# ECONOMIC IMPACT OF PETROLEUM REFINING AND PETROCHEMICAL PRODUCTION AND THE DEVELOPMENT IMPLICATION OF A DEEPWATER PORT FACILITY

by

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The existence of a deepwater port facility off the Mississippi/Alabama Coast should result by 1980 in new refining and petrochemical facilities in the area of four 200,000 barrels per day refining units and two 1 billion pound ethylene units (a 1 billion pound ethylene unit is equivalent to a 200,000 barrel per day refining unit in capital investment and labor requirements).

This represents a capital investment in 1976 dollars of $2.4 billion and direct employment of 3,600. Estimates on indirect employment varies from 3.5 to 5.5 for each direct employee. This represents $41 million annual direct payrolls using 1973 wage scales--not including indirect employment earnings.

If Mississippi obtains location decisions on two 200,000 barrels per day refining units and one 1 billion pounds per year ethylene unit, this would result in Mississippi increases in personal income of $37.4 million, an increase in retail sales of $27.5 million and increase in sales tax revenues of $1.8 million annually in 1980 (based on an R & D Center econometric model). This does not include increases in indirect employment that would be associated with these installations, nor does it include possible satellite developments such as fertilizer, monomers for fibers, plastics and elastomers.

Advanced processing technology, variables in the chemical structure of various crude oils, environmental protection requirements, and economic incentives for further downstream processing have had material influence on the design of present-day refineries and petroleum plants, and will most likely continue to do so in the future.

With the explosive increase in automobile population following World War II, the heating oil and industrial fuels oriented refineries of the pre-war era gave way to light oils refining in order to increase their percentage of yields of motor gasolines. As the horsepower and compression ratio of automobile engines increased, the industry was forced to develop fuels to meet the performance requirements.

The technology and processing capability developed as a result of this impetus carried the industry beyond just meeting the needs for high performance motor fuels and into the area of petrochemicals. Aromatics of the benzene family were produced by molecular reforming; and though high in anti-knock quality, were more valuable as basic building blocks for the rapidly expanding petrochemical and plastics industry.

Olefins, such as ethylene, propylene and longer carbon chain hydrocarbons, are also produced in conventional refining facilities; and as their value increased for utilization in the petrochemical industry, they were isolated from various fuel products and diverted to that industry.

By 1960 the refining capacity of the United States, following 15 years of unprecedented expansion and new construction, exceeded demand by approximately 20 per cent with the result that product prices were severely depressed in fiercely competitive markets. The poor economic yields only gave further incentive to the diversion of more of their product yields to the ever-expanding petrochemicals industry.

Historical chemical producers were integrating backwards into what has become known as chemical refineries, while the petroleum industry was integrating even further forward into an even wider product spectrum of petrochemicals. It is reported that the chemical giants of today derive up to 65 per cent of their organic raw materials from crude oil, or its fractions, while up to 25 per cent of petroleum refineries yields are ultimately utilized as petrochemicals.

This trend has not only had a material impact on refinery design, but has made more than a little contribution to the current energy crisis.

On November 7, 1973--and repeated many times since--President Nixon presented his "Project Independence." The goal of the project is to make the United States energy self-sufficient by 1980. Though a creditable goal, it is the question in the minds of many whether in six short years this ambitious program can be realized.

With oil and natural gas bearing a 73 per cent share of our total energy consumption, they will be called upon to make the most dramatic expansion of capabilities in order to achieve the President's objective. Though coal and nuclear energy will ultimately expand by a greater percentage than oil, the lead time required for the development of any substantial quantities of energy from these sources puts them substantially beyond the 1980 target date.

Crude oil and natural gas liquids production is being called upon to increase by some 40 per cent, while natural gas production should climb 15 per cent.

In order to convert this newly produced crude oil to usable petroleum products, the refining capacity of the United States will need to expand by at least 25 per cent, or five million barrels per day. By today's standards, an optimum size refinery will process 200 thousand barrels per day; and on this basis 25 grass roots refineries need to be placed in operation within this six years. (Figure 1 illustrates such a typical petroleum refinery.)

Concurrently, the petrochemical industry, realizing a growth rate of almost ten per cent per year, needs to expand its capability by an amount equal to two new grass roots one billion pound per year ethylene plants per year. (Such a typical facility is illustrated in Figure 2.)

In keeping with the industry trend established over the past decade, it is anticipated that these new plants will incorporate the most technologically advanced processing units to afford themselves the greatest flexibility in processing capability. Such design will permit variable operations to take maximum advantage of the type of raw materials more readily available while producing end products which offer the optimum economic return. These modern-day refineries are referred to as chemical-fuels refineries, as illustrated in Figure 3.

Further downstream processing to convert petrochemical building blocks to usable commercial products will be a natural incedence to this rapid buildup of refining capability. Illustrated in Figure 4 is a ten-year growth projection of the manufacturing facilities that would be spawned and supported by a 250 thousand barrel per day chemical refinery. The realization of this industrial growth would result in an estimated 21,870 new industrial jobs within the State.

The average number of employees required in refineries and petrochemical plants varies with the complexity and number of process units incorporated in the total complex. The Standard Oil refinery at Pascagoula, Mississippi, is representative of a rather typical fuels refinery with an average daily throughput of 215 thousand barrels. This plant requires 681 employees with an annual payroll of $7,930,300. The manning table broken down by classification and average earnings for each is illustrated in Table 1.

The Newfoundland Refining Company, a recently built chemicals-fuel refinery, manning chart is illustrated in Table 2. Processing only 100 thousand barrels per day, 417 employees are required. For purposes of this study, average earnings per employee for each classification were equated to the Standard Oil rates, resulting in an annual payroll of $4,624,740.

With these illustrations and in consideration of other references, we would assume an average 200 thousand barrel per day refinery would require 600 employees at an annual cost of $11,000 per employee.

A one billion pound per year petrochemical facility relates in size, capital investment, manpower requirement, and annual payroll to a 200 thousand barrel per day refinery.

Gulf Canada recently made a survey which revealed that each refinery job creates 3.5 jobs in closely allied service and manufacturing sectors. In their opinion this same factor applies to the United States. Still further, this does not take into account the employment in other service areas in housing, food, entertainment, education, roads, civil needs and other downstream activities.

The main socio-economic effects of a deepwater oil unloading facility can be derived from two indicators: Employment and Population. Other social and economic implications of such a facility can be estimated from the changes in employment and population which these facilities cause.

These expected changes are the result of two distinct but related activities:

1. The construction of the facility itself.

2. The construction and operation of refineries and other industrial plants which would be dependent upon the unloading facility for assurance of adequate supplies of crude oil.

The main criterion for locating refineries has traditionally been the ready availability of crude oil supplies; thus Texas and Louisiana, with large reserves of domestic crude, have proven a popular refinery location up to now. However, in the period from 1975 to 2000, it is estimated that refining capacity on the Gulf Coast will probably need to be expanded threefold. It is estimated that this increase will require an additional 10,000,000 barrels per day of refining capacity.

Studies by the R & D Center forecast the economic impact (utilizing the econometric model developed) of a single 200,000 barrels per day refinery in Mississippi. The assumptions made are:

Construction would cost $300 million dollars; $100 million spent in each of the years 1974, 1975 and 1976. (Industry projections are that inflation will result in an increase in construction costs to $2000 daily barrel of capacity which will increase this total cost to $400 million.) This construction would bring about an increase in manufacturing output, durables, of $10 million each year. The refinery would begin operation midyear 1976 with a value added of $73 million a year. This would increase manufacturing output nondurables by $36.5 million in 1976 and $73 million each year from 1977 through 1980. During the years of operation an additional increase of $5 million each year would occur in both the durable and nondurable sectors of manufacturing output. These assumptions are outlined in Table 3.

A most comprehensive and coordinated development plan for land use--industrial, commercial and residential--is an absolute necessity if we are to successfully ingest this magnitude of growth. The planning, development and wise use of our water resources is an essential part of the overall plan.

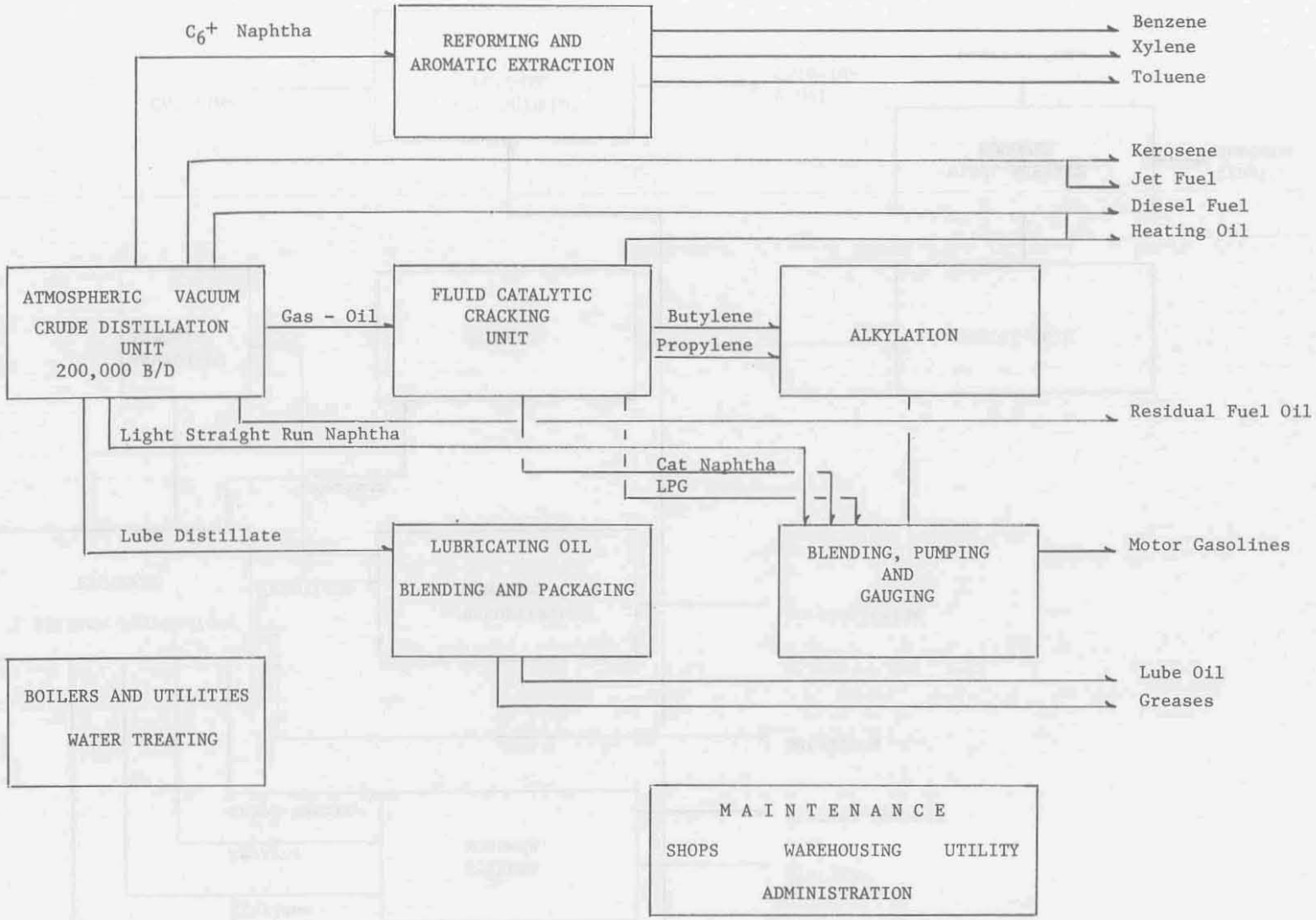


Fig. 1 -- TYPICAL PETROLEUM REFINERY

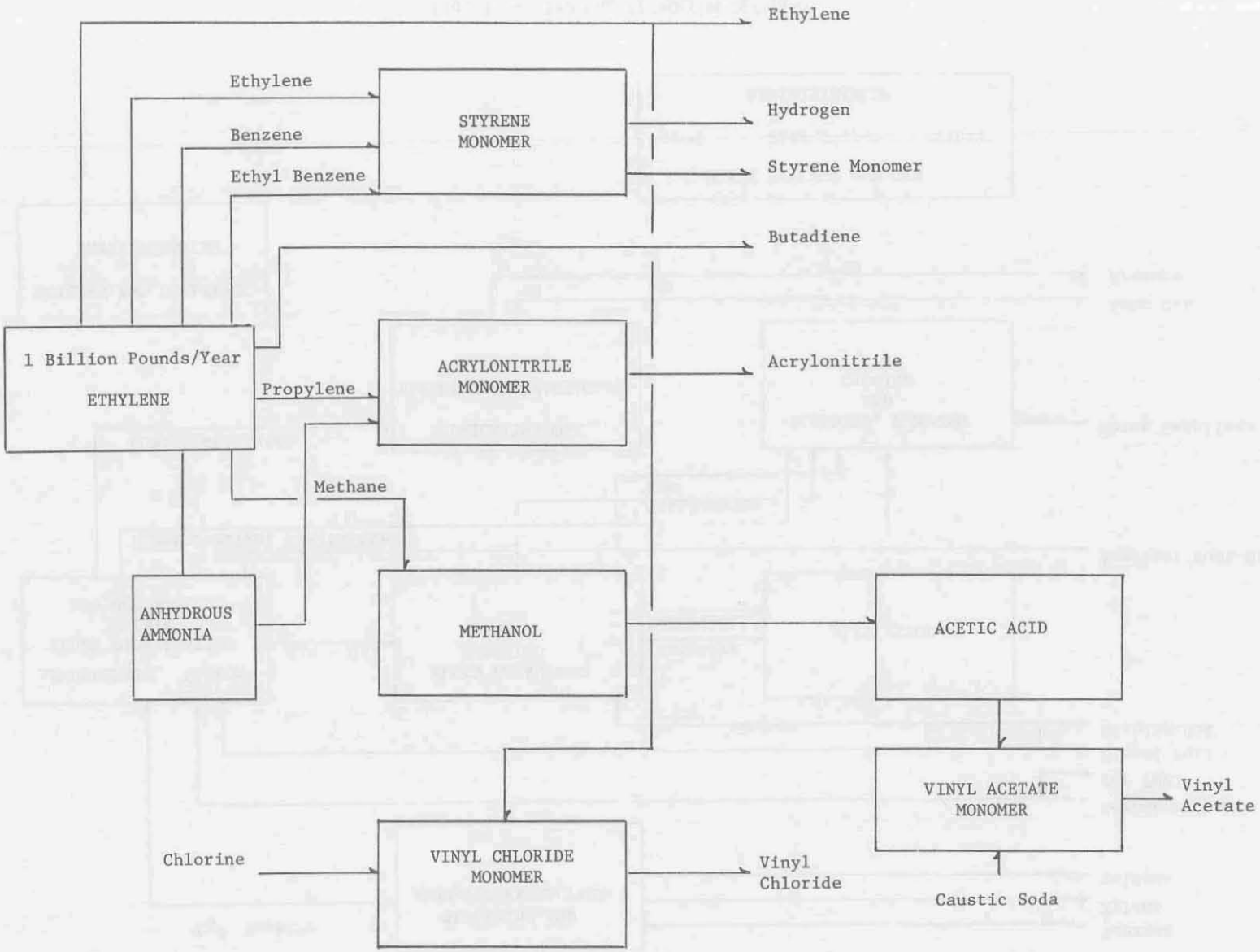


Fig. 2 -- TYPICAL PETROCHEMICAL FACILITY

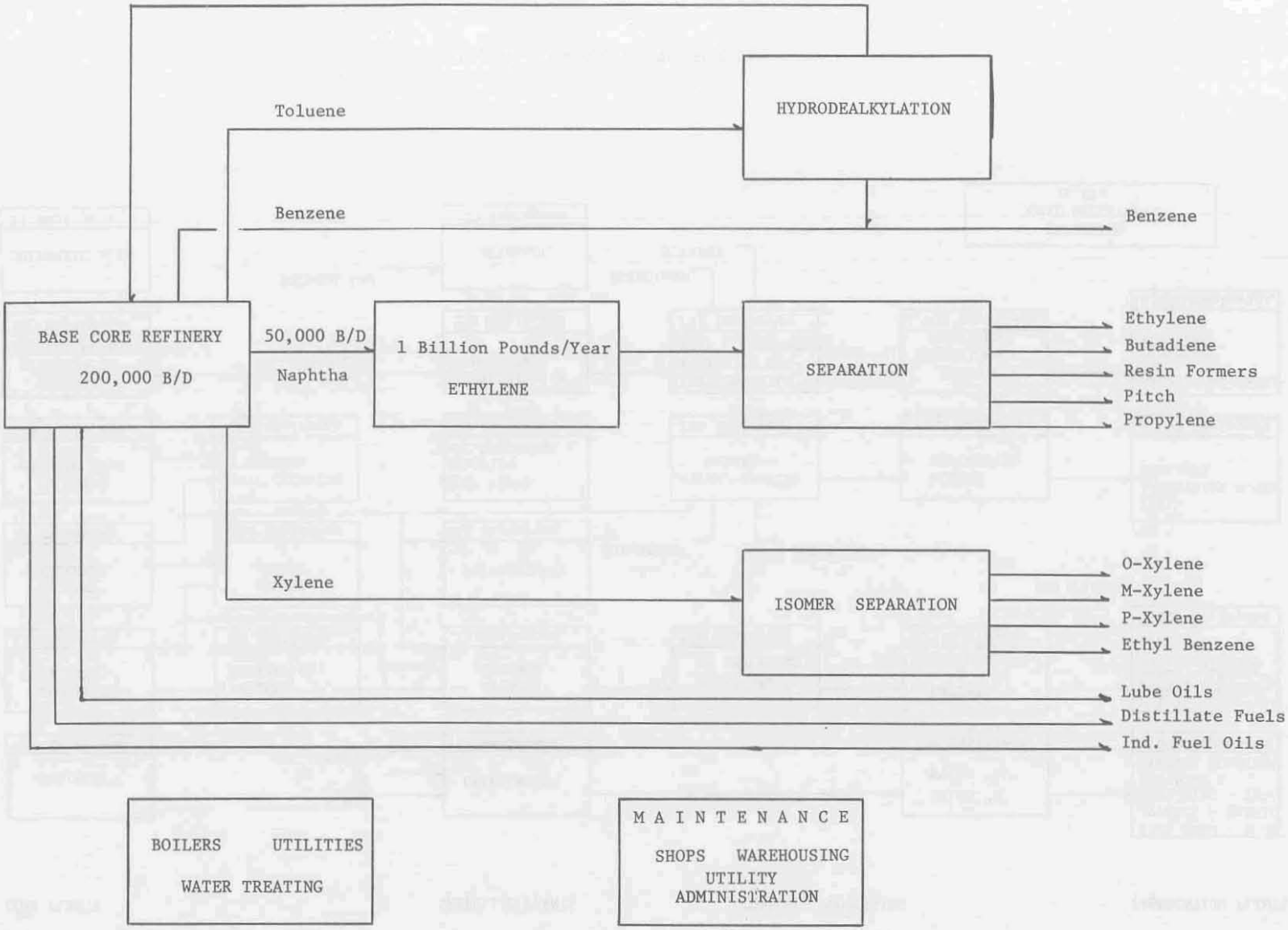


Fig. 3 -- TYPICAL CHEMICALS-FUELS REFINERY

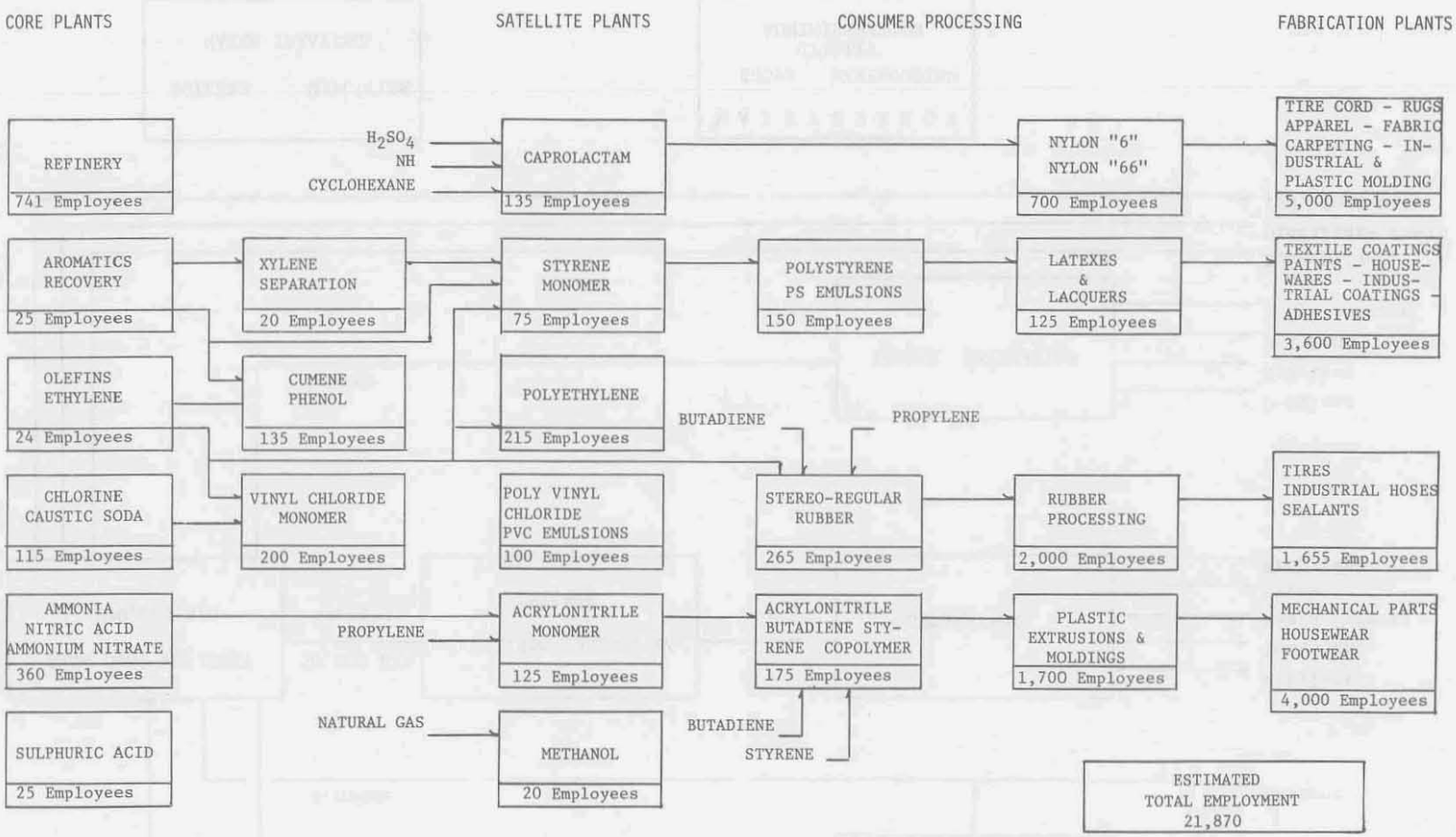


Fig. 4 -- TEN YEAR GROWTH PROJECTION

Table 1

Manning Table

STANDARD OF KENTUCKY *

Pascagoula, Mississippi

| NUMBER | CLASSIFICATION | AVERAGE UNIT ($) | ANNUAL ($) | TOTAL ($) |
|---|---|---|---|---|
| 35 | Utility | 2.50 hour | 5,200 | 182,000 |
| 30 | Clerical | 650 month | 7,800 | 234,000 |
| 36 | Administrative | 825 month | 9,900 | 356,400 |
| 25 | Technicians | 975 month | 11,700 | 292,500 |
| 250 | Operators | 5.50 hour | 11,440 | 2,860,000 |
| 160 | Mechanical | 5.50 hour | 11,440 | 1,830,400 |
| 145 | Salaried or Unclassified | | 15,000 | 2,175,000 |
| 681 | Employees | | TOTAL ANNUAL PAYROLL | $7,930,300 |
| | | | Average Annual Income | $ 11,645 |

* 215,000 barrels per day

Table 2

Manning Table

NEWFOUNDLAND REFINING COMPANY *

Come By Chance, Newfoundland

| NUMBER | CLASSIFICATION | AVERAGE UNIT ($) | ANNUAL ($) | TOTAL ($) |
|---|---|---|---|---|
| 25 | Utility | 2.50 hour | 5,200 | 130,000 |
| 8 | Clerical | 650 month | 7,800 | 62,400 |
| 10 | Administrative | 825 month | 9,900 | 99,000 |
| 19 | Technicians | 975 month | 11,700 | 222,300 |
| 158 | Operators | 5.50 hour | 11,440 | 1,807,520 |
| 183 | Mechanical | 5.50 hour | 11,440 | 2,093,520 |
| 14 | Salaried or Unclassified | | 15,000 | 210,000 |
| 417 | Employees | | TOTAL ANNUAL PAYROLL | $4,624,740 |
| | | | Average Annual Income | $ 11,090 |

* 100,000 barrels per day.

Table 3

ECONOMIC IMPACT

OF

A 200,000 B/D REFINERY IN MISSISSIPPI

| YEAR | INCREASE IN NEW CAPITAL EXPENDITURES | INCREASE IN MANUFACTURING OUTPUT DURABLE | NONDURABLE |
|---|---|---|---|
| 1974 | $100 mil | $10 mil | |
| 1975 | $100 mil | $10 mil | |
| 1976 | $100 mil | $10 mil | 1/2 ($73 mil) |
| 1977 | | $ 5 mil | $73 mil + $5 mil |
| 1978 | | $ 5 mil | $73 mil + $5 mil |
| 1979 | | $ 5 mil | $73 mil + $5 mil |
| 1980 | | $ 5 mil | $73 mil + $5 mil |

| YEAR | INCREASE IN TOTAL EMPLOYMENT | INCREASE IN PERSONAL INCOME | INCREASE IN RETAIL SALES | INCREASE IN SALES TAX REVENUES |
|---|---|---|---|---|
| 1974 | 1,100 | $16.5 mil | $ 7.2 mil | $ .2 mil |
| 1975 | 1,900 | $29.9 mil | $19.8 mil | $ .7 mil |
| 1976 | 2,200 | $39.4 mil | $28.5 mil | $1.2 mil |
| 1977 | 1,800 | $34.8 mil | $29.2 mil | $1.5 mil |
| 1978 | 1,500 | $29.6 mil | $24.0 mil | $1.4 mil |
| 1979 | 1,300 | $25.2 mil | $19.3 mil | $1.2 mil |
| 1980 | 1,000 | $20.7 mil | $15.3 mil | $1.0 mil |