and continued strong in 1984, reaching 1.3 million tons. This was close to the record set in 1979. But currently sliding exports will continue to slide as chlor-alkali industries develop in countries with much-lower-cost energy.

Imports of caustic into the U.S. are rising from countries other than the traditional ones, such as Canada. These imports come from countries that have lower energy costs, either direct or subsidized, and that are attracted by the strong dollar. The greater imports plus lower exports reduce the favorable trade balance.

This trade-balance effect tends to put pressure on caustic prices, which were raised in 1984. So far, prices, though discounted significantly from list prices, have held up. Prices could go higher, according to some industry sources, because caustic may have to carry a larger share of the production cost of an electrochemical unit, which is 1 ton of chlorine and about 1.1 tons of caustic. Caustic's share of an electrochemical unit will rise because of possible softer chlorine demand if shipments of PVC ease during the second half of 1985.

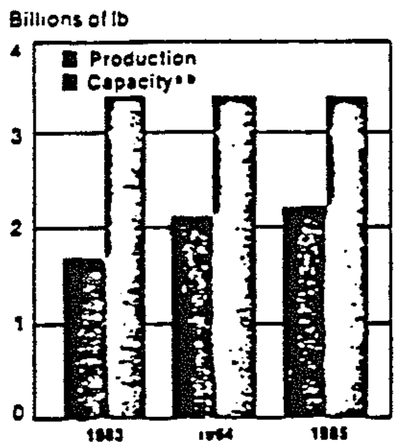
Demand strength for caustic comes mainly from the big catch-all use category—chemicals manufacture. Often, caustic used in chemicals simply passes through the process and is regenerated. But some caustic is lost in most processes requiring constant addition. A similar situation exists for pulp and paper manufacturing.

Demand for caustic in 1985 will remain strong enough to keep production rising another year, even in the face of a less favorable trade balance. With net exports possibly slowing and U.S. demand growing slowly, chlor-alkali producers will have the same struggle with profitability that they have had.

Cyclohexane

- *Demand recovered*
- *Capacity may fall*
- *Prices down*

PRODUCTION/CAPACITY



a Some capacity down and may not restart. b First quarter

MAJOR PRODUCERS

Du Pont, Gulf Oil Chemicals, Phillips Chemical, Texaco Chemical, Union Oil

HOW MADE

Catalytic hydrogenation of benzene; recovered from natural gasoline

MAJOR DERIVATIVES (U.S.)

Adipic acid 60%, caprolactam 30%

MAJOR END USES (U.S.)

Nylon 66 60%, nylon 6 30%

FOREIGN TRADE

Exports—rising, may reach 150 million lb in 1984, imports—very small, may reach 25 million lb in 1984

PRICES

List prices follow benzene prices closely; now at $1.26 per gal

Cyclohexane production this year has been rising and falling like a roller coaster. After a slow start in the first three months of 1984, output climbed fast in the second quarter, only to slow drastically in the third. This unusual variation in the production pattern was partly the consequence of changes in demand for nylons—which account for practically all of cyclohexane's end uses—and partly the consequence of plant problems experienced by some producers early in the year.

As a result, forecasting total production for the year is more or less guesswork. Probably, cyclohexane output will top 2 billion lb, possibly 2.1 billion lb. Although not a record by far, that total still would represent the best production year of the 1980s. Next year, if all goes reasonably well with the economy and interest rates hold or rise only modestly, a slight increase in production would bring the total to 2.2 billion lb.

The vagaries of 1984 production levels can be seen clearly in data reported by the U.S. International Trade Commission. Monthly output started at 140 million lb in January, rose to 181 million lb in February—despite 6% less production time—and then ballooned to 270 million lb in March. Because of plant problems, output fell off in April, and, in May, was back down under 160 million lb. By July, production had reascended to 236 million lb, before plunging again to 140 million lb and 145 million lb in August and September, respectively. Guesses are that in the fourth quarter output has been quite low, possibly at the lowest monthly levels of the year.

Cyclohexane producers have had no trouble handling demand at the peaks of their roller coaster ride, because there is plenty of excess capacity. Of the nameplate capacity available as 1984 began, nearly 10% was down temporarily, and during most of the year that fraction of capacity has not been running. During a siege of plant problems that began late in the first quarter, about half the remaining capacity was down for an average time of one month. Thus, total 1984 nameplate capacity for the cyclohexane industry includes more than 400 million lb that was not producing during the year—about an eighth of the total.

Even with an eighth of capacity inactive, cyclohexane producers still will operate their plants at no better than an average 70% of operable capacity for the year. Based on nameplate capacity, the average utilization rate falls to less than 62%. The erratic nature of the year shows up in monthly changes in utilization rates, however, ranging from more than 100% to less than 54% of active capacity.

Those wide swings in production and operating rates haven't affected prices significantly. The cyclohexane price is very closely tied to that of benzene, and consumers are quick to insist that a decline in the benzene price be passed on to them when it occurs. Because of the large average overcapacity for cyclohexane, producers have little leverage with which to loosen the connection to benzene pricing.

Demand for cyclohexane will closely track demand for apparel and carpet uses of nylon 66 and nylon 6. Since imports of both nylon fiber and apparel are rising rapidly, domestic fiber consumption will do little anytime soon to increase demand for U.S.-produced cyclohexane. The use of nylon as an engineering resin keeps growing faster than the gross national product, but volume is still too small to create sales that would significantly increase demand for cyclohexane. Cyclohexane's solvent and chemical intermediate uses are also small and not growing much.

During 1985, cyclohexane producers will continue to struggle with excess capacity while hoping that nylon will return to better times. A small production gain might occur, but it won't do anything for profitability

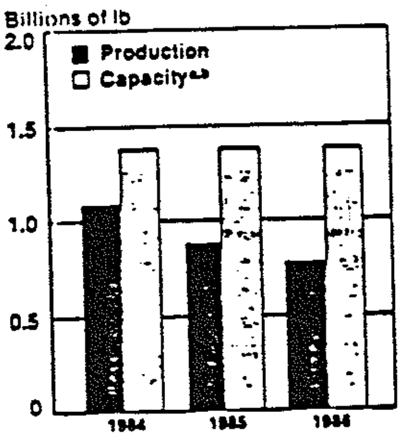
CH_3CH_2OH

Ethanol

$CH_2{=}CH_2 + H_2O \rightarrow CH_3CH_2OH$

- *Production off steeply*
- *Capacity on hold*
- *Prices level*

PRODUCTION/CAPACITY



a Synthetic only. b First quarter, excludes capacity "on standby."

MAJOR PRODUCERS

Eastman Chemical, U.S.I. Chemicals, Union Carbide

HOW MADE

Synthetic—direct hydration of ethylene; otherwise fermentation

MAJOR DERIVATIVES

Acetic acid (vinegar) 10%, esters 10%, ethers 10%

MAJOR END USES

Solvents 55% (85% including derivatives), food 10%

FOREIGN TRADE

Exports—declining to less than 10 million lb; imports—rising to more than 500 million lb

PRICE

$1.80 per gal

Synthetic ethanol production (excluding beverage alcohol), which has been declining rapidly in recent years, is expected to continue its slump through 1986 and possibly later. Any reversal of this situation will depend on a tight control of imports. This year imports of both synthetic and fermentation ethanol likely were several times U.S. output.

The import problem is far worse for producers of fermentation ethanol, which is used in gasoline mixtures for motor fuel, than it is for producers of synthetic ethanol. However, in 1985 a considerable—but impossible to estimate accurately—quantity of synthetic ethanol arrived from Saudi Arabia.

Some imported fermentation ethanol goes to uses formerly supplied by synthetic ethanol, including uses in some solvents and as intermediates for various chemicals. Rising imports of both fermentation and synthetic ethanol caused this year's rather steep decline in output of synthetic ethanol. Production in 1985 will do well to reach 900 million lb, down about 20% from 1984 output of more than 1.1 billion lb. For the first three quarters of 1985, preliminary figures show production of about 730 million lb on an annualized basis. Often, however, a surge in synthetic ethanol production occurs during the fourth quarter. This makes a higher annual total likely.

The decline in production of synthetic ethanol forecast for 1986 will be about half that expected for 1985. Next year's output could total 800 million lb, but probably will be less, if imports continue at current levels or rise slightly.

Falling capacity utilization is hurting the three synthetic ethanol producers. For 1985, the average operating rate is estimated to be less than 65% of nameplate capacity, and for 1986, it is predicted to be less than 60%. This downward trend indicates that some capacity might be shut down. However, a number of producers have captive uses for their ethanol, allowing them to keep units operating. But, the make-or-buy decision looms over producers, especially if they have a more profitable use for the ethylene consumed in the ethanol.

Some synthetic ethanol will continue to be needed for certain cosmetic and pharmaceutical solvents in which odor is critically important. Slightly more than half of U.S. synthetic ethanol is used as a solvent, and, of this, about 30% goes into cosmetics. Fashion influences make demand forecasts difficult in cosmetics. Over the near term, growth is predicted to be modest—less than 5% annually.

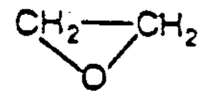
Other solvent uses of ethanol such as in coatings and inks are under pressure from lower-cost imported material. In certain proprietary uses, only synthetic ethanol will do the job, but in most uses, fermentation ethanol is acceptable. In some applications, especially coatings, isopropyl alcohol also provides competition. Growth in these other solvent applications will remain modest; for most it will be less than 5% annually.

Ethanol is used to make a wide variety of chemicals, with ethyl acrylate, vinegar, various glycol ethers, ethylamines, and ethyl acetate ranking among the larger uses. Each of these products has various uses as well, of which none have strong growth prospects. Because of the inroads of fermentation alcohol, as a group the various chemical uses of synthetic ethanol probably will show a small decline next year, as they are showing in 1985. Use in glycol ethers is especially vulnerable owing to concern over their possible toxicity.

The small growth expected in the aggregate of ethanol's chemical and solvent end uses will be obscured by the rise in its consumption as a motor fuel. If imports of ethanol for fuel use continue to rise in 1986, they still will be diverted into nonfuel uses, which is what caused the declines in production of synthetic ethanol in 1985 and is expected to cause them in 1986.

Key Chemicals

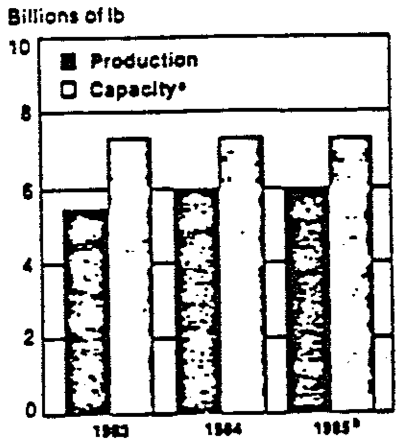
$2CH_2CH_2 + O_2 \rightleftharpoons 2CH_2\text{-}CH_2$ O



Ethylene Oxide

- *Demand on hold*
- *Capacity declining*
- *Prices down*

PRODUCTION/CAPACITY



a First quarter. b Some capacity down, may never be restarted.

MAJOR PRODUCERS

BASF Wyandotte, ICI Americas, Shell Chemical, Texaco Chemical, Union Carbide

HOW MADE

Vapor-phase oxidation of ethylene with air or oxygen

MAJOR DERIVATIVES (U.S.)

Ethylene glycol 60%, ethoxylates 10%, glycol ethers 5%

MAJOR END USES (U.S.)

Polyester fibers, films, and molded items 30%; antifreeze 25%

FOREIGN TRADE

Exports—small, probably less than 25 million lb for 1984, imports—probably less than 10 million lb for 1984

PRICES

For merchant sales less than 10% of total output, about 35 cents per lb

Demand for ethylene oxide is being undermined seriously by a flood of imports of finished products containing the materials that make up the chemical's most important end-use markets. Producers of ethylene glycol—by far the most important derivative of ethylene oxide—are seeing both domestic and overseas demand for its two chief consumers, polyester fibers and antifreeze, undercut by imports of polyester garments and foreign-made autos containing factory-installed antifreeze.

As would be expected, weakening demand has reduced capacity utilization rates and will continue to do so this year. Production in 1985 will do well to match that of 1984. Prices are under pressure, especially since ethylene prices remain soft.

If the economy continues to grow next year at the 1984 rate, 1985 production of ethylene oxide probably will total 6 billion lb, the same volume expected for 1984. Since some producers expect demand to decline in second-half 1985, however, some growth will be needed in the first six months to reach the 1984 level. Such a scenario would recapitulate 1984's pattern of production; output rose well in the first half of the year before apparently slumping, destroying chances for meeting optimistic forecasts made in the spring.

Ethylene oxide capacity may seem excessive if just the total is considered. However, nearly 1 billion lb of nameplate capacity probably will be shut down during most of 1985. Earlier this quarter, both Dow Chemical and Union Carbide disclosed that they will place ethylene oxide plants on standby. Whether those units are restarted will depend greatly on the overall economics of production and consumption ranging from ethylene feedstock costs to the level of competition with imported ethylene glycol and finished goods containing ethylene oxide derivatives.

With about 920 million lb of capacity down next year, the average operating rate could be a quite healthy 94% of the roughly 6.4 billion lb of nameplate capacity that actually will be running. Taking the total industry nameplate capacity of 7.3 billion lb, however, the rate falls to 82%. That is a clearer indication of the position in which ethylene oxide producers now find themselves. Moreover, that estimate of potential nameplate capacity could be understated, because some producers have slowly been debottlenecking plants and adding process improvements in an effort to increase profitability. The additional capacity probably does not exceed 3% more, however, so the industry total is 7.5 billion lb at most.

Good performance by ethylene glycol, which accounts for more th 60% of ethylene oxide consumptic remains the key to achieving these operating rates. Demand from each of ethylene glycol's three major uses—polyester fibers, antifreeze, and exports—is expected to decline from current levels because of foreign competition. Although other ethylene glycol uses—as a solvent and in deicing fluids, for instance—are affected little by the vagaries of international trade, their potential growth is considered small.

There is a wide spectrum of other end uses of ethylene oxide and its derivatives. One, glycol ethers, may lose its market in paints and other solvent applications to propylene oxide derivatives in coming years because of toxicity concerns. Other derivatives, such as ethanolamines and ethoxylates, eventually end up used in natural gas scrubbing and surfactants.

For ethylene oxide, the outlook over the near term seems to be for profitless, high operating rates as a result of reduced capacity. But 1985 also could be the year in which U.S ducers get a much better idea o. great an impact foreign competition will have on them. That would give some indication of what will happen in the future to domestic capacity that is still running.

$C_nH_m + nH_2O \rightarrow (n+\frac{m}{2}) H_2 + nCO$

$CO + H_2O \rightarrow CO_2 + H_2$

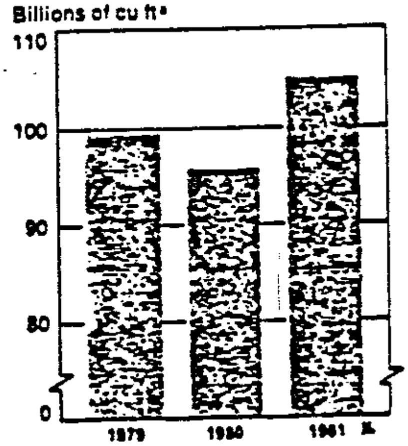
Key Chemicals

H_2

Hydrogen

- *Production recovering*
- *Market expanding*
- *Prices up*

PRODUCTION



* Excluding captive production.

HOW MADE

Steam reforming of natural gas

WATER GAS SHIFT

MAJOR USES

Chemical processing 63%, metallurgical uses 37%

FOREIGN TRADE

Negligible

PRICES

98 cents per 100 cu ft in 13,000-gal lots (liquid)

COMMERCIAL VALUE

About $150 million for total merchant production, 1981

Hydrogen has been one of the bright spots in the U.S. industrial gas business—that is until last year. In 1980, however, hydrogen production fell 3.2% from 1979 levels. This is quite a change from the gas's 10-year growth rate of about 6%.

This growth rate, alone, however, did not make hydrogen's reputation for profitability. Rather it was the relative lack of competition and modest growth of producing capacity that has made merchant hydrogen a good product to be in. And producers believe that the growth rate will increase—to as much as 10% per year.

There are essentially only three producers of liquid hydrogen in the U.S.—Union Carbide, Air Products, and Airco, the U.S. subsidiary of Britain's BOC International. Union Carbide and Air Products dominate the market.

Merchant hydrogen is just a small part of all of the hydrogen produced in the U.S. Some industry experts have estimated that total production of hydrogen far outstrips any other industrial gas on a cubic-foot basis. This is because many users of hydrogen produce their own gas for captive use. These sources of hydrogen are largely unknown and thus not counted in the government production figures. Therefore, no one knows just how much hydrogen is produced or even how many producers there are. This segment has been estimated to be at least as much as 10 times as large as merchant hydrogen output, however.

Merchant hydrogen production suffered last year because it is closely tied to two highly cyclical products. About 63% of merchant hydrogen production goes to chemical processing for such products as plastics, pesticides, and chemical intermediates. The other 37% goes to metal processing where it is mixed with nitrogen to form blanketing atmospheres.

Since both chemicals and metals suffered last year, it is no wonder that merchant hydrogen production declined. In fact, merchant hydrogen production is a lagging indicator for the economy. Last year hydrogen production did not start to decline until after the recession had begun.

And since the chemical and metal economies have not yet improved, neither has hydrogen production. U.S. production of hydrogen was off 3.8% through the first four months of 1981 to 32.1 million cu ft. This number is only roughly correct, since it takes into account some hydrogen gas that is sold on the merchant market. It rather should be used as an indication of the way the market is going.

The price for hydrogen seems to be increasing, although price seems to be uncertain, too. Since, like other industrial gases, contracts include widely varying prices, the average for the industry is largely unknown. The best guess is that hydrogen currently is selling at about 98 cents per 100 cu ft in 13,000-gal lots. This excludes equipment and shipping charges. Other estimates have put the price about 10 cents higher. However, these prices are discounted and, further compounding the problem, in some cases energy surcharges apply.

But, if it is assumed that the current list price is 98 cents, this represents an increase of about 7.7% from a year ago. It also means that the price of hydrogen has increased almost 30% in the past three years.

Even though there is discounting now, the small number of producers almost guarantees a more orderly marketplace for hydrogen than for other industrial gases. For one thing, there is not the spate of new capacity as in the three other gases. Merchant hydrogen capacity is still about 128 tons per day, the same as it was at this time last year, according to industry sources.

Two new plants will be coming on stream to serve the U.S. market. Air Products' new plant at Sarnia, Ont., although not a U.S. plant, will be sending most of its products into U.S. markets. This plant will come on stream sometime this year, and will be the first new capacity serving U.S. markets since 1979. Union Carbide also is building new capacity at Niagara Falls, N.Y., which will be on stream in 1982.

Transportation costs also are becoming problematical. In the past, liquid hydrogen has been shipped up to 1000 miles from the plant. Although it still is possible to do this, producers feel that they had better look to ways of cutting this overhead. They say that in the future plants will be built closer to areas where the merchant hydrogen is needed.

* 2.3 × 105 tons

Key Chemicals

CALCINING: $CaCO_3 \rightleftarrows CaO + CO_2$ en

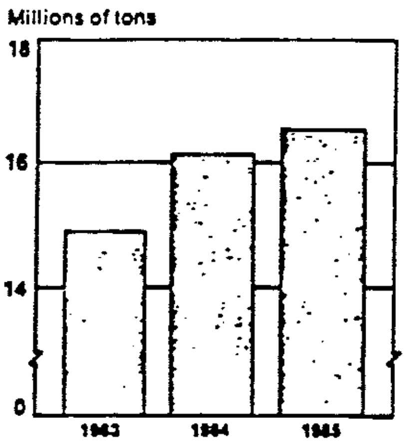
$CaO + H_2O \rightleftarrows Ca(OH)_2$ ex

CaO

Lime

- *Demand growth slower*
- *Capacity in excess*
- *Prices weak but holding*

PRODUCTION



Note: No capacity estimates are available.

MAJOR PRODUCERS

Chemical Lime, Dravo Lime, Genstar, Marblehead Lime, National Lime, U.S. Gypsum

HOW MADE

Calcining limestone to make quicklime, CaO-MgO, then adding water to make hydrated lime

MAJOR END USES (U.S.)

Metallurgy (mainly steel) 40%, pollution control and wastewater treatment 15%, chemicals 10%, potable water treatment 10%

FOREIGN TRADE

Exports—tiny and holding at about 20,000 tons, imports—small and declining to about 200,000 tons

PRICES

$50 to $55 per ton, list, with variations for volume, type, and plant location

Lime producers have reason to expect an increase in their total output in 1985 to about 16.5 million tons. At that level, production will not be near the recent historical high of some 21 million tons in 1979, but it will be substantially above the recession low of about 14 million tons in 1982.

This year's production of lime—one of the oldest chemicals known to man—will be up about 400,000 tons, or about 2%, from production in 1984. That incremental gain will be much smaller than last year's, resulting from the continuing shift in uses of lime. Major long-term uses in the metallurgical field are expected to decline again in 1985, but this drop will be more than offset by increased use in construction and in pollution control. Both of these lime uses also will continue to grow relatively fast, giving hope to producers who recently have had severe problems from excess production capacity.

No estimate of total plant capacity is available for lime production because of the diversity of producers and because of the relative ease with which plants can be shut down and restarted. Some plants have been down for several years now, because of declines in metallurgical demand by steelmakers during the 1980s. The Bureau of Mines reports that 137 plants produced lime during all or part of 1984, down from 154 plants in the 1979 peak. The average operating rate of these plants in 1984 was well below that in 1979.

The lower lime-plant operating rate results in part from the problems in demand for steel. About 20% of lime production is captively used, with a big share of the captive lime used as a fluxing agent in steelmaking. During 1985, steel mill operating rates have slipped after rising last year, leading to lower estimates for that use of lime.

Besides steelmaking, the other big metallurgical use of lime is in processing copper ores, bauxite, and other nonferrous metal ores. Copper production, in particular, has declined rapidly, which has hurt overall demand for lime.

The fastest growing uses for lime are in the environmental area. About 10% of total lime use goes to treat water in preparation for potable uses and another 15% of the total is used for various kinds of pollution control. The latter includes sewage treatment, acid mine water drainage neutralization, and sulfurous gases removal.

Stack gas scrubbing, however, keeps growing quite rapidly and will require some 1.25 million tons of lime this year. The future for this use of lime could be very bright, if addition of scrubbers measurably alleviates acid rain by reducing sulfur gas emissions from power plants and other plant stacks. Addition of wet or dry scrubbers to existing power plants could be expensive and operating costs high, so efforts are under way to develop burners through which hydrated lime is injected in preference to limestone. This is because lime's relatively greater surface area improves reactivity.

Still other new and large potential uses for lime in pollution cleanup could result from tests under way in Ohio to use lime to neutralize and coagulate waste pickle liquors containing oils now lying in pits. The dewatered product would go to a landfill.

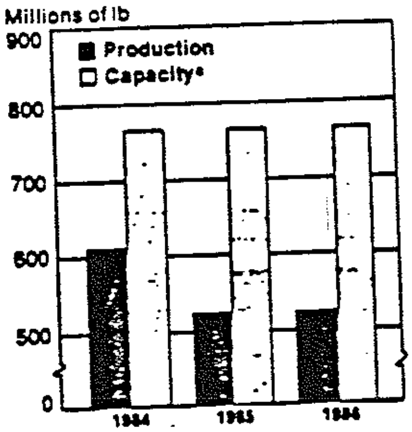
The other major uses of lime will contribute to demand growth this year as they offset declines in the metallurgical use, but none will show very rapid growth. Chemical manufacturing has become a very diverse use with the various individual uses varying from year to year. A sizable decline in one area of this use will occur this year, when the last synthetic soda ash plant is closed down. Pulp and paper manufacture takes about 1 million tons a year of lime as makeup, in addition to large quantities recycled. Construction uses of lime could be up because of more soil stabilization for road building, and increased use as an antistripping agent in asphalts.

CH_2Cl_2

Methylene chloride

- *Production to hold*
- *Capacity variable*
- *Prices steady*

PRODUCTION/CAPACITY



a First quarter, maximum (actual capacity varies with product mix of chloromethanes).

MAJOR PRODUCERS

Diamond Shamrock, Dow, LCP Chemical, Vulcan

HOW MADE

Chlorination of methane; hydrochlorination of methanol, then chlorination of methyl chloride

MAJOR END USES

Paint remover 30%, aerosols 20%, degreasing agent 10%, chemicals manufacturing 10%, blowing agent 5%

FOREIGN TRADE

Exports—about 50 million lb; Imports—about 50 million lb

PRICE

About 35 cents per lb

Methylene chloride producers have cut output drastically in 1985, and prospects for improvement in 1986 are slim. Compounding the problem, the Environmental Protection Agency has begun its long-awaited study on the possible risks of cancer from exposure to methylene chloride, which is used largely as a solvent.

Current estimates put production of methylene chloride in 1985 at about 520 million lb, or slightly less. That figure is about 15% less than last year's output of 607 million lb estimated by the U.S. International Trade Commission. However, the annualized 1985 production for the first three quarters totals 510 million lb. If the final 1985 estimate is increased as much as was the final 1984 figure over the preliminary estimate, then 1985 production could be as much as 550 million lb. Thus, output would be down only about 10% from 1984.

Production of all four chloromethanes—methylene chloride, methyl chloride, chloroform, and carbon tetrachloride—is down, but not uniformly, from levels in 1984 when recovery from the recession reached its peak. The reason for irregular changes in output is the flexibility that manufacturers have in running plants to make whichever chloromethane is most in demand. Capacity estimates for methylene chloride are the maximum that can be produced, partly at the expense of output of other chloromethanes. Based on this maximum capacity, the 1985 average operating rate for methylene chloride plants is 68% of nameplate.

Manufacturers of methylene chloride would like to increase output this year and next to offset anticipated lower production and sales of chloroform. This decline in sales will result from the modification of a Du Pont chloroform plant that will make Du Pont nearly self-sufficient in its supply of raw material to make dichlorodifluoromethane, used as a refrigerant and in manufacturing fluoropolymers.

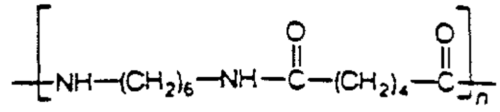
Demand for methylene chloride is forecast to remain nearly stagnant in 1986. The end uses are expanding very little and may well shrink, depending on how the public views the results of the EPA toxicity study. Most uses of methylene chloride depend on its solvent properties; relatively small quantities are used as chemical intermediates.

The largest solvent use of methylene chloride is in paint removers. For several years this use grew rapidly as methylene chloride replaced other solvents that came under air pollution control regulations. However, growth has abated recently because demand for paint removers is rising slowly and capture of the markets held by other, older paint remover solvents is almost complete. If more concern develops over toxicity, use in paint removers could decline steeply after 1986.

The second largest use of methylene chloride, that as a propellant in aerosol preparations, also has grown little. Methylene chloride took over much of the market from fluorocarbon propellants because of concern about damage to the atmospheric ozone layer. Methylene chloride apparently causes little damage to the ozone layer because it decomposes relatively rapidly in air. For the near term, growth in this use of methylene chloride will follow closely that of the population and will vary as a result of changes in use of hair sprays and other aerosol products.

The other uses of methylene chloride also rely on its solvent properties. Those include industrial cleansers and degreasers, which depend on trends in industrial operations. For example, the shift to less metal processing in making automobiles and other durable goods tends to reduce demand for methylene chloride. A host of small solvent uses account for a large part of consumption, but none of these are increasing fast enough to help much in stemming the general decline in use of methylene chloride.

Key Polymers

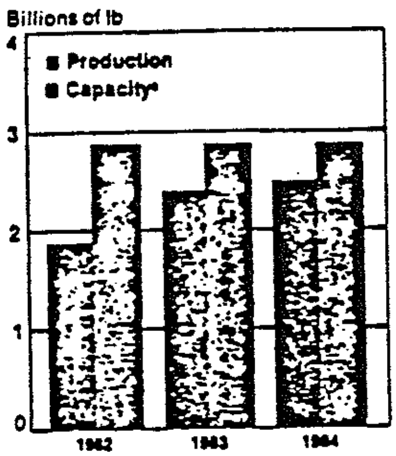


Nylon 66

Nylon

- *Production to rise*
- *Capacity holding*
- *Prices improved*

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Nylon 66—adipic acid and hexamethylenediamine reacted to form hexamethylene diammonium adipate, which is polymerized by removal of water; nylon 6—caprolactam polymerized by addition and subsequent removal of water

MAJOR END USES (U.S.)

Home furnishings 60%; apparel 20%

FOREIGN TRADE

Exports—to rise to about 125 million lb this year, imports—to increase to about 50 million lb

PRICES

Carpet staple $1.10 to $1.25 per lb; apparel grades $1.50 to $3.00; discounting continuing

COMMERCIAL VALUE

$3 billion for production, 1984

Nylon's success in 1984 will depend on the construction business—more specifically, on carpet use. There is probably enough nylon fiber produced, either ready to go into carpet or in manufactured carpet, to meet demand for the rest of the year. A surge in carpet demand during the last quarter probably would not help nylon fiber production this year, but it could set the stage for a fast start in 1985.

Since housing starts have been relatively strong, but so far not at record-breaking levels for much of 1984, nylon fiber demand has risen. This probably will result in an increase in nylon fiber production of 5% or a bit less for all of 1984 to about 2.5 billion lb. The gain this year will be in the 100 million lb range, a shadow of the gain in 1983 when production rose almost 500 million lb during the economic recovery. Production in 1982 of 1.93 billion lb was the lowest since 1971.

Nylon fiber production capacity is holding at about 2.9 billion lb a year. A small portion of this capacity apparently can be used to make other fibers. Neglecting the very small swing capacity and taking 1984 production at 2.5 billion lb, the operating rate for this year once again will run above 85%, a level reached in the late 1970s.

No new capacity is expected to be built anytime soon. Now that the economic recovery is well under way, gains in production are expected to be small. Additional capacity will be obtained from the usual debottlenecking methods and through replacement of lines of old machinery. The amount of additional capacity to be added is forecast to be small for the next few years. This situation will prevail until capacity is pushed very hard.

Prospects now are for continued small gains in production next year unless a major downturn in the economy occurs during the second half. Housing use of nylon carpet may not gain much next year, but prospects are good for the commercial or contract carpet business to follow its usual lagging cycle of feeling the effects of a recession last and recovering last.

With home furnishings taking more than 60% of nylon fiber production, this use gets most of the attention by forecasters. Home furnishings should really be termed carpet because all other uses of nylon fibers in home furnishings total 5% or less. Hence, with more than half of nylon fiber use going to carpets, and a major share of this in home carpets, analysts are watching closely all the factors that influence housing construction and sales.

Of the noncarpet uses of nylon fibers, about half is apparel and half industrial uses. Each of these categories further breaks down into many small markets. None of these are changing enough to have significant impact on total nylon demand this year, but some are improving as a result of fashion changes and the recovery.

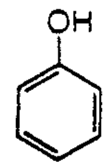
Most of the apparel items proffer steady demand for nylon fibers, even during recession times. No new developments have occurred to change demand in such items as underwear, nightwear, robes, socks, or sweaters. Hosiery has received a slight boost from fashion as a result of a shift toward more patterns and colors.

Industrial uses of nylon fibers are being boosted as expected by the recovery. Tire demand, especially for truck and off-the-road tires, has been strong and is expected to remain so because of the expanded road building programs. This will continue even with a slowdown in the economy. Tire cord accounts for roughly 50% of the industrial demand for nylon fibers and probably will change little over the next few years.

On balance, nylon, in its main use as carpet, accounts for most of t market, so the fiber's capture potential is small. Therefore, the outlook for nylon will be that of slow, steady growth when averaged over good and bad economic times.

CH_3CHCH_3 + H_2O_2 → $CH_3\overset{O}{\overset{\|}{C}}CH_3$

Key Chemicals

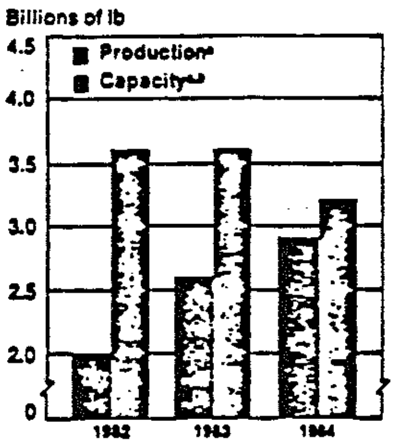


+ H_2

Phenol

- *Demand higher*
- *Capacity to rise*
- *Prices up*

PRODUCTION/CAPACITY



a Synthetic only. b First quarter.

HOW MADE

Peroxidation of cumene (isopropyl benzene) and cleavage to phenol and acetone

MAJOR DERIVATIVES (U.S.)

Resins (mostly with formaldehyde as comonomer) 40%, bisphenol A 20%

MAJOR END USES (U.S.)

Adhesives 60%, plastics 20%

FOREIGN TRADE

Exports—to hold at about 100 million lb in 1984, imports—small and holding around 25 million lb

PRICES

List prices 36 to 39 cents per lb, discounts still significant

COMMERCIAL VALUE

$1 billion for production, 1984

This year phenol will join that small, but growing, group of organic chemicals whose excess capacity is about used up. Production of synthetic phenol in 1984 could exceed 3 billion lb, surpassing the 2.95 billion lb record set in 1979.

Since 1979, considerable changes have occurred for phenol. Nameplate capacity has continued to rise and exceeded 4 billion lb in 1981. Then following a severe decline in production during the recession to about 2 billion lb in 1982, capacity also dropped.

Monsanto is the latest to leave the phenol business, dropping 500 million lb from the 1983 capacity list. Minor debottlenecking offset a part of this shutdown capacity, but the current total, at about 3.2 billion lb, will be strained if 3 billion lb of phenol are produced in 1984.

Even if production falls a little short of the 1979 high this year, the average operating rate for plants on stream as the year began will be 90% for all of 1984. But some help is coming. By the end of this quarter, Georgia-Pacific will be putting some 157 million lb of capacity on stream in a plant that has been shut down for several years.

Additional debottlenecking is going on as well, which will add a bit to phenol capacity and help the snug supply. These small expansions could total between 100 million and 200 million lb when added up by the end of 1985.

List prices for phenol have risen so far in 1984 and some discounts have been taken off. This has helped to raise the previous low returns on sales of phenol and its derivatives. (Merchant sales account for about half of the production of phenol, although for some producers, sales are very small.) Considering current and expected returns on sales, producers still are unlikely to build new plants. A producer would require a large captive use to justify a plant, with any phenol for sale as incremental production.

Capacity additions by debottlenecking may be all that will be needed for several years. If 1984 production reaches 3 billion lb, it will be just 3.4% above the previous high. This tiny growth means that for the past five years production of phenol languished—hardly an incentive to build new capacity. Therefore, small capacity additions likely will be enough to get through 1985 when demand again might slow as the economy cools.

Exports, of course, are a potential outlet for additional product made in the U.S. Currently, exports of phenol probably will amount to about 100 million lb, about the same as last year. Exports could be reduced to meet internal demand, but exporters have some investment in special handling equipment for phenol on which they would like to keep earning some return. New foreign plants also could cut into exports.

Adhesives—particularly those made with formaldehyde—for the housing market account for a major share of the consumption of phenol. This market depends heavily on housing demand. But, even if housing demand slows next year and, in turn, demand falls for plywood made with phenol-based adhesives, enough demand remains in other phenol uses for it still to have a good year. Inventory changes in plywood have some influence on adhesive demand, which could cause temporary swings in phenol demand as plywood inventories are liquidated and then rebuilt quickly.

Other applications for phenol are much smaller, and many also are connected with housing and with auto production. They also are partly responsible for pushing phenol production to capacity limits this year, but they, too, would decline if the economy slows. After many poor years, the many uses are making a very good year for phenol.

L/B(P-11)2

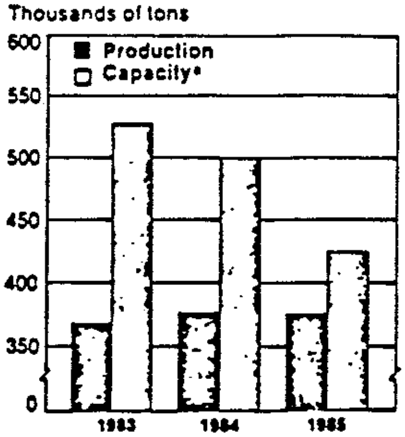
Key Chemicals

$T = 1300°C$ $2Ca_3(PO_4)_2 + 6SiO_2 + 10C \rightarrow 6CaSiO_3 + 10CO + P_4$ 1500

Phosphorus

- *Production flat*
- *Capacity reduced*
- *Prices holding*

PRODUCTION/CAPACITY



a First quarter.

MAJOR PRODUCERS

FMC, Monsanto, Occidental, Stauffer

HOW MADE

Reduction of phosphate rock in electric furnaces with carbon (coke) and silica as aids

MAJOR DERIVATIVES (U.S.)

Phosphoric acid and derivatives 85%, other chemicals 10%

MAJOR END USES (U.S.)

Detergents and cleansers 45%, metal treatment 15%, foods and beverages 10%, chemicals 10%

FOREIGN TRADE

Exports—expected to hold at about 20,000 tons, imports—negligible

PRICES

91 cents per lb, list

Phosphorus producers this year will have the best capacity utilization rate among the major-volume mineral inorganics. Although actual production will be up marginally, if at all, from last year, use rates will be up because electric furnace phosphorus capacity has dropped 20% in the past two years.

A good plant operating rate, however, doesn't mean that all is well with the phosphorus industry. The reduction in capacity during the 1980s clearly indicates that this industry has had and continues to have problems. The production estimates for 1984 and 1985, at 375,000 tons, are up less than 5% over the recent historical low of 361,000 tons in 1982.

However, production this year may not even reach 375,000 tons, depending on demand by the major uses such as detergents and cleansers, metal treating, and foods and beverages. Estimates of reported output by the Department of Commerce for the first quarter total just over 100,000 tons, but this production may be high for seasonal reasons.

The chance that phosphorus production will return to 1980's level or higher now seems slim. The 1980 production total of more than 430,000 tons exceeds some current estimates of nameplate capacity. Thus, new plants would be needed to produce even 400,000 tons. Equally slim is the likelihood that new plants will be built at today's production economics. Low selling prices of elemental phosphorus and the derivatives made from the acid from this phosphorus will not allow construction.

Manufacture of detergents and cleansers dominates the electric furnace phosphorus uses at about 45% of domestic consumption. Most of the thermal phosphoric acid used in detergents and cleansers is made into sodium tripolyphosphate (STPP). This use of thermal phosphoric acid in the U.S. differs from the situation in most other countries where wet-process phosphoric acid is used in making STPP. Small amounts of wet-process acid, however, are used in STPP in this country.

The problem for producers of phosphorus and of STPP is the expanding regional bans on use of phosphate builders in detergents. The bans aim at reducing water pollution. For example, a prohibition on detergent phosphates has been passed in Maryland and one might be passed in the next legislature in North Carolina. Removal of a ban on phosphate in Dade County, Florida, has helped in a small way, but not enough. Some Great Lakes states have banned sale of phosphate-containing detergents, and others are expected to do likewise.

STPP and other phosphoric acid derivatives also go into a variety of household, industrial, and institutional cle[aners], many of which are formulate[d for] specific uses. Their consumption changes as they move in and out of favor with new formulations and new advertising campaigns. Growth of these products continues to be small and will have no significant effect on demand for phosphorus this year.

Metal treating ranks next in volume to detergents as a consumer of phosphorus, but it is a distant second accounting for about 15% of total consumption. Use in metal treating—most of which is in the automobile industry—will have little, if any, effect on changes in consumption of phosphorus this year. Down-sizing of cars and a shift in style away from bright metal trim indicate that this use likely will not grow much this year and will leave demand substantially lower than at the beginning of the decade.

Food and beverage uses of thermal phosphoric acid grow at about the same rate as population growth. Shifts in fashion and diets change the pattern of individual products' consumption of phosphoric acid and derivative[s, bu]t the net growth remains small a[nd] is not enough to do much more than offset a minimal part of the declines in other uses.

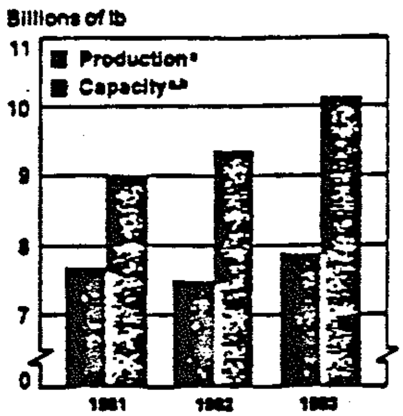
Key Polymers

$-\!\!\left[CH_2-CH_2 \right]\!\!-_n$

Low-density polyethylene

- *Demand rebounding*
- *Capacity growing*
- *Prices still low*

PRODUCTION/CAPACITY



a Includes linear low-density polyethylene. b First quarter, includes some shut-down capacity not expected to restart.

HOW MADE

Polymerization of ethylene at high and low pressures aided by catalysts and initiators

MAJOR FABRICATED FORMS (U.S.)

Film, largely for packaging, 65%; coatings· 10%; injection molding 5%

FOREIGN TRADE

Exports—large, but may drop to less than 1 billion lb in 1983, imports—less than 40 million lb

PRICES

List prices 28 cents per lb and up; discounts varied and sizable

COMMERCIAL VALUE

$2.5 billion for production, 1983

Low-density polyethylene weathered the recession a little better than expected and will make a run for record U.S. production this year. Producers have enough confidence that capacity expansions continue, mostly in the new, linear low-product type. Still, plant use rates and profitability aren't very good, and the resin's important export market is due for a drop.

Production of low-density polyethylene declined just 3% in 1982 from 1981 to 7.5 billion lb. For 1983, production could bounce back to a new high of 7.9 billion lb, possibly more if linear low-density polyethylene demand reaches optimists' expectations. The record is 7.8 billion lb in 1979.

Both production and sales of this polymer ran above the expected 1983 rate of gain in the latter part of 1982. This unsustainable pace apparently was due to inventory building as interest rates declined and buyers all through the sales chain, from polymer producers to end-product distributors, believed they saw a business pickup. However, analysts say this growth rate, more than 12% for December 1982 over December 1981, can't be maintained for 1983 as a whole.

Plant capacity for low-density polyethylene continued to grow in 1982. This growth equals the net of plant additions for conventional and linear low-density polyethylene minus permanent shutdowns in conventional plants. The largest addition in 1982 was Exxon Chemical's plant at Mont Belvieu, Tex., with capacity of 600 million lb per year of linear low-density polyethylene.

Other additions and subtractions brought total nameplate capacity to 10.1 billion lb as 1983 began, up 9% from a year earlier. Of additions due in 1983, the vast majority will be accounted for by Eastman Chemicals and Mobil Chemical, which are building the last of the conventional low-density plants in the U.S. In addition, process technology improvements will add some linear low-density capacity, and there will be some shifting of older high-density units to make this form of polyethylene.

Not all of this capacity actually is producing. At least 500 million lb currently is shut down and not expected to operate again, at least at the present locations. Probably another 500 million lb, possibly more, of capacity is temporarily shut down. All shut-down capacity uses the older, high-pressure technology, whose economics have been eclipsed dramatically by the new, low-pressure processes.

Subject to market demand, some temporarily shut-down capacity might be converted to make linear low-density material. However, costs of conversion compared to costs of new plants or costs of conversion of high-density polyethylene plants make forecasts almost impossible on the outcome of the current capacity excess.

The likely result in 1983, unless an unusual demand surge comes along, is that more than 1 billion lb of capacity will remain idle. If production reaches 7.9 billion lb, remaining capacity will run at a very decent 87%. Counting all shut-down capacity, the plant-use rate for the year will drop to 78% from 81% in 1982. The recent high in plant use was 93% in 1979.

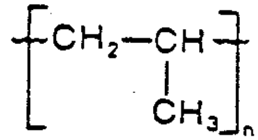
On the market side, U.S. uses of low-density polyethylene, counting all resin forms, will have roughly the same pattern as in recent years, with film dominating. Growth in film use will account for most of the production gain, excluding inventory building. This will favor linear low-density material, which goes largely into film. Further help here for linears will come from quality improvements.

Outside the U.S., low-density polyethylene faces a different picture. As with many other U.S. chemicals, exports will suffer because of the high value of the dollar and competition from new foreign plants with lower-cost feedstocks. After reaching almost 1.1 billion lb in 1982, close to the all-time high in 1980, exports of low-density polyethylene are forecast to drop 10% to about 1 billion lb in 1983.

The export sag will combine with competition for U.S. sales to take a toll on profitability and lead to more plant shutdowns. Efforts to raise polyethylene prices seem continuous but with little result. Enough new capacity will become available in 1983 that the pricing/profitability situation will remain much like 1982 despite a respectable volume increase. So this plastic will have a smart upturn in many respects but without much financial reward.

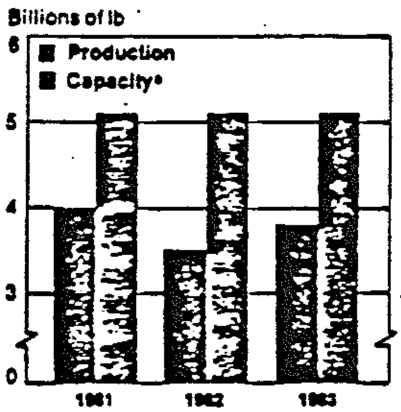
Key Polymers

Polypropylene



- *Demand mending*
- *Capacity flat*
- *Prices discounted*

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Polymerization of propylene catalyzed by metallic salts and alkyls

MAJOR FABRICATED FORMS (U.S.)

Injection molding 40%, fibers 30%, film 10%

FOREIGN TRADE

Exports—declining to about 700 million lb in 1983, imports—about 10 million lb

PRICES

List prices 42 cents per lb and up; discounting large

COMMERCIAL VALUE

$1.3 billion for production, 1983

Polypropylene was shaken badly by the recession, which for the moment has undercut all the glowing forecasts of the late 1970s for this plastic. Production fell about an eighth in 1982 from the record in 1981 and will recover so slowly that another year will be needed to reach new highs. That's bad news for all the companies that have poured new-entry or expansion money into polypropylene since 1975. At the moment, the investment wave is over, but the resulting overbuilt capacity keeps prices at unprofitable levels.

A combination of slumps in two key markets for polypropylene—autos and housing—and abnormally high costs of feedstock propylene for much of 1982 dropped production to less than 3.5 billion lb, off 12% from 1981. Sales in 1982 dropped only half as much as production, suggesting that inventories were pulled down more than 200 million lb.

This inventory drop could set the stage for a relatively stronger recovery in 1983 for polypropylene than for the polyethylenes. Production could increase 8% this year to about 3.8 billion lb, still below the 1981 high of about 4 billion lb. Some industry sources, however, doubt such a gain will occur, noting that at year end 1982 polypropylene's pickup was slower than for the polyethylenes. These analysts fear that polypropylene will struggle through 1983 with just a 5% gain, giving production of 3.7 billion lb or less.

In any event, U.S. polypropylene plants will run no higher than 75% of nameplate capacity on average this year. If production sticks at the pessimistic level, the operating rate will just break 72%.

Such relatively low operating rates for a polyolefin are the direct result of the capacity bulge in the late 1970s. Investment incentive is now zero and capacity has been almost flat for three years. No expansions will come on stream during 1983 either, other than the usual small gains from catalyst improvements and other process efficiencies. These gains might total 50 million lb among several polypropylene producers.

Other than exports, the big outlets for polypropylene all fell hard in 1982. Use in fibers, for example, declined almost a sixth from 1981. Fibers felt the decline in housing and in furnishings such as carpet and curtains. This fibers market, some 30% of U.S. polypropylene demand, probably will trail the current upturn in housing because of the lag time in ordering. The second half of 1983 could bring higher fiber use after carpet demand sops up large carpet inventories rumored to be held by manufacturers and dealers.

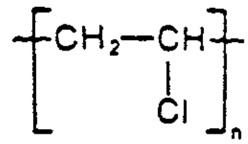
In general, the injection molding uses of polypropylene, some 40% of total U.S. consumption, were hit hard by the recession. These markets involve autos, appliances, toys, housewares, and many others. Recovery for these items will be spotty in 1983. Autos, for example, have posted smaller sales gains for the first quarter than analysts forecast. Such gains, plus the trend toward smaller cars, will result in little growth for polypropylene in this complex area in 19[illegible]. Appliance demand is doing better, a[illegible] with demand for other consumer pro[illegible]ucts that contain molded polypropylene. These uses could rise 10 to 15% in 1983, but they still will not get back to 1981 levels after declines exceeding 20% in 1982.

Exports were the brightest outlet for polypropylene in 1982, rising 8% to 740 million lb. However, the strength of the dollar and competition in world markets from producers in other countries are expected to pull exports below 700 million lb this year. The drop could be worse under the impact of declines in oil prices benefiting foreign producers.

Other major polypropylene markets in general are expected to aid the plastic's recovery. For example, high hopes exist in some quarters for polypropylene film, whose demand held up better in 1982. However, other opinion holds that film will have steady but not spectacular growth even though developmental work may overcome problems such as heat sealing.

Overall, polypropylene so far in the 1980s has failed producers' fond forecasts of the late 1970s. Even with a moderate upswing in demand this year, plant use and profitability will remain disappointing. Producers still have h[illegible] for polypropylene and are push[illegible] new-use development and downstream investment, but a big payoff is unlikely in 1983.

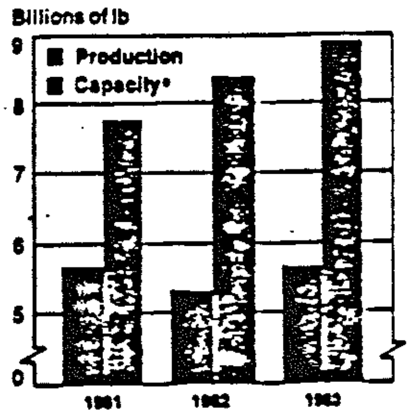
Key Polymers



Polyvinyl chloride

- *Demand recovering*
- *Capacity shaking out*
- *Prices turning up*

PRODUCTION/CAPACITY



a First quarter.

HOW MADE

Polymerization of vinyl chloride by suspension, emulsion, bulk, or solution processes initiated by free radicals

MAJOR FABRICATED FORMS (U.S.)

Extrusions, nearly two thirds pipe 65%; calendered sheet, film 10%

FOREIGN TRADE

Exports—declining to about 500 million lb in 1983, imports—staying about 50 million lb

PRICES

List prices unsettled, starting at 28 cents per lb; discounting large

COMMERCIAL VALUE

$1.5 billion for production, 1983

Signs of recovery finally are coming through for polyvinyl chloride, but it will take some time for this plastic to recover from the tumultuous times of the early 1980s. In 1983, even with a moderate production rebound powered by an improved construction market, polyvinyl chloride plants will bump along at only 64% of nameplate capacity.

The result will be a continued shakeout in this business, with more plants closing and more producers heading for the exit. In this respect, PVC is starting the new business cycle far different than in the late 1970s, when plant use strained the limit at 87% of capacity in 1979 and expansions rolled on and on.

PVC gets these wild cyclical changes in part because it is the thermoplastic most tied to the gyrating construction market, which takes a bit more than half of total U.S. PVC output. If home furnishings and other consumer items used around the house were included, construction's share of PVC demand would be still greater.

Unfortunately, at the beginning of a business recovery as at present, PVC lags construction because of the multistage pipeline extending back from construction sites to plastic extruders to resin producers. This "line-fill" time can account for as much as half a year, depending on perceptions of demand strength at different stages of the pipeline.

Currently, these perceptions indicate strong coming PVC demand in construction. Spurred by lower interest costs, these assessments call for renewed inventory building and increased PVC production, continuing a trend begun in late 1982. For 1983, output now is heading back to the 1981 level of 5.7 billion lb, possibly higher by 100 million to 200 million lb. This increase of 8% or higher still would leave PVC shy of its 1979 record of 6.1 billion lb.

As 1983 began, operable PVC plant capacity totaled 8.9 billion lb per year, but probably 1 billion lb of this was not running. How much shut-down capacity eventually will restart is difficult to estimate; not much will be tempted out under current financial conditions.

Later this year, startup decisions obviously will depend on PVC prices, including the differential between polymer and monomer prices. At this time efforts are under way to raise PVC prices. Part of the reason is that monomer prices are being pushed up under pressure from price hikes in raw material chlorine. With such cost pressure from the rear and with a moderate demand increase in front, PVC producers seem likely to get some price hike during 1983.

If, however, resulting price increases of a few cents per lb are not enough to cause shut-down PVC production units to restart, actual operating capacity of 8 billion lb will run at 71%. If production reaches 5.9 billion lb, the operating rate could rise to 74%. But, if all available capacity were included in the computation, operating rates would range from 64 to 66%.

At these levels of operation, PVC profitability is iffy. Price increases could help, along with greater volume, but the question remains: is there enough money in PVC to justify development work to broaden uses of this versatile thermoplastic? Small producers probably cannot finance projects such as developing new compounds aimed at light and weather resistance—for example, in construction uses of siding and windows. These producers also can be at a cost disadvantage compared to larger producers integrated back to vinyl chloride and maybe chlorine. Hence, shut-down capacity at these smaller producers is more likely to remain closed this year and possibly never restart.

Besides the expected demand improvement in the construction market, some upturn will come in the many other uses, such as consumer products, electrical items, and packaging. However, none will outdistance construction in percentage growth.

The export market, which last year took about 10% of production, is expected to fall in 1983. One big reason is higher prices, up from bargain levels in 1982. Offsetting PVC exports for integrated producers may be an increase in exports of the polymer precursors, ethylene dichloride and vinyl chloride.

Without much help from exports, in 1983 PVC will ride largely on the fortunes of the U.S. construction business. Basics have impoved a lot here, but benefits for PVC will take a while, especially on the bottom line.

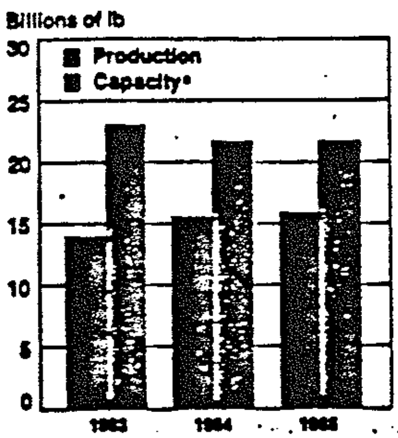
Key Chemicals

$CH_2{=}CH{-}CH_3$

Propylene

- *Production up a bit*
- *Capacity flat*
- *Prices down*

PRODUCTION/CAPACITY



Note: All grades. a First quarter.

MAJOR PRODUCERS

Amoco Chemical, Arco Chemical, Dow Chemical, Exxon Chemical, Shell Chemical

HOW MADE

Recovered from cracked gas streams from steam crackers and refinery catalytic cracking units

MAJOR DERIVATIVES (U.S.)

Polymers 35%, acrylonitrile 20%, propylene oxide 10%, cumene 10%

MAJOR END USES (U.S.)

Fabricated plastics 50%, fibers 15%, solvents 15%

FOREIGN TRADE

Exports—negligible, imports—holding at about 500 million lb for 1985

PRICES

Chemical grade 16 cents per lb, polymer grade 17 cents per lb

The outlook for propylene has at least one similarity to that for ethylene—a nearly complete halt in production growth during 1985 after a major recovery in 1984. Production of all grades of propylene in 1985 will be up slightly to about 15.7 billion lb from about 15.2 billion lb last year. This covers all uses of propylene for making chemicals and polymers, but excludes refinery uses for making gasoline components such as alkylate. The production gain of slightly more than 1% compares with a nearly 11% gain in 1984, the slowdown resulting from more severe competition in many export markets for U.S. propylene derivatives.

Most polypropylene derivatives are made from chemical and polymer grades of propylene. A few exceptions use "refinery grade," whose propylene content may range from 35 to 90%. Gasoline components also use refinery-grade propylene, thereby acting as competition for chemical uses. These uses also are in competition with the upgrading of the refinery-grade propylene stream for use in making derivatives.

Roughly two thirds of propylene is produced in refineries, mainly in fluid catalytic cracking units; the other third is produced as a coproduct of ethylene in steam crackers. Practically all of the propylene made in steam crackers is used to make chemical and polymer derivatives and an important part of refinery propylene also is used for derivatives. Except for the relatively small quantity of derivatives made directly from refinery-grade propylene, most refinery-grade propylene used for derivatives must first be purified at a significant cost. The purification cost also makes the economics of derivative manufacture favor use of coproduct propylene wherever possible.

Sufficient propylene capacity exists to meet demand if that available from refinery operations is included. But propylene must be priced high enough to justify its being drawn away from the fuel uses. This capacity could be expanded, if returns on investment are sufficient, because cracking units in refineries produce more propylene than now is purified or used directly in making derivatives. However, there is a limit to the quantity of propylene available at any time because the refinery cracking units are operated to make gasoline and other fuel components, and not to make propylene.

Shifts in operation of steam crackers and of refineries have led some derivatives producers to sound an alarm about a possible shortage of the chemical and polymer grades of propylene. This alarm has caused higher prices of propylene relative to ethylene. Ten years ago, a rough rule of thumb was that the price of propylene was 70% that of ethylene. Now propylene pric are the same as ethylene prices or slightly higher, reflecting the apparently less plentiful supply.

The causes of the current rough parity in prices for ethylene and propylene come from the economic squeeze of the early 1980s. The economic recession led steam cracker operators to adapt to the lowest-cost feedstocks, largely ethane, to make ethylene at lowest possible cost. At the same time, refinery operations were cut back, because of lower demand for fuel products. More recently, imports of fuel products have further reduced refinery operations.

However, no real long-term shortage of propylene is expected by industry sources. Even without steam cracker operators changing to heavier feedstocks to raise propylene yields to meet demands, more propylene could be taken from refinery fuel uses, if prices were to rise.

The conditions of propylene prices and supply aren't expected to have any major impact on manufacture of derivatives. As is the case with et ene polymers, polypropylene will gr... faster than will most other propylene derivatives and will take a slowly growing share of propylene consumption.

$SO_2 \rightarrow H_2SO_4$

$S + O_2 \rightarrow SO_2$

$2SO_2 + O_2 \rightarrow 2SO_3$

$SO_3 + H_2O \rightarrow H_2SO_4$

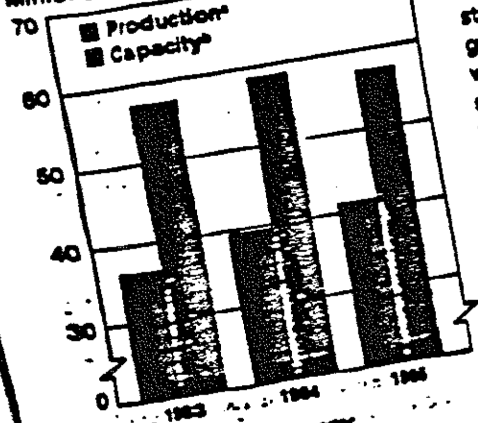
H_2SO_4

Sulfuric acid

- *Production up modestly*
- *Capacity off again*
- *Prices slightly higher*

PRODUCTION/CAPACITY

Millions of tons, 100% H_2SO_4



a From all sources. b First quarter.

MAJOR PRODUCERS

Allied, Du Pont, Monsanto, Olin, Stauffer Chemical

HOW MADE

Sulfur dioxide made by burning sulfur or recovered from smelting, oxidized, and reacted with water

MAJOR DERIVATIVES (U.S.)

None more than 5% of production

MAJOR END USES (U.S.)

Fertilizer manufacturing 70%, metals processing 10%

FOREIGN TRADE

Exports—could rise to 150,000 tons in 1985. Imports—remaining around 500,000 tons in 1985

PRICES

List for smelter acid, $20 to $50 per ton; for virgin acid, $55 to $95 per ton

Prospects for sulfuric acid in 1985 are for a further net decline in capacity, a small gain in production if fertilizer and industrial uses are up slightly, and the usual price pressure, minimizing profitability in spite of marketers' best efforts.

Output of sulfuric acid—the largest-volume chemical produced in the U.S.—is expected to increase modestly this year to 41.0 million tons (expressed as 100% product) following a substantial rise in 1984. This slowing of growth is to be expected in a year in which economic expansion has been slowing. But causes of the slowdown this year are more than simply the general level of the economy. They include slowing of exports of phosphate fertilizers, which consume by far the largest share of sulfuric acid.

Actual increase in 1985 sulfuric acid production could be less than 1 million tons of 100% H_2SO_4, or about 2% over 1984 production of 39.9 million tons. However, a small increase is normally expected for such a major-volume product after a large gain in the preceding year. The 1984 production gain was more than 3.4 million tons measured as 100% acid, a 9.3% increase over 1983 output.

Capacity to make sulfuric acid declined during 1984. Part of the net decline of about 500,000 tons came as a result of a shutdown of a major copper smelter, ending its production of by-product acid. Other smelter acid capacity is expected to be either completely shut down or drastically reduced during 1985. Some virgin acid production, going mostly to various industrial uses such as steelmaking, also has been shut down and more will be closed down this year. Offsetting the declines in smelter by-product acid and acid produced for industrial uses will be minor gains in capacity used to make phosphoric acid for fertilizers.

As 1985 began, estimated nameplate capacity to make sulfuric acid from its various sources—including burning of sulfur, recovery from smelter operations, and roasting pyrites—is about 57.5 million tons of 100% acid. Most of this capacity will be available for production during 1985. Thus, the average capacity utilization rate for all plants will be a bit over 71%.

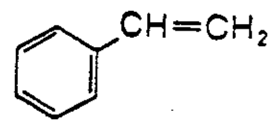
In addition to acid production from the various sources, some 350,000 tons will be added to the supply as a net of imports over exports. The major source of imported sulfuric acid is Canada and much of this is smelter acid (because of pollution regulations, sulfur dioxide can't be released to the atmosphere, and so is converted t[o] sulfuric acid). The major destinatio[n] of U.S. exports of the acid is Mexico—mostly smelter acid eventually used [in] diverse small applications such as a[u]tomobile batteries.

Imported sulfuric acid, most hea[...]
acid from the upper Midwest to [...]
northeastern U.S., keeps pressur[e ...]
prices for merchant acid. Other [...]
pressure comes from recovered s[...]
which is moved to markets as q[...]
as possible from desulfurization
at refineries and gas processing [...]
The result is a wide range of [...]
for sulfuric acid.

In 1984, prices for elementa[...]
especially Frasch sulfur, ro[...]
17% as three price incre[...]
Frasch sulfur accounted for [...]
$25 per long ton, bringing th[...]
price at Tampa, Fla., to $1[...]
ton after discounts. Merc[...]
prices also rose, but not by [...]
because of the large over[...]
large gain in phosphate [...]
ports with accompanying [...]
allowed captive sulfuric [...]
ers to pass on part of th[...]
costs of sulfur during 19[...]

Sulfuric acid's majo[...]
some 70% of product[...]
phosphoric acid and [...]
materials, will not grow[...]
The other uses of su[...]
as in metals proces[...]
refining, and manufac[...]
ferent chemicals, als[...]
this year.

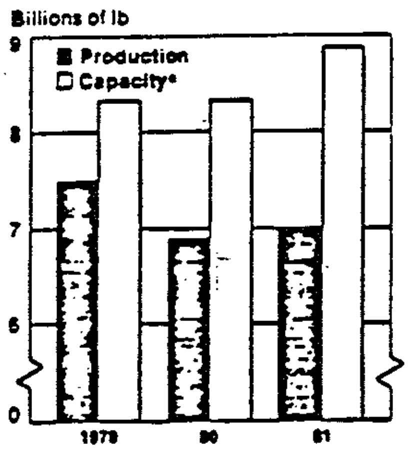
Key Chemicals



Styrene

- *Demand flat*
- *Capacity boosted*
- *Prices falling*

PRODUCTION/CAPACITY



a As of first quarter.

HOW MADE

Dehydrogenation of ethylbenzene made either from ethylene and benzene or from petroleum reformate, coproduction with propylene oxide

MAJOR DERIVATIVES

Plastics-oriented polymers 80%, styrene-butadiene rubber 10%

MAJOR END USES

Fabricated plastics 90%

FOREIGN TRADE

Exports—falling to about 800 million lb in 1981, imports—small

PRICES

List price 37.5 cents a lb

COMMERCIAL VALUE

$2.75 billion for production, 1981

About all U.S. producers of styrene can look forward to this year is matching 1980's poor production of about 7 billion lb. To those in the industry, such a performance is truly disheartening, especially since past slumps have been followed by recovery to a new high the following year. This time, based on performance during this year's first half, styrene can at best pull even with 1980 even if the economy improves late in 1981.

As a result, styrene producers will have two off-years in a row before production has a chance to get back to 7.5 billion lb, the previous record set in 1979. Some pessimists expect a third year below that level in 1982. Such pessimism arises from a hopeless triad of problems—a slump in U.S. exports, weakness in rubber demand, and little or no growth in packaging and other consumer product uses of styrene polymers.

Slumping demand plus new plant capacity put on stream in 1980 by American Hoechst—somewhat offset by the company's shutting down old capacity—will keep the average plant operating rate in the U.S. below 80% of nameplate capacity, now 8.9 billion lb per year. If 1982 output matches 1979, the operating rate will move up a few notches to about 84%.

Fortunately, for some time to come no capacity additions are in view for styrene except minor debottlenecking activities. Most producers are probably above break-even on their current operations but are well below the profit level that would permit capital expenditures for new capacity.

The squeeze on profitability, an almost constant problem in recent years for styrene producers, isn't helped by the fact that most of their customers (or customers of captively produced styrene derivatives) carefully follow the price of benzene, a large part of the raw material price of styrene, and keep the styrene price in line. For example, as benzene's price has weakened in 1981 with continuing decline in demand for gasoline, which uses benzene as an octane booster, so have styrene's actual and list prices. The current styrene list price of about 37.5 cents a lb at plants is down as of the third quarter before being further reduced by temporary voluntary allowances (discounts). Even so, many industry sources feel that the current list prices come much closer to the actual selling prices than in the second quarter.

Hence, an apparent inconsistency has occurred in styrene pricing. Much of styrene's discounting has been in exports. Now, despite lowered domestic list prices, actual U.S. selling prices and effective export prices are increasing. Export volume as a result is taking it on the chin.

Exports are further weakened most by currency conditions but also by revived European protectionism. Strengthening of the dollar relative to European currencies makes styrene more expensive in foreign local currency. In effect, the stronger dollar ends profitability of exporting styrene except at prices far below production cost.

The European duties, both an antidumping levy of 21% and the normal tariff of 6.5%, further reduce attractiveness of styrene exports. In spite of a good first quarter, exports for the whole year may be off 20 to 25% from the nearly 1 billion lb exported in 1980.

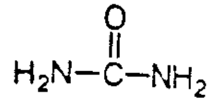
In the U.S., packaging of one kind or another dominates uses of styrene. Packing uses many styrene-based polymers, made from styrene alone or as a comonomer. These diverse uses buffer styrene demand, since a slump in one final use frequently is offset by an improvement in another. For example, packaging of electronic components, such as calculators and radios, has been increasing its use of high-impact polystyrenes, but at the expense of acrylonitrile-butadiene-styrene resins. Overall, such uses underlie a growth forecast for styrene of about 5% annually over the next few years.

Offsetting such styrene polymers in growth is styrene-butadiene rubber (SBR). This year, SBR's use of styrene will be no better than in 1980. Longer term, SBR seems to offer growth of no more than 1% a year.

On balance, small growth in U.S. demand will offset a decline in styrene exports in 1981. In other words, it's year of no recovery—unlike styrene's very strong rebound in 1976 from the severe decline it suffered in the 1975 recession.

Key Chemicals

$2NH_3 + CO_2 \rightleftharpoons NH_2CONH_4$

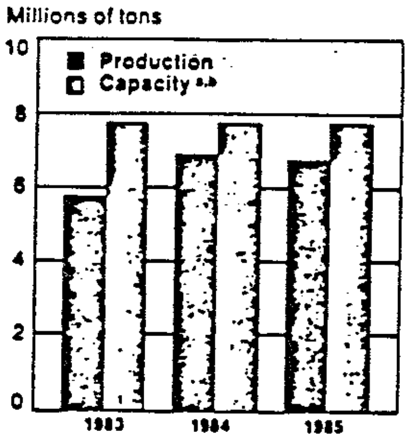


Urea

$NH_2CONH_4 \rightleftharpoons NH_2CONH_2 + H_2O$

- *Demand may rise*
- *Capacity on hold*
- *Prices under pressure*

PRODUCTION/CAPACITY



a First quarter. b Some capacity shut down.

MAJOR PRODUCERS

CF Industries, Columbia Nitrogen, Farmland, Union Oil, Williams Cos. (Agrico)

HOW MADE

Reaction of ammonia and carbon dioxide under pressure

MAJOR DERIVATIVES (U.S.)

Urea-formaldehyde resins 5%

MAJOR END USES (U.S.)

Fertilizers 80%, animal feeds 10%, adhesives and plastics 5%

FOREIGN TRADE

Exports—may rise slightly to above 1.25 million tons in 1985, imports—rising rapidly to around 2.5 million tons in 1985

PRICES

List prices about $150 per ton on Gulf Coast

The outlook for production of urea in 1985 holds uncertainties similar to those for ammonia. These uncertainties could be extended as well to other high-nitrogen-content fertilizers that often compete with urea and ammonia.

At this time, however, urea production, inventories, and selling conditions are running about normal for this time of the year. Changes could come in all of these factors, caused by changes in demand, as a better idea of the success for fertilizer sales develops this spring along with the outlook for housing, which is the major nonagricultural end use for urea.

Based on early forecasts, urea producers will not have nearly so good a year in 1985 as they did last year. In 1984, production of urea reached an estimated 6.9 million tons, up some 19% from 1983. In 1985, production probably will be down slightly, less than 5%, to the 6.5 million to 6.7 million ton range.

Forecasts for 1985 urea production attempt to take into account U.S. consumption of urea and the net difference between imports and exports. The domestic consumption of urea will depend on many of the usual conditions, starting with weather, actual applied costs relative to similar costs of other fertilizer nitrogen sources, and planted acreage.

Weather, while not so absolute a factor as cost, can heavily influence urea use. If the spring weather provides generally dry and relatively easy-to-work fields, anhydrous ammonia will be used more heavily than urea. Urea-ammonium nitrate solutions rank in between.

The costs of applied fertilizer nitrogen to farmers and planters rank first, as might be expected, in most decisions of which material to use. Shifts in prices of ammonia and urea at plant sites bring even larger swings in prices that farmers pay. Therefore, substitution could become important, especially as farms get larger and purchases of fertilizer and the cost of its application account for large amounts of money to the individual farmer.

Prices of nitrogen fertilizers are strongly affected by the trade situation. Imports of urea have risen rapidly and may exceed 2.5 million tons in 1985. As is the case with ammonia, imports of urea from countries with large, low-cost supplies of natural gas offer many benefits to the exporting countries. Generally, hard currency is obtained, and the gas is exported in a profitable form in contrast to little or no use as yet in the producing country. Plant operating problems have limited some countries' urea exports to the U.S. in the past, but now perhaps experience has reduced these problems.

Exports of urea from the U.S., especially to the Far East, continue at higher levels than were anticipated some years ago. However, they are well down from the peak of nearly 2 million tons set in 1980, with rough estimates for 1985 at about 1.25 million tons.

This net trade imbalance of about 1.25 million tons of urea in 1985 will keep plant operating rates lower than desirable for good profitability at about 85% of nameplate capacity. Some of the small plants either will continue their current shutdowns or will be shut down after the main fertilizer season is over. This will indeed be true for those that depend on an adjacent ammonia plant for a supply of carbon dioxide.

The feed and industrial markets for urea take about 15% of U.S. consumption. Feed use always faces strong price competition from other sources of nitrogen such as molasses, so probably will not grow much if at all. Industrial uses are dominated by urea-formaldehyde resins used as adhesives for particle board for interior construction, especially for housing—a use that may remain unchanged or decline slightly in 1985.

Urea, then, will have a slightly down year with production declining after a good recovery in 1984.

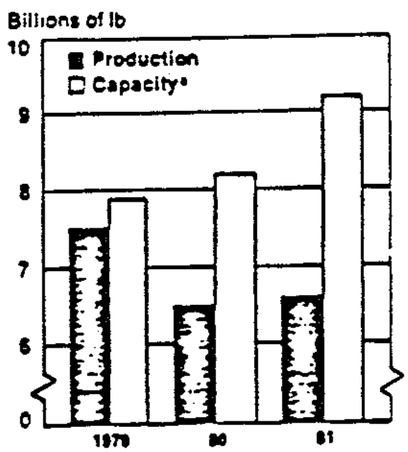
Key Chemicals

Vinyl chloride

$CH_2{=}CHCl$

- *Demand slow*
- *Capacity expanding*
- *Prices flat*

PRODUCTION/CAPACITY



* As of first quarter.

HOW MADE

Dehydrochlorination of ethylene dichloride made from ethylene and chlorine

MAJOR DERIVATIVES

Vinyl polymers nearly 100%

MAJOR END USES

Fabricated vinyl plastic items nearly 100%

FOREIGN TRADE

Exports—dropping fast to about 750 million lb in 1981. Imports—negligible

PRICES

List price 22 cents a lb, lowered by discounting

COMMERCIAL VALUE

$1.4 billion for production, 1981

If 1981 looks bad for styrene, it's even worse for vinyl chloride, the main building block for vinyl plastics. Behind this assessment are even lower U.S. plant operating rates than styrene's. As a result, vinyl chloride selling prices will remain lower than needed to justify new investment.

Vinyl chloride production in 1981 will do well to barely exceed 1980 production of 6.5 billion lb. Recent reports show housing starts and building permits dropping again to roughly 1980 recession levels. This means that the outlook for polyvinyl chloride (PVC), heavily dependent on construction markets, is now poorer than had been expected early in 1981, even though PVC output this spring showed some life. As a result, some industry forecasts of 1981 vinyl chloride production are being lowered below 1980's output level by a small amount.

Compounding this grim outlook is an increase in annual nameplate capacity of some 1.5 billion lb for vinyl chloride within the past year. As 1981 opened, Georgia-Pacific started up 1 billion lb of capacity. Then three months ago, PPG Industries added 500 million lb. These additions bring the total in-place vinyl chloride capacity to more than 9.7 billion lb a year, up 18% over capacity a year ago.

No more new capacity is due in 1981. But capacity additions by several producers are scheduled for completion between 1982 and 1984. Whether these expansions are completed on time, or ever, remains to be seen.

If one takes an optimistic view of 1981 production, say 6.6 billion lb, and adjusts operable capacity for the entire year to 9.2 billion lb to account for possible startup problems and partial-year operation, the average operating rate will be 72%. In 1980, based on estimated reported production of 6.5 billion lb and a nameplate capacity of 8.2 billion lb, the operating rate was almost 80%. In a healthier time, the 1979 rate was more than 91%, pushed to the limit by strong demand for all kinds of chemicals.

Prospects for vinyl chloride production in 1982 seem better. It's expected that business will improve late in 1981 and extend the improvement into 1982.

Based on current opinion that some deferred demand will surface next year, vinyl chloride's plant operating rate could move up a few percentage points. A bit more than 500 million lb of capacity is scheduled to come on stream in 1982, but this should have little influence on the total operating capacity for the year.

Future oversupply appears possible for vinyl chloride through the mid-1980's, springing from several factors. One was the high operating rates in the late 1970's. Such rates seemed to justify additional investment, especially with weak pricing in raw material chlorine, which has become the poor relative of coproduct caustic soda. To chlorine producers, captive vinyl chloride appears to be another place to put chlorine to help rescue operating rates for chlorine-caustic plants.

Another factor in the vinyl chlor building binge was anticipation of hi exports. But decontrol of U.S. crude oil prices, which raised energy and feedstock costs, made vinyl chloride less competitive in world markets, even to foreign buyers who saw it as a lower-cost way to avoid direct investment in chlorine. Because of such changing costs, exports of vinyl chloride are expected to continue a downward trend. In effect, this will force more product into a saturated U.S. market.

Most U.S. markets for vinyl chloride as PVC are quite mature. With a couple of exceptions, growth rates for PVC markets are all small even under good economic circumstances. At present, with housing and auto sales in a slump, the outlook for PVC demand is worse than normal.

When PVC demand growth resumes, the best numerical, if not percentage, increases are expected in the favored product form of pipe, fittings, and conduit. This product category accounts for 40 to 45% of total PVC consumption in the U.S. Its share should hold, if not grow slightly, with time as costs continue to favor PVC over competing pipe.

Overall, with slumps in vinyl chloride and PVC exports, vinyl chloride duction will do well to match a pressed 1980. Added plant capacity will keep down profitability, and the question of the wisdom of continued capacity expansion grows more important.