E. C. No. 541

ESTIMATES COMMITTEE (1967-68)

FORTY-EIGHTH REPORT

(FOURTH LOK SABHA)

(MINISTRY OF PETROLEUM AND CHEMICALS)

Petro-Chemicals

LOK SABHA SECRETARIAT
NEW DELHI

March, 1968/Phalguna, 1889 (Saka).
Price : Rs. 1·50 Paise

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CORRIGENDA

To

Forty-eighth Report of the Estimates Committee (Fourth Lok Sabha) on the Ministry of Petroleum and Chemicals - Petro-chemicals.

Page 2, para 1.3, line 3, for 'an' read 'on'

Page 3, para 1.8, line 3, for 'and' read 'end'

Page 4, footnote, for 'S.F. Venkiteswaran' read 'S.L. Venkiteswaran'.

Page 8, para 1.15, line 26, after 'elastomers' insert 'as'.

Page 12, para 1.15, line 5 from bottom, for '1664' read '1964'.

Page 20, para 1.15(vi), ~~line 1~~, for 'at' read 'its'.

Page 43, para 2.18, lines 6/8 from bottom, for 'Nylong' read 'Nylon'.

Page 43, para 2.22, line 2, for 'are' read 'a'.

Page 49, para 2.30, line 2, for 'paptha' read 'naphtha'.

Page 57, para 2.52, line 7, for 'resign' read 'resin'.

Page 63, para 2.62, line 7, for '1955-56' read '1965-66'.

Page 68, para 3.2, line 5, for 'throughout' read 'throughput'.

Page 68, para 3.2, line 10, for 'an' read 'and'.

(P.T.O.)

Page 70, para 3.7, line 9, for 'might' read 'right'.

Page 72, para 3.10, line 11, for 'ad valerom' read 'ad valorem'.

Page 72, para 3.12, line 1, for 'or' read 'of'

Page 72, para 3.12, line 2, for 'tone' read 'ton'.

Page 80, para 4.5, line 1, for 'conductive' read 'conducive'.

Page 84, para 5.3, line 5, for 'complete' read 'compete'.

Page 85, para 5.9, line 10, for 'drawings' read 'drawings and'.

Page 86, para 5.9, line 2, for 'column' read 'columns'.

Page 89, para 5.19, line 3, after 'this' insert 'will'.

Page 90, para 5.24, line 7, after 'training' insert 'in'.

Page 91, para 5.26, line 2, for 'India' read 'Indian'.

Page 106, App. II, line 2, after 'over the' for 'leisurely way' read 'manner in which'.

Page 112, App.II, line 17, for 'Dehradun' read 'New Delhi'.

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(1967-68)

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INTRODUCTION

I, the Chairman, Estimates Committee, having been authorised by the Committee to submit the Report on their behalf, present this Forty-Eighth Report on the Ministry of Petroleum and Chemicals—Petro-chemicals.

2. The Committee took evidence of the representatives of the Ministries of Petroleum and Chemicals; Industrial Development and Company Affairs and the Planning Commission on the 9th and 10th November, 1967.

3. The Committee wish to express their thanks to the officers of these Ministries for placing before them the material and information which they wanted in connection with the examination of the subject and for giving evidence before the Committee.

4. They also wish to express their thanks to Dr. C. J. Dadachanji, Administrative Managing Director, National Organic Chemical Industries Ltd., Bombay for giving evidence and making valuable suggestions to the Committee.

5. The Committee also wish to express their thanks to all the Associations and individuals who furnished memoranda on the subject to the Committee.

6. The Report was considered and adopted by the Committee on the 28th February, 1968.

7. A statement showing analysis of recommendations contained in the Report is also appended to the Report (Appendix III).

NEW DELHI-1;
March 6, 1968.
Phalguna 16, 1889 (*Saka*).

P. VENKATASUBBAIAH,
Chairman,
Estimates Committee.

I

INTRODUCTORY

A. General

Definition

1.1. Petro-chemicals are chemicals (both organic and inorganic) which are directly or primarily derived from petroleum sources. These chemicals have their origin in petroleum and are mostly made or recovered from raw materials which include crude oil, refined petroleum fractions and refinery gases. They are also obtained from natural and associated gases and solid petroleum products like petroleum coke and petroleum wax. The basic raw materials constituting the sources for chemicals from petroleum are given in the Table below and may be classified into three categories *viz.* (i) gaseous, (ii) liquid and (iii) solid:

Petroleum Feed Stocks

FIRST ORDER DERIVATIVES

	Gaseous		Liquid		Solid	
	Natural Gas	Liquified Petroleum gases	Naphtha	Middle Distillate	Coke	Wax
(1)	Acetylene	Olefins	Synthesis gas	Aromatic extracts	Electrodes	
(2)	Synthesis gas	Butadiene Acetylene	Olefins	Detergent base	Graphite	
(3)	Carbon black	Synthesis gas Acetic acid	Aromatics		Acetylene	

1.2. The bulk of petro-chemicals are derived from the common hydrocarbons broadly grouped as under:

(i) Paraffins : (Saturated)	Methane, ethane, propane, butanes (iso & normal) etc.
(ii) Olefins : (Unsaturated)	Ethylene, Propyene, butylenes (butene 1 & 2 & Isobutylene), etc.
(iii) Aromatics :	Benzene, toluene, xylene, etc.

1.3. A peculiar point about petro-chemicals is that most of them can be made from more than one hydrocarbon raw material, depending an availability and economics of the process. For chemical conversion the common processes employed are the thermal and catalytic cracking, oxidation, hydrogenation, alkylation, chlorination, polymerization, dehydrogenation, isomerisation and other related reactions.

Organic and inorganic Chemicals

1.4. Petroleum chemicals can be divided into two types—organic and inorganic. The organic petro-chemicals are basically composed of carbon and hydrogen but often contain certain other elements notably oxygen, chlorine and nitrogen. Since petroleum is essentially a mixture of hydrocarbons most petro-chemicals are organic chemicals. A few petro-chemicals such as ammonia, urea, sulphur, carbon black and some of their derivatives are inorganic. Hence petro-chemicals are a part of the synthetic organic chemical industry.

1.5. Before the advent of natural gas and petroleum processing, the three main raw materials for the manufacture of synthetic organic chemicals were:

(i) Ethyl alcohol from fermentation industries (agricultural products like molasses etc.);

(ii) Acetylene from calcium carbide; and

(iii) Byproducts of coal carbonisation and coal-tar distillation such as naphthalene, benzene, toluene and xylenes (commonly known as aromatic hydrocarbons).

These raw materials are gradually being replaced by the more versatile petroleum feedstocks.

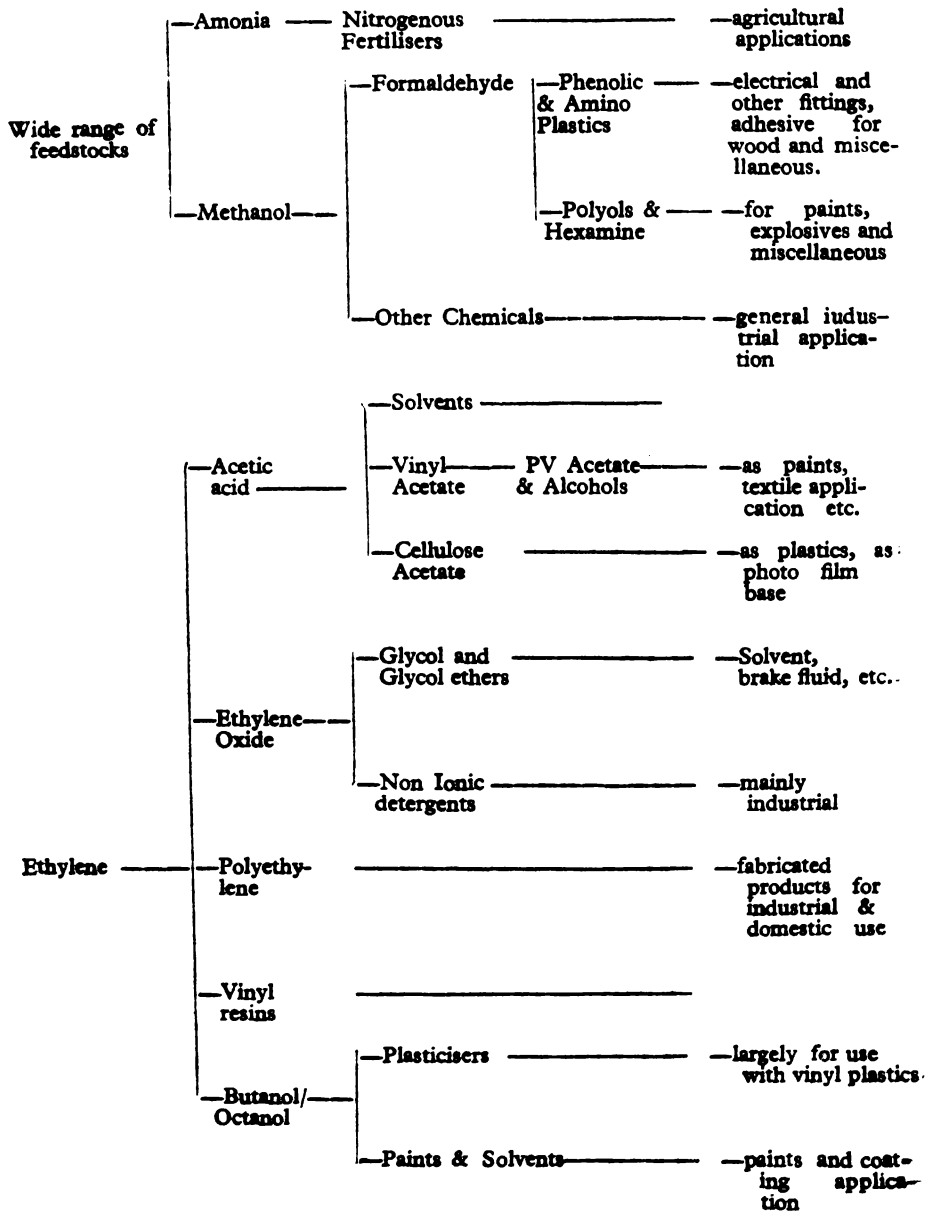
1.6. The Primary 'building blocks' of petro-chemicals are the basic organic compounds such as methane, acetylene, ethane, ethylene, propane, propylene, butane, butylene, butadiene, and benzene and other aromatic compounds.

Intermediates and Finished Products.

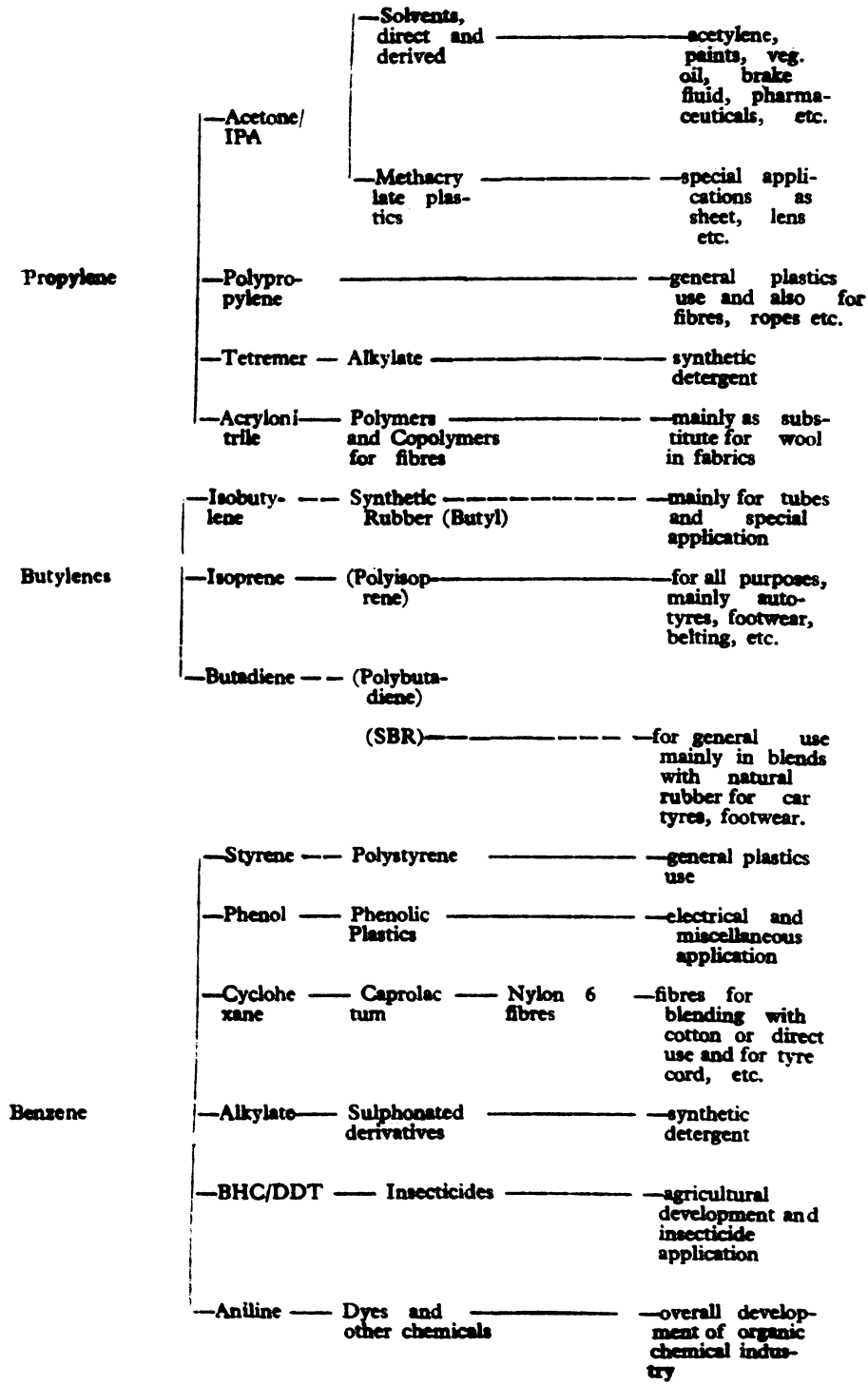
1.7. The primary and secondary intermediate and finished products which are made from basic hydrocarbons are estimated to number several thousands: Literally, thousands (some sources place it between 20,000 and 30,000) of chemicals can be manufactured from a combination of the primary compounds with other chemicals.

1.8. The following chart illustrates the relationship between the basic raw materials or feedstocks, the various intermediates and the more important and products together with the principal lines of application of these end products:

Chart of Petro-chemicals and their applications



*SOURCE : Paper presented at the Petro-chemical Seminar(1966) by Shri S.E. Venkiteswaran


Propylene
Butylenes
Benzene
Acetone/ IPA
Solvents, direct and derived
acetylene, paints, veg. oil, brake fluid, pharmaceuticals, etc.
Methacrylate plastics
special applications as sheet, lens etc.
Polypropylene
general plastics use and also for fibres, ropes etc.
Tetremer
Alkylate
synthetic detergent
Acrylonitrile
Polymers and Copolymers for fibres
mainly as substitute for wool in fabrics
Isobutylene
Synthetic Rubber (Butyl)
mainly for tubes and special application
Isoprene
(Polyisoprene)
for all purposes, mainly auto-tyres, footwear, belting, etc.
Butadiene
(Polybutadiene)
(SBR)
for general use mainly in blends with natural rubber for car tyres, footwear.
Styrene
Polystyrene
general plastics use
Phenol
Phenolic Plastics
electrical and miscellaneous application
Cyclohexane
Caprolactum
Nylon 6 fibres
fibres for blending with cotton or direct use and for tyre cord, etc.
Alkylate
Sulphonated derivatives
synthetic detergent
BHC/DDT
Insecticides
agricultural development and insecticide application
Aniline
Dyes and other chemicals
overall development of organic chemical industry

Oxylene—Naphthalene	Ph. anhydride	Paints	—paints, lacquers, varnish and enamels, for general use with PVC
		Plasticisers	
P Xylene	Dimethyl — Terephthalate	Polyester fibres	fibre for blend with cotton, for wool or direct use.

The chart is in no way exhaustive, for complete coverage of endless number of end-products is rather impractical.

1.9. It will be seen that a wide range of industries, such as the plastics, synthetic rubber, dye stuff intermediates, nitrogenous fertilisers, synthetic detergents, synthetic fibres, automotive chemicals, printing inks etc. have been benefited from the recent developments in the field of petro-chemicals.

B. Importance of Petro-chemicals in economic development

1.10. Petro-chemical industry has great significance for the economic development of a country. The cost of chemicals derived from petroleum is cheaper. The very large number of synthetic chemicals, derived on a commercial scale from petroleum, helps to overcome the shortages of natural raw materials like cotton, wool, rubber, steel, non-ferrous metals and oils and fats. The growing variety of synthetic fibres, fabrics and plastics materials, which petro-chemicals are producing as end-products, are meeting the growing sophistication in demand. The variety of products made from petroleum include not only necessities of life like fabrics but also those which are essential for increasing productivity of land like fertilisers and those such as proteins which are vital for human existence. Petroleum products also include construction and engineering materials.

1.11. Petro-chemicals also make significant contribution to food industry. The current developments in the production of protein feed—supplements from petroleum feedstocks have significance towards a probable solution of present and future food shortage in the World. Many of the insecticides developed in recent years are also used to protect the health of the World's population. Petro-chemical industry is important not only for import substitution but also for spurring new lines of industrial activity. Petro-chemicals not only

contribute to the present day industrial growth, economic development and better life but are also playing an active role in shaping the World of tomorrow.

1.12. The important role of petro-chemical industry in our national economy can easily be judged from the wide range of chemicals that can be produced as petro-chemicals and the vast field of their application. For instance, thermoplastics like polyvinyl chloride, polyethylene, polypropylene, polystyrene can partly replace the conventional materials for building, like steel and scarce metals. The manufacture of pipes, cables and refrigerators etc. is becoming progressively dependent on plastics. Synthetic fibres which are also derived from petro-chemicals have a special significance to our country mainly because we are short of natural fibres. For example, we are importing Rs. 90 crores worth of cotton every year. Synthetic detergents mark yet another field of petro-chemicals, the development of which will be in the country's interest mainly because we are short of edible oils and fats required for the production of conventional soap.

1.13. Petro-chemical industries will also provide considerable employment potential not only through the major petro-chemical complexes but also through the consumer industries in the small and medium scale sector which are generally labour-intensive. This is very important in India where the provision of employment is a major factor in developing the economy of the country. According to a recent survey (1965) conducted by the Sub-Group of the Institute Francais Du Petrole (I.F.P.) and the Indian Institute of Petroleum (I.I.P.), the man-power requirements in plastic conversion and rubber processing industries alone (1970-71) are estimated as under:

	Plastics	Rubber
Engineers	1,472	214
Foremen	5,492	502
Operators	20,864	21,200
Helpers	24,136	9,247
	51,964	31,163

C. Development of Petro-chemical industry in various countries

1.14. The petro-chemical industry is comparatively of recent origin. Petroleum raw materials began to be used for the manufacture

of chemicals about 40 years ago in the U.S.A. when gases from the refineries were available at a very low price. In Western Europe the industry started after the Second World War. During the past several years the synthetic organic chemical industry in advanced countries is growing at a much faster rate than industry in general. Within the group of synthetic organic chemicals, the rate of expansion of the petro-chemical industry in particular has surpassed that of the chemical industry as a whole. Significant technological and other developments which are having far reaching consequences in the field of the petro-chemical industry, have taken place in recent years and further developments are in progress. As a consequence of these rapid changes, new products are being put on the market which are supplementing as well as substituting conventional older products.

1.15. The developments in petro-chemical industry in some of the important countries are given below:

(i) *U.S.A.*: The petro-chemical industry came into being in the U.S.A. nearly 40 years ago when the ESSO Standard of the U.S. succeeded in producing isopropyl alcohol from cracked gas. Considerable amount of cracked gases rich in propylene content was available through the development of the thermal cracking technology, keeping pace with the increasing demand for gasoline. The demand for acetone also sharply increased as a paint solvent for the aircraft industry during World War I. To cater to this demand, the American industry successfully developed the method of making acetone from isopropyl alcohol which in turn is produced from propylene. This resulted in the quick development of the American petro-chemical industry. It made great headway during and particularly since World War II so much so that today the largest output of petro-chemicals is from the U.S.A.

In 1967, the U.S. production of basic petro-chemicals topped the 18 million ton mark; ethylene was the most important of these, the production of which was more than 6 million

tons or a third of all the basic petro-chemicals building blocks. Next were benzene (3.7 million tons) followed by propylene (2.4 million tons). During the period 1964—67 production of some of the basic petro-chemicals in U.S.A. increased as follows:

In '000 tons.

Basic Chemicals	1964	1965	1966	1967
Acetylene	508	522	536	600
Ethylene	3922	4345	4994	6250
Propylene	1620	1698	1907	2400
Benzene	2429	2751	2951	3700
Xylene	1149	1130	1271	1650
Butylene	876	953	931	908

The progress in the production of some of the major thermo-plastics in U.S.A. between 1961 and 1967 was as follows:

In '000 tons

Type	1961	1962	1963	1964	1965	1966	1967
PVC	490	475	790	745	825	1213	1250
Polytehylene	803	758	1036	1185	1385	1617	2045
Polypropylene	40	N.A.	51	123	168	231	290
Polystyrene	461	579·3	667·2	785·4	924	1089	1300

This high rate of growth can be attributed to the rapid expansion in the production of plastics which had increased by about 13 per cent a year, after 1961. In the future, increased use of plastics in the construction industry is expected to add substantially to the markets for plastics, synthetic fibres and elastomers also account for a substantial consumption of basic and intermediate petro-chemicals, but it is felt that the growth of the petro-chemical industry would primarily be determined by the growth of the plastics industry.

In the U.S.A., the plant sizes continue to become bigger. Thus today (1967-68) large ethylene plants are about 3 times as big as the top scale in 1961-62 being in the range 300,000 to 600,000 tons/year compared with the 100,000 to 200,000 tons/year previously. Similarly for ethylene derivatives—for ethylene oxide and polyethylene, the

size in top brackets are of the order of 250,000—350,000 and 50,000—100,000 tons a year respectively. The largest single—train ethylene plant on stream has a capacity of 350,000 tons a year; a 350,000 tons/year ethylene oxide and a 100,000 tons/year polyethylene plant are stated to be under construction.

The U.S. petro-chemical industry is primarily based on natural gas and refinery by-products, chiefly off-gases. Thus ethylene comes from plants near refineries, isolating ethylene from the off-gases or cracking refinery products and from ethane and/or propane or mixtures from natural gas. Refinery off-gases are stated to account for about 10% of the current ethylene production and the other 90% from cracking of ethane, propane or mixtures from natural gas facilities. Similarly for propylene the main source is the refinery off-gases *i.e.* gases produced from the thermal cracking, thermal reforming and catalytic cracking of crude petroleum.

However, there has been a recent trend to set up ethylene facilities based on imported naphtha. This appears to be from a fear of a future shortage of conventional raw material viewed in the context of the unabating pace of growth registered by the petro-cremical industry. It has been estimated that an ethylene plant using imported naphtha at 5 cents a gallon would have a 2.2 cents/lb advantage over a plant using ethane feedstock at 3 cents a gallon. By-product propylene, butylenes and aromatics from the naphtha cracker account for the substantial economies, compared to the traditional feedstocks.

(ii) *Britain*: The British chemical industry was probably the first in Europe to turn to petroleum as a source of olefins. British Celanese, now a subsidiary of Courtaulds began to make ethylene and propylene by cracking naphtha as early as 1941. Before this date practically no chemicals were manufactured from oil in Britain. The choice of raw materials was influenced by the abundant availability of coal and non-availability of oil on the one hand and the high duty levied on the imported hydrocarbon oil on the other. The realisation of the future importance of petro-chemical industry led to the removal of the duty on imported hydrocarbon oils used in chemical synthesis on the basis of the recommendations of the Ayre Committee (1944). Since then the petro-chemical industry has made spectacular progress. In the year 1949, propylene was made on a large scale from petrleum fractions. The Distillers Co. Ltd. and British Petroleum formed British Hydrocarbon Chemicals (B.H.C.) to make petro-chemicals. In 1951 B.H.C. built a naphtha cracker at Grangemouth (Scotland). Soon ESSO Petroleum, I.C.I. and Shell

Chemical also built naphtha crackers. These developments brought about a big change in the British chemical industry which until the end of World War II had derived most of its organic chemicals from fermentation alcohol and coal. Now production of ethylene in Britain is totally naphtha-based and in turn polyethylene, ethylene oxide, ethanol, styrene and ethylene dichloride are derived from ethylene. Vinyl acetate also will be made from ethylene.

In Britain "propylene is ethylene's shadow". Each time ethylene capacity rises, so does that of propylene. This is due to the fact that all the ethylene in Britain is made by cracking light naphtha. Isopropyl alcohol is one of Britain's leading propylene outlets. The production of acrylonitrile based on propylene is stated to be rapidly increasing. The bulk of acrylonitrile production goes into the manufacture of acrylic fibre. There is also demand for acrylonitrile—butadiene styrene and acrylonitrile styrene.

Ethylene is mainly used for producing polyethylene for domestic as well as export markets. Ethylene oxide is used chiefly for conversion into ethylene glycol. The glycol in turn is used for making antifreeze and both saturated and unsaturated polyesters. But now the potential outlet for ethylene glycol is for making fibre and film. Styrene's two big outlets in Britain are polystyrene and styrene—butadiene rubber.

The percentage share of raw materials from petroleum sources has continued to rise during the last few years. Now about 70% of British Organic Chemicals are petroleum-based. This rapid expansion in the output of organic chemicals is largely due to increased production of ethylene, propylene, butadiene and benzene and their conversion to polyethylene, synthetic rubber, styrene, synthetic detergents and synthetic fibres.

The rapid increase in output of some of the major petro-chemicals namely plastics and resins, non-cellulosic synthetics fibres, synthetic

Rubber and synthetic detergents in Britain over the last few years is obvious from the following table:

(In '000 tons)

Product	1948	1957	1958	1959	1960	1961	1962	1963	1964	1965
Synthetic detergents . .		255	269	286	303	301	323	322	337	350
Synthetic rubber . .		0·8	11·5	57·2	91·9	107·2	118·8	127·3	155·6	174·5
Plastics and resins . .	..	367·8	397·9	479·6	566·1	574·7	662·9	756·2	883·4	957·3
Non-Cellulosic										
Filament . . .	0·64	20·73	21·32	26·40	37·24	39·69	51·71	64·27	75.11	81·65
Staple fibre . . .	..	11·34	8·98	13·47	23·72	26·63	31·21	41·10	51·30	66·36
TOTAL . .	0·64	32·07	30·30	39·87	60·96	66·32	82·92	105·37	126·41	148·01

The production of some of the major thermoplastics progressed in Britain between 1959 to 1967 as follows:

(In '000 tons)

Type	1959	1960	1961	1962	1963	1964	1965	1966	1967
PVC	87·2	100	110	120	150	175	190	204	342
Polyolefins	100	124	127	171·8	139·5	233	252	285	430 (approx.)
Polystyrene	38·9	42	52	68·8	77·0	82·0	92	104	122

(iii) *West Germany*: A relatively high percentage of the German chemical industry has been based on coal; coal resources are large. Sophisticated chemical processes based on coke-oven products were developed. In 1961 about 50% of organic chemical production was still based on coal, but this percentage is rapidly declining. The petro-chemical industry in West Germany is said to have commenced during the year 1950.

There has been a tendency for the larger firms to adopt processes that could utilise any number of feedstocks such as whole crude, natural gas, coke-oven gas, or naphtha in order to take advantage of the feedstock market as it exists at any given time. The trend at the moment however is clearly in the direction of naphtha feedstocks and this trend is expected to accelerate.

West Germany has also developed a process for cracking crude oil directly into acetylene and ethylene and the German programme is for having plants that are built to utilise a wide variety of hydrocarbon feedstock depending upon the availability and price. There has been a trend for large chemical plants to build their own refinery to produce streams which have pearo-chemicals utilisation. i.e., for example, by maximum naphtha output etc.

The emphasis is on the production of ethylene and less on propylene. Most of the ethylene is either 'captive or tied up in supply contracts'. The bulk of West German ethylene is derived from light naphtha. The German acetylene production upto 1664 was still based to a large extent on calcium carbide but the trend has been towards hydrocarbon sources of acetylene. Acetylene production is not expected to rise rapidly due to its higher cost in relation to ethylene. During 1960 German acetaldehyde production was based

almost exclusively on acetylene, however, there is a definite trend to ethylene based processes, primarily direct oxidation. German processes and plants for cracking of hydrocarbons heavier than methane result in joint production of acetylene and ethylene. Ethylene is also produced from refinery off-gases. During 1964 ethylene capacity was expected to be over 800,000 tons/year. The production of ethylene from petroleum sources by 1968 is estimated at 1077000 tons and of propylene 500,000 tons.

Although many factors as enumerated earlier had caused the development of petro-chemical industry in West Germany, the chief reason was the need for olefins (which could not be obtained in sufficient quantities at reasonable prices from coal-tar products) required for the manufacture of plastics and synthetic fibres. Since 1958 the petro-chemical industry in West Germany has grown rapidly. In 1959 out of a total production of 1348000 tonnes of primary organic chemicals nearly 60% was derived from coal. The petro-chemical industry in West Germany is expected to continue to expand and West Germany is likely to maintain her position as the second biggest petro-chemical producer in Europe.

In the table below is indicated the production of synthetic rubber, plastics and resins and non-cellulosic fibres in West Germany over the last few years:

(In '000 tons)

Product	1948	1957	1958	1959	1960	1961	1962	1963	1964	1965
Synthetic rubber . .	3·4	11·8	23·1	48·9	81·1	87·0	89·6	108·2	138·2	164·2
Plastics and resins . .	..	550·7	622·2	796·2	982·2	1072·8	1248·6	1434·0	1754·0	1972·0
Non-Cellulosics										
Filament . . .	..	11·63	15·66	21·05	27·95	36.06	46·59	58·22	78·40	91·64
Staple fibre . . .	0·23	7·39	8·72	17·35	24·32	29·01	46·47	49·61	61·52	87·70
TOTAL . .	0·23	19·02	24·38	38·40	52·27	63·07	93·06	107·83	139·92	179·34

The production of some of the major thermoplastics progressed in West Germany over the last few years as follows:

In '000 tons

Product	1960	1961	1962	1963	1964	1965	1966	1968 (Estimated)
PVC	170	200	240	270	350	370		440
Polyolefins	75	110	160	180	240	300	..	415
Polystyrene			55	N.A.	120	140	..	..

The production of some of the basic and other petro-chemicals during 1963 and their estimated production during 1968 indicating the progress in their manufacture during the last 4-5 years in West Germany is obvious from the following table:

	1963	1968
Ethylene	457	1077
Propylene	220	500
Ethylene Oxide	113	153
Acetadehyde	121	250
Styrene	160	278
Synthetic ethanol	40	50
S.B.R.	90	150
Synthetic Phenol	109	140

(iv) *France*: The petro-chemical industry in France is barely 15 years old, it came into being in early 1950's and since then it has grown rapidly. The Lacq natural gas field was discovered in 1949 and reserves are estimated as high as 10 million cubic feet. French natural gas is sour and separation of sulphur (4850 short tons/day) from the gas, has helped France to become the World's second largest sulphur producer (behind the United States and slightly ahead of Mexico). It has been estimated that in 1962 the French petro-chemical industry consumed 600,000 tons of hydrocarbon raw materials from petroleum and natural gas.

The capacity of ethylene during 1961-62 was about 150,000 tons and 84% of this was based on cracking naphtha, the remainder being obtained from coke-oven gas. Ethylene capacity expanded to 235,000 tons in 1963. Out of this total output 78% was from cracking naphtha—12% from natural gas and 10 per cent from coke-oven gases. Although, only a small amount of ethylene dichloride is produced in France now, it is anticipated that in future it would be an important outlet for ethylene. French P.V.C. producers, who presently use the acetylene route would begin switching part of their production to the combined acetylene—ethylene dichloride process. France is stated to be roughly three years behind West Germany in polyethylene production and consumption. French production in 1963 was 65,000 tons and is the second largest tonnage plastics (P.V.C. is at the top) having displaced polystyrene in 1962. France exports a small quantity of polyethylene, but still remains a net importer of polyethyleie with a productive capacity of about 75,000 metric tonnes and apparent consumption of 89,000 tonnes annually.

Styrene has not had a particularly dazzling performance in France, but it is expected to assume importance in the next five years. Production was 40,000 metric tonnes in 1963 (equivalent to 12,800 metric tonnes of ethylene). Imported styrene has been flooding the market for the past several years in large quantities. In 1963 52 per cent of the styrene imports came from the U.S. and 12 per cent from West Germany. Styrene is mainly consumed for the manufacture of polystyrene, styrene—butadiene rubber and latex.

Acetaldehyde is relatively new to France as a consumer of ethylene. Production of acetaldehyde in 1963 was 24,000 metric tonnes. Ethylene based acetaldehyde production by 1968 is estimated at 57,000 metric tonnes equivalent to 40,000 metric tonnes of ethylene. P.V.C. has shown an enormous increase.

France has in the past several years produced more propylene than ethylene on account of the use of 'low-severity crackers'. Production of acrylonitrile is still in its infancy and is based on propylene. Cumene is one of the largest propylene consumers and is used for the production of synthetic phenol and acetone. Most of the synthetic phenol produced is utilised for the manufacture of Nylon-66 salt. The synthetic fibres production has also risen rapidly in France. The percentage of pure synthetics to all other fibres is estimated to have risen from 6.1 per cent in 1959 to 18 per cent in 1965 and per capita consumption from about 1.6 lbs in 1959 to about 5.0 lbs in 1965.

Larger capacity plants for the production of petro-chemicals such as acetylene, ammonia, methane, ethylene, butadiene, aromatics, sulphur and carbon black etc. have already been set up in France.

The French petro-chemical industry is currently based upon refining gases, naphtha cracking and natural gas. The production of chemicals from coal is expected to decline with the exception of calcium carbide. Future olefin and synthesis gas production would be based primarily upon naphtha feedstocks.

Fully realising the importance of petro-chemicals in the future the petro-chemical industry in France is undergoing a vast modernisation in line with the official 1966-67 plan. Its aims are to keep pace with the increasing demand and to produce chemicals at the lowest possible cost. Expansion is envisaged in three stages: (a) replacement of existing plants by more efficient ones—partly by changing from coal—chemicals to petro-chemicals (b) construction of new plants to increase production and (c) adopting new processes and new techniques. Besides there is a growing trend to overhaul the chemical industry's structure. The State is trying to set up a single Chemical Trust much along the lines of the State 'Oil Trust'.

In the following table is given the production of synthetic rubber, plastics and resins and non-cellulosic fibres in France over the last few years

(In '000 tons)

	1948	1957	1958	1959	1960	1961	1962	1963	1964	1965
Snythetic rubber .				6·0	18	40	[63·9	98·4	129·6	148·3
Plastics and resin . .		182·0	231·6	270·0	347·0	375·0	448·0	508·0	611·0	695·0
Non-ecllulosic filament .	0·59	11·71	15·29	20·06	26·90	29·86	38·06	46·15	52·45	46·60
Staple fibre . . .	..	8·04	8·08	12·46	18·38	21·50	50·27	35·02	40·12	40·68
TOTAL . .	0·59	19·75	23·37	32·52	45·28	51·36	89·33	81·17	92·57	87·28

The production of ethylene, propylene acetone, ethylene oxide and a few other petro-chemicals during 1963 and their estimated production (1968) indicating the progress achieved in their manufacture in France over the last few years is obvious from the following table:

Production	1963	1968 (estimated)
Ethylene	178·9 (1964)	484
Propylene	163	300
Acetone	63	100
Ethylene oxide	47	60
Ethylene glycols	30	45
Styrene	40	165
S.B.R.	47	95
Acetaldehyde	24	57
Synthetic Phenol	83	120

(v) *Italy*: The petro-chemical industry in Italy had a rather late start. The building of a steam cracking unit by Montecantini's at Ferrara in 1950 for the production of olefins for conversion to plastics, plasticisers and solvents marks the beginning of petro-chemicals industry in Italy. Since then this industry has made very rapid progress in the production of petro-chemicals on a large scale.

The Italian petro-chemical industry is based upon both natural gas and petroleum and has made a notable contribution to the increase in Italy's foreign trade. It has been estimated that during 1962 petroleum consumption for petro-chemicals use amounted to 1300,000 tons and natural gas for petro-chemicals use amounted to 400,000 tons.

All the ethylene in Italy is obtained from naphtha stream cracker and naphtha is available in plenty. The big levers from ethylene growth are polyethylene, ethylene dichloride and styrene; ethylene-based acetaldehyde is not yet a factor, though it may become one in the future. Polyethylene production has increased sharply due to the fact that there has been a great demand in South Italy for this product and also to cater to the export markets in Africa.

The main use of ethylene dichloride has been for the manufacture of P.V.C. Rigid P.V.C. is used for the production of pipes, valves etc. Italy is stated to be ahead of other European countries in the use of rigid P.V.C., except for Holland. Styrene is one of the major user of ethylene, in Italy. Imports of both styrene and ethylbenzene have been high. So production alone does not give full measure of a styrene potential as a consumer of ethylene. But if Italian producers are successful in replacing import with their own domestic production, then, there would be swift growth of styrene. The main outlets of styrene are polystyrene and styrene butadiene rubber. Propylene is produced as a by-product of ethylene. The major derivatives from propylene are (a) isopropyl alcohol (b) propylene oxide (c) nonene (d) Dodecene (e) cumene (f) polypropylene. Isopropyl alcohol is used for the production of acetone, solvents, drugs and pharmaceuticals etc. Acrylonitrile production may consume large quantities of propylene in future.

The aromatics situation in Italy is somewhat different to other European countries. Italy does not have a large coal industry and aromatics consumption has been far ahead of domestic production. Recently installed aromatics units and those currently under construction are expected to give Italy selfsufficiency in such chemicals.

(vi) *Japan*: During 1955 Japan commenced reorganising at chemical industry mainly based on petroleum sources and since then Japan's petro-chemical industry has grown from strength to strength supported by an active domestic demand and a determined export drive.

In 1955 when the shift to petro-chemicals was initiated only 3 per cent of the $ 83.4 million capital investment in chemical industries was attributable to petro-chemicals, whereas in 1965-66 fiscal year 30 per cent of the $ 84 billion was accounted for by petro-chemicals. Today the bulk of the acetone, butanol, acetaldehyde and acetic acid are made from petroleum sources as compared with 1962.

Percent Production from Petroleum sources

	1962	1966
Acetone	70	99
Butanol	41	97
Acetaldehyde	13	72
Acetic acid	3	63

Ethylene capacity based on naphtha cracking which stood at 110,700 tonnes in 1957 had reached 947,700 tonnes/year in 1962 and 120,3800 tonnes in December, 1966. Further additions to the capacity have been approved to the extent of 698,000 tonnes and are expected to be on stream in 1969. In this expansion Japan is following the trends in the U.S. towards larger capacities. During 1967 additional capacities are being created to the extent of 150,000 tons for high pressure polythylene to bring the total capacity to 420,000 tons/year.

Japan's petro-chemical industry is based on naphtha cracking to produce ethylene along with the efficient use of all the co-products derived therefrom. The naphtha is obtained from petroleum refineries based on imported crude (amounting for 99 per cent of the total). Therefore the technical features of Japanese petro-chemical industry are similar to those obtained in Europe than that in the United States.

Another important feature of petro-chemical industry in Japan is that after the start it has sustained much of its subsequent development through the import of foreign technology. Thus out of the first stage development programme of the petro-chemical industry in Japan i.e. during the period 1955—1960 involving a total outlay of $ 228 million, $ 35 million or 16 per cent was on fees, royalty and technical know-how.

(vii) *Rumania*: Rumania has been producing crude oil since the middle of the nineteenth century and there are 18 refineries in the country. Rumania also has significant resources of non-associated as well as associated natural gas. Rumanian natural gas has a very high methane content of 98-99 per cent and no sulphur. Casing head gas is also produced at the rate of about 10,000 cubic ft. per ton of crude oil produced. The casing head gas contains a large portion of higher paraffins. Due to the availability of large hydrocarbon resources, Rumania has built a petro-chemical industry at a more rapid rate than other countries. Petro-chemical production actually began in 1949 although lamp black was produced from natural gas as far as 1936 and calcium cyanamide from natural gas in 1917.

The petro-chemical industry in Rumania is based on natural gas, casing head gas and refinery products. The country has an ambitious nitrogenous fertiliser programme. All the new ammonia plants are based on synthesis gas from natural gas. Petro-chemicals expansion is likely to continue at a rapid rate with more emphasis on the large quantities of natural gas and casing head gas available rather than refinery streams. The production of polyvinyl chloride rose from 1160 tons in 1959 to 6400 tons in 1963. Synthetic detergents (20 per cent as active substance) production increased from

2090 tons in 1959 to 25000 tons in 1966. The production of synthetic rubber during 1965 and 1966 was 30800 tons and 35400 tons respectively. Benzene production increased from 44480 tons in 1963 to 62460 tons in 1966. Similarly xylenes production increased from 23550 tons in 1963 to 50590 tons in 1966.

(viii) *Soviet Union:* The Soviet Union is the World's second largest crude oil producer and it also has substantial natural gas resources. It has a large coal based organic chemical industry, but it is rapidly building an organic chemical and plastics industry—based on natural gas, natural gas condensates, and refinery streams. It is expected that aromatics production would continue to be served primarily by coal sources, although petro-chemical aromatics will gradually become more important. There would be large chemical industry based on acetylene from natural gas, with the hydrogen rich tail gases to be utilised for ammonia synthesis. Olefin production is to be primarily based on refinery streams, possibly off-gases, however, surplus naphtha should be available at refineries for cracking to olefins. Some ethane (as well as L.P.Gs.) would be extracted from natural gas and cracked to ethylene. It was estimated that only 10—15 per cent of Russian production was based on petroleum and natural gas during 1963-64 but it is expected that this percentage would rise rapidly in future.

Soviet goals for 1970 and 1980 for some of the major petroleum based synthetic materials are:

Million tons.

	1970	1980
Synthetic fibres	1·4	3·2
Plastics and resins	3·5 to 4·0	30

By 1970 no natural rubber would be used for the production of automobile tyres.

Soviet Union has extremely large resources of petroleum and natural gas allowing excellent feedstocks flexibility. The Soviet Union would probably some day become the World's second largest petro-chemical producer. Due to the large consumption of plastics in the building industry, it is expected that plastics consumption would eventualy exceed that of the U.S.A. The production of non-

cellulosic fibres and filaments and plastics and resins progressed in U.S.S.R. during the last few years as follows:

(In '000 tons)

Product	1958	1959	1960	1961	1962	1963	1964	1965
Non-cellulosic Filament	9·10	9·80	10·80	15·30	22·60	27·70	39·20	54·20
Staple fibre	3·60	4·20	4·20	8·30	11·30	14·90	17·70	23·30
TOTAL	12·70	14·00	15·00	23·60	33·90	42·60	56·90	77·50
Plastics and resins	258	293	332	404	473	567·2	698·8	801·5

D. Development of Petro-chemicals in India

1.16. In 1960 the Government of India appointed a Committee under the chairmanship of Dr. G. P. Kane (vide the Ministry of Commerce and Industry O.M. No. CH(1)-2(81)/60 dated the 10th October, 1960) for the preparation of a plan for the development of petro-chemical industries during the Third and Fourth Five Year Plans. The background to the appointment of the Committee has been stated in the O.M. as under:

> "During the last few years in many advanced countries of the world, products such as synthetic rubber, plastics, insecticides, detergents and organic solvants have been made increasingly as petro-chemicals. In view of the rapidly rising demands for such products in the country and the likely availability of suitable petroleum fractions for their production in the next few years, Government recognise the need to encourage the development of petro-chemical industries. It has, therefore, been decided to set up a committee to study the subject in all its aspects so as to evolve a plan for organising such industries during the Third and the Fourth Five Year Plans."

1.17. The Kane Committee submitted its report to Government in December, 1961. This report recommended the manufacture of various chemicals based on petroleum sources and indicated targets of production by 1965-66 and 1970-71.

1.18. Subsequently in June, 1962, the Oil and Natural Gas Commission entrusted the I.F.P. with the preparation of development plan for the petro-chemical industry in the country. The Study Team from the Institute Francais Du Petrole which was headed by Dr. V. E. Henny presented the Study Report in February, 1963. As to the reasons for appointing this Study Team, it has been stated that the Kane Committee Report did not carry out any detailed technical or financial assessment of the petro-chemical production in India. Further in view of the capital intensive nature of this industry with a high foreign exchange component and substantial economies of scale, it was decided that these aspects should be studied in detail. The I.F.P. was, therefore, entrusted with the task of preparing a detailed report indicating time phasings, locations and order of investments for the development of the petro-chemical industry in India.

1.19. In October, 1963, the erstwhile Ministry of Industry and Supply set up a Planning Sub-Group for petro-chemicals to dovetail the planning for petro-chemicals with that for other chemical industries during the Fourth Plan period. This Group submitted its Report in April, 1964 recommending specific schemes for inclusion in the Fourth Five Year Plan. These recommendations were in slight modification of those contained in I.F.P. Report. These recommendations could not be accepted by the Planning Commission on account of the large investment suggested *viz.*, about Rs. 500 crores during the Fourth Plan, thereby necessitating a review of this report.

1.20. In November, 1964 the Ministry of Petroleum and Chemicals (Department of Chemicals) set up a Working Group for planning the manufacture of petro-chemicals during the Fourth Plan period in order to review and suggest minimum targets of production to be achieved by 1970-71. This Group submitted its Report in January, 1965 which forms the basis of the Fouth Plan programme for petro-chemicals.

1.21. The composition and terms of reference of the four Governmental Committees/Groups are given in Appendix I.

1.22. Asked as to why the development of petro-chemicals was not considered during the years when the three private sector refineries *viz.* Burmah Shell, ESSO and Caltex were set up, that is, in 1954—57, it was stated during evidence that there was no specific plan or thinking in the Ministry regarding the development of petro-chemicals. Apart from gearing up these refineries to meet increasing demand of petroleum products, the question of utilising any of the oil products

for developing petro-chemical industries was not specifically considered. It was further explained that from 1959 onwards certain companies did start thinking of possibilities of entering into petro-chemicals manufacture in due course. In Bombay the Union Carbide (I) Ltd. were already erecting a very small polyethylene plant. They thought that in due course demand would come up to justify the erection of petro-chemicals plant for ethylene for the production of polyethylene. Similarly Calico's wanted to erect P.V.C. plant at Bombay next to the refinery. There was a certain amount of thinking but it was not specifically detailed thinking.

1.23. The Secretary of the Ministry however stated that during 1954—57 when the three refineries came into operation progressively it was the first occasion when petro-chemicals could have been thought of in the country.

1.24. The Committee consider that the development of petro-chemical industries in the country should have been planned at the time of setting up of three refineries in the private sector in 1954—57. They regret that there was absence of integrated planning on the part of the Government which only thought of setting up the refineries to meet the demand for petroleum products but did not simultaneously consider the development of the petro-chemical industry in which vast developments were taking place in the developed countries and which were increasingly being used to supplement or substitute conventional raw materials. The Committee note that during the Second and Third Plan periods large quantities of organic chemicals which could be produced from petro-chemicals were imported* from abroad. Moreover, naphtha which is the base for the production of petro-chemicals was surplus in the country from 1956 itself and exports of naphtha of the order of about 200,000 tons per annum were made from 1957 to 1962 and over 300,000 tonnes from 1962 onwards. Had the development of petro-chemicals been thought of along with the setting up of these refineries surplus naphtha could have been put to good use for the production of petro-chemicals which would have saved considerable foreign exchange which is now being spent on their imports.**

E. Role of the Public Sector

1.25. The role of the public sector in the field of petro-chemical industry has been defined in the Report of the Working Group, in the following words:

"Petro-chemical manufacture is highly capital intensive, involving repidly changing sophisticated know-how which has necessarily

*Please see para 3.18—19.
**Please see para 3.1—2.

to be backed up by continuing research and pilot plant studies, scientific application technology, and dynamic marketing.

The present consumption of a wide variety of petro-chemical products is small, partly through limited availability, but is increasing rapidly and the potential demand is enormous. It will, however, take some time to increase production and simultaneously teach fabricators how to convert petro-chemicals into marketable products conforming to standard specifications. Plants are highly susceptible to economies of scale and it is clear that for some years to come the size of the market for a wide range of chemicals will justify only one unit which will occupy a dominant position and feed a number of competing fabrication units.

The manufacturing schemes recommended call for major investment in the erection of basic units—olefins plants—around which there will have to be a complex of other plants to convert the 'building blocks' produced into resins, detergents, fibre intermediate etc. Significant economies can be achieved by integrating off-site services (utilities, electricity, distribution, maintenance etc.) and exchange of feedstocks between the many component units in a complex; further substantial economies can be achieved by integrating a refinery, ammonia plant and petro-chemical manufacturing schemes in the new sites to be developed.

The preceding paragraph serves to provide the economic and technical context in which the role of the public sector needs to be judged.

The following basic principles are suggested:

(a) The sites suggested for development of major petro-chemical activities are such that substantial economies can be achieved through the integration of refinery, ammonia plant and petro-chemical manufacture. Such integration requires the presence of a coordinating agency to initiate development, plan ahead, assure fair pricing and also to 'pick-up' certain components units which, if they do not move ahead simultaneously, could hold up the entire complex of plants. The public sector could play this role and in certain circumstances may have to do it.

(b) Aromatic and olefins plants are closely linked with refinery operation. In the sites where the refineries are owned

by the public sector, it may be advantageous for such petro-chemical plants to be also similarly owned. This would ensure:

(i) that the higher returns anticipated from petro-chemical plants compensate for the low price obtained from the supply of feedstocks from the refinery;

(ii) non-discriminatory pricing of raw materials produced from such petro-chemical plants and used by a large number of other public and private sector industries.

(c) In regard to downstream units:

(i) the public sector should have significant participation in units whose production caters to the need of a large number of competing manufacturing units to ensure fair pricing;

(ii) profitability in basic units (B.T.X. and olefins plants) is vulnerable to the operation of downstream units. Participation (in varying degrees) in downstream units can reduce this vulnerability, and ensure a fair share in the higher profitability generally expected in such downstream units.

The precise pattern and extent of participation of the public sector judged appropriate at any particular moment of time would be influenced by—

the overall merits of the processing schemes and availability of process know-how, and availability of foreign exchange."

1.26. In a written note, the Ministry have further stated "that generally speaking, public sector will implement the basic projects which supply raw materials to a number of other units in a big complex, *e.g.*, naphtha crackers, aromatics extraction plants, the fibre intermediate plants etc. Ultimately, the overall merits of the processing scheme, availability of the process know-how and the availability of foreign exchange will decide whether the scheme will be implemented in the public sector or in the private sector. Sometimes to ensure profitability for basic units public sector may have to participate in downstream units also. The private sector will generally implement schemes manufacturing the end use products like the synthetic detergents, plastics articles, synthetic fibres and in some cases intermediates also."

1.27. Asked to indicate whether any specific schemes and/or products had been earmarked for each of the sectors, the Ministry have stated that no long-range reservation of any schemes or products has been attempted. However, the following Fourth Plan schemes are likely to be implemented in the public sector:

(i) Gujarat Aromatics Project,

(ii) Gujarat Naphtha Cracker, and

(iii) Barauni Aromatics Extraction Project.

All other Fourth Plan schemes are likely to be implemented in the private sector. The more important of them are listed below:

(i) Plastics *viz.*, P.V.C. polystyrene, polyethylene etc.,

(ii) Synthetic fibres *viz.*, polyester, nylon, acrylic and P.V.A.,

(iii) Plastics fabrication,

(iv) Synthetic detergents and detergent alkylates,

(v) Synthetic rubber, and

(vi) Agricultural chemicals.

1.28. During evidence, the Secretary of the Ministry stated that 'the need for the public sector to take the initiative in undertaking some of these developments was realised in 1962-63, *i.e.*, when we commissioned the French Petroleum Institute (I.F.P.) to undertake studies to make concrete proposals for the sort of the lead which the public sector should give. This resulted in certain initiative in respect of Gujarat and it was realised that this will have to be done in the shape of large complexes involving pooling of services covering a large variety of plants and this could come up under public sector umbrella. This did take place in or around 1962.

1.29. The Committee note that in view of the highly capital intensive nature of the petro-chemical industry, basic petro-chemical projects which would supply raw material to other units, like naphtha cracker, aromatics extraction plant etc., are mostly being set up in the public sector and that downstream units which would manufacture end products, would generally be set up in the private sector. Since the petro-chemical industries have a profound impact on the industrial economy of the country and since these industries offer vast

scope for substitution of conventional raw materials such as cotton, wool, rubber, steel, cement, non-ferrous metals, vegetable oils and fats, it is imperative that Government should take effective measures for the rapid development of these industries. The Committee would like to emphasise that public sector should take initiative in accelerating the pace of development in this regard wherever considered necessary.

II. DEVELOPMENT PROGRAMMES AND PROGRESS

A. Programmes of production suggested by Government Committees/ Groups

(i) *Kane Committee targets*

2.1. The tentative targets of production for some of the more important petro-chemical products for the Third and Fourth Five Year Plans recommended by the Kane Committee in 1961 on a priority basis are given below:

(Value in Rs. lakhs)

Name of the Material	Unit	Estimated Demand			
		1965-66		1970-71	
		Quantity	Value	Quantity	Value
1	2	3	4	5	6
Organic Chemicals					
1. Methyl alcohol .	Tons	25,000	100	60,000 70,000	280
2. Ethyl Alcohol	,,	200,000	600	290,000	870
3. Acetone .	,,	9,500	95	18,000	180
4. Acetic Acid	,,	29,000	348	57,000	684
5. Phenol . .	,,	18,000	400	43,000	945
6. Dodecyl benzene	,,	8,000	160	24,000	480
7. Ethylene Oxide . . .	,,	5,000	150	10,000	300
8. Carbon tetra-chloride and chloro-methane . . .	,,	8,000	140	10,000	250
9. Aniline	,,	4,000	120	10,000	300
10. Benzene .	,,	80,000	480	170,000	1,020
11. Naphthalene .	,,	20,000	120	40,000	240
12. Phthalic Anhydride .	,,	13,000	390	28,500	850
Pesticides					
13. D.D.T.	,,	6,000	240	9,000	360
14. B.H.C.	,,	15,000	345	24,000	625

1	2	3	4	5	6
Plastics					
15. P.V.C. ..	,,	30,000	960	75,000	2,490
16. Polyethylene					
(a) Low density .	,,	28,000	1,260	100,000	4,000
(b) High density	,,	8,000		15,000	
17. Polystyrene .	,,	20,000	600	50,000	1,500
18. Polyproylene	,,	4,000	300	20,000	10,000
Synthetic Elastomers					
19. S.B.R. . .		30,000		30,000	5,610
20. Cis-4-Polybutadiene .	,,	30,000		80,000	
21. Poly-isoprene	,,	..	2,310	30,000	
22. Butyl Rubber .	,,	10,000		30,000	
Others					
23. Carbon Black . .	,,	35,000	350	70,000	700
24. Caprolactam (nylons) . .	,,	12,000	960	28,000	2,240

(ii) *I.F.P. Study Team targets*

2.2. The I.F.P. Study Team (Dr. Henny's Team) worked out the targets for the principal intermediate products in 1963 as under:—

	Required III Plan production (in tons)	Required addl IV Plan production (in tons
1. Ethylene	50,000	1,22,000
2. Propylene	42,000	72,000
3. Butadiene	31,000	83,000
4. Isoprene	41,000	..
5. Acetylene	..	16,000
6. Methanol	59,000	21,000
7. Benzene	32,700	47,900
8. O-Xylene	..	11,000
9. P-Xylene	..	8,000
10. Synthetic fibres	25.000	78,500
11. Synthetic rubber	50,000	1,80,000

2.3. This Study Team recommended the setting up of the following production schemes/complexes for petro-chemicals in the country:

Location	Stages of realisation	To be authorised	To be started up
Bombay	2	1963	1966
Gujarat	4	1963	1966
South India	1	1964	1967/68
Barauni	2	1964	1967/68
East India	1	1967	1970

(iii) *Targets set by Planning Groups*

2.4. The Report of the I.F.P. Study Team was reviewed by the Planning Group for petro-chemicals towards the end of 1963 in the context of altered raw material position, latest review of demand, capital and operating cost, savings through improved economies of scale etc. and this Group set the targets for each of the petro-chemical intermediates based on end-use analysis. The estimated production targets for 1970-71 in respect of some important products, suggested by the Planning Group are as under:

(tons/year)

	1970-71 capacity required
1. Plastics :	
(*i*) Polyethylene	1,20,000
(*ii*) Polypropylene	50,000
(*iii*) P.V.C. Resin	1,10,000
(*iv*) Vinyl Chloride for PVC	1,15,000
(*v*) Polystyrene	45,000
2. Synthetic fibres	1,36,000
3. Synthetic Elastomers	1,20,000

(tons/year)

	1970-71 Capacity required
4. Other organic chemicals :	
(*i*) Methanol . . .	60,000
(*ii*) Formaldehyde . . .	77,000
(*iii*) Detergent alkylate . .	20,000
(*iv*) Acrylonitrile . . .	5,000

(iv) *Targets set by Working Group*

2.5. It has been stated that after the submission of the Report by the Planning Group in April, 1964, the following further developments took place:

"(a) Sharp increase in fertiliser targets necessitating the demand of petroleum raw materials for fertilisers and thereby reducing the quantity available for other petro-chemicals,

(b) The anxiety of the existing chemical plants to switch over to cheaper petroleum and petro-chemical raw materials to reduce their production costs and thereby improve their economies,

(c) The retardation in the growth of conversion industry on account of the two conflicts with China and Pakistan and financial stringency."

2.6. In the circumstances the Working Group for planning the manufacture of petro-chemicals during the Fourth Plan, reassessed the position and recommended rephasing of the complexes in various parts of the country and a perspective programme of development for the Fourth and Fifth Plans.

2.7. The minimum/desirable production level for major petrochemicals for 1970-71 and desirable production level for 1975-76 set by the Working Group is given below:

('000 tons/year)

	1970-71		1975-76
	Min. production necessary	Desirable production level	Desirable production level
I. *Plastics* :			
1. Polyethylene	100	115	240
2. Polyvinyl chloride	100	115	240
3. Polypropylene	..	10	40
4. Polystyrene	35	45	80
II. *Synthetic Fibres* :			
5. Nylon	28	28	60
6. Polyester	30	30	60
7. Acrylonitrile	23	25	45
8. Polyvinyle alcohol	10	15	40
III. *Synthetic Rubber*:			
9. Butyl synthetic rubber	20	20	not estimated
10. Polybutadiene synthetic rubber	20	30	,,
IV. *Aromatics and other organics*:			
11. Benzene	80	100	..
12. Detergent alkaylate	10	15	not determined
13. Methanol	55	60	120
V. *Synthetic fibre intermediates*:			
14. Acrylonitrile	23	25	45
15. Vinyl Acetate	23	33	92
16. Caprolactam etc.	33	33	73
17. D.M.T. etc.	30	30	60

2.8. The Working Group on Petro-chemicals recommended the setting up of petro-chemical complexes in different regions of the country as were suitable from nearness of raw materials etc. Brief particulars of the schemes are given below:

(a) *Schemes of manufacture to be undertaken in Bombay*:

1. P.V.C. Expansion.
2. Polystrene expansion.
3. Manufacture of D.M.T.
4. Manufacture of phthalic anhydride.
5. Manufacture of miscellaneous derived chemicals.

(b) *Schemes of manufacture to be undertaken in Bombay or Gujarat depending on availability of raw materials*:

1. Manufacture of butyl rubber.
2. Manufacture of polybutadiene rubber.
3. Manufacture of dodecyl benzene.
4. Manufacture of polybutenes.
5. Manufacture of propylene oxide and other derived chemicals.

(c) *Gujarat Complex*:

In this complex manufacture of benzene, toluene, ortho and para-xylene, caprolactam, olefins, polyethylene, vinyl-chloride, polyvinyl chloride vinyl acetate, styrene, poly-styrene, acrylonitrile, propylene, tetramer, chlorinated solvents and other miscellaneous derived chemicals will be undertaken.

(d) *Schemes of manufacture to be undertaken at Barauni and East*:

1. Extraction of benzene, toluene, ortho and para-xylene.
2. Manufacture of cyclohezane and caprolactam.
3. Manufacture of D.M.T.
4. Manufacture of maleic anhydride.

(e) *Schemes of manufacture to be undertaken near Haldia*:

1. Erection of olefin plant.
2. Manufacture of propylene and acrylonitrile.

(This will be the first phase of a cracker complex which will be expanded during Fifth Plan).

(f) *Schemes of manufacture to be undertaken in South India:*

1. Erection of ethylene acetylene cracker.

2. Manufacture of V.C. and P.V.C.

3. Manufacture of D.M.T.

B. Plan Objectives and Achievements

(i) *Progress during the Third Five Year Plan*

2.9. As already stated, no specific targets for petro-chemicals were fixed in the Third Plan as these matters were under study by the Petro-chemical Committee (1960-61). Some tentative targets (85,000 tonnes) were, however, put down for plastics but these were to be considered after the receipt of Kane Committee Report. Since a perspective of the type of development required in this field was known, 20 projects are stated to have been licensed during the Third Plan period.

2.10. The production capacity licensed, capacity actually installed and the production achieved during the Third Plan in respect of important groups of petro-chemicals is given below:

Sl. No.	Name of Product	Production target laid down during Third Plan	Production capacity in existance at the begining of the Third Plan	Production capacity licensed during Third Plan period	Capacity actually installed	Production achieved during the plan period	Shortfalls, if any
1	2	3	4	5	6	7	8
		(in tons)		(in tons)	(in tons)	(in tons)	
1	Polyvinyl chloride (PVC) . .	85,000	Nil	21,600	9,000	9,000	12,600
2	Polyethylene . . .		Nil	38,000	12,000	12,000	26,000
3	Polystyrene		Nil	12,000	6,000	6,000	6,000
4	Nylon yarn and Nylon tyre cord .		Nil	8,640	1,940	1,940	..
5	Acrylic fibre . . .		Nil	8,000	..	..	8,000
6	Polyester fibre		Nil	..	2,000	2,000	..
7	P.V.A. fibre .		..	..	..	..	..

2.11. Regarding the delay in installing the licensed capacity, it has been stated that "the licenses were issued only between 1960 and 1965. Some of the units are under implementation and will start production during the Fourth Plan. In the case of M/s. Union Carbide (I) Ltd., there were delays in implementation on account of labour strike, construction workers' strike and shipment difficulties. There has been some delay in the start up of N.O.C.I.L. plant on account of a transformer having been burnt and delay in shipment on account of Suez closure"

2.12. The Committee regret to observe that against the tentative target of 85,000 tonnes of plastics to be manufactured during the Third Plan period, the capacity licensed was about 71,000 tonnes and the actual production was 27,000 tonnes only. The Committee find that the imports of plastics i.e., P.V.C., polyethylene and polystyrene during the last year of the Third Plan (1965-66) was of the order of 3,860 tonnes valuing Rs. 83:30 lakhs. They consider that had the plastic units been commissioned in time the heavy imports on account of plastics could have been largely eliminated. They hope that concerted measures would now be taken to set up these thermoplastics units without further delay.

(ii) *Objectives for Fourth Five Year Plan.*

2.13. The tentative targets proposed for some of the important groups of petro-chemicals in the Draft Outline of the Fourth Plan and the progress made in that regard is given in the following statement:

Product	1970-71 capacity target (in tons.)	Capacity already licensed	Present installed capacity	Capacity under implementation	Capacity still to be licensed and/or implemented (In tons)
1	2	3	4	5	6
I. *Plastics*					
1. Polyethylene	100,000	39,000	19,000	20,000	61,000
2. Polyvinyl chloride—PVC	100,000	50,000	15,600	76,400	Nil (as Gujarat schemes also envisage PVC to the extent of 20,000 tonnes per annum)
3. Polypropylene	10,000	..	Nil	Nil	10,000
4. Polystyrene	35,000	17,500	10,000	7,500	17,500
II. *Fibre Intermediates*					
5. Nylon Intermediates (for fibre and plastics)	33,000	..		..	33,000

1	2	3	4	5	6
6. Polyester intermediates for fibre . .	30,000	..	..	..	30,000
7. Acrylonitnile for fibre & other use . . .	23,000	..	..	..	23,000
8. Vinyl Acetate for fibre and paints . . .	23,000		..	..	23,000
III. *Synthetic rubber*					
9. Butyl Synthetic rubber . .	20,000	..		..	20,000
10. Polybutadiene synthetic rubber . .	20,000	..	..	..	20,000
IV. *Aromaties and other organics*					
11. Detergent Alkylate	10,000/15,000	..	..	..	20,000
V. *Synthetic fibres*					
12. Nylon yarn & Nylon tyre cord	28,000	13,836	2,480	11,356	13,644
13. Acrylic fibre	6,000	6,500	Nil	6,500	Nil
14. Polyester fibre	13,000	4,500	2,000	2,500	13,500
15. PVA/PVA fibre	6,000	..	..	..	6,000

2.14. With regard to the prospect of achievement of above targets, the representative of the Planning Commission stated during evidence:

> "The Fourth Plan Draft Outline was brought out only in August, 1966 and since then it has been considered as tentative, and at the moment after the reconstitution of the Planning Commission in last September (only two months back), the Planning Commission is engaged in the formulation of the annual plan for 1968-69, and it is after the completion of this work that the Planning Commission will take up the formulation of the Fourth Plan, and finalise the targets."

2.15. In a written note, the Ministry have subsequently furnished the revised tentative targets to be achieved by 1973-74 which are given below:

(in tonnes)

Name of item	Revised* tentative IVth Plan (1970-71) target	Capacity expected to be achieved			
		1970-71	1971-72	1972-73	1973-74
P.V.C. . .	70000	61000	80000	100000	115000
Polyethylene .	70000	54000	70000	110000	110/125000
Polystyrene and styrene copolymers . .	20000	20/22000	22000	45000	50000
Polypropylene .	Nil	Nil	Nil	Possibly 12000	Possibly 15000
Detergent Alkylate	15000	Possibly 15000	20000	30000	30000
Nylon intermediates	18000	18000	18000	18000	38000*
Polyester fibre .	18000	18000	20000	20000	40000**
Acrylonitrile .	Nil	Nil	Nil	16000	16000/4000

*These are tentative figures (For original targets see the next page).

**Dependent on the revised Fourth Plan which is yet to be formulated.

2.16. It will be seen that the capacity expected to be achieved by 1973-74, according to the latest assumptions, will only be slightly higher than the original targets fixed for 1970-71, as seen from the following table:

(In '000 tonnes)

Item	Original IV Plan targets (1970-71)	Revised capacity expected to be achieved by 1973-74
V.C.	100	115
Polyethylene	100	115
Polystyrene	35	50
Polypropylene	10	15
Detergent alkylate	10	30
Nylon intermediates	33	38
Polyester fibre	30	40
Acrylonitrile	23	16/24

2.17. The Committee realise that in view of the altered circumstances, it is necessary to readjust the targets to correspond to the realities of the economic situation prevailing in the country. They would, however, stress that the final targets of production of petro-chemicals during the Fourth Plan should be realistic and co-related to the demand of organic chemicals as nearly as possible, so as to make the country self-sufficient in this vital sphere.

C. Financial Investment in Petro-chemicals

(i) *Investment during the Third Plan*

2.18. It has been stated that no specific petro-chemical manufacturing schemes were included in the Third Plan and no financial allocations were made for such schemes. But as a result of the examination of recommendations made by I.F.P. Team, Government took steps to license a 225,000 tonne naphtha cracker in Bombay and a number of other related units. The total investment in the petro-chemical industry till the end of the Third Plan has been stated to

be of the order of Rs. 100 crores. This includes the investment made in the projects which would either switch over to petro-chemical feedstock or are capable of doing so and those which are still to be commissioned. The approximate break up of this investment unit-wise as also indicating the units based on conventional or petro-chemical feedstocks is given below:

Particulars of the units based on conventional feedstocks:

	Investment in crores of rupees
A. *Plastics*	
1. M/s. Shriram Vinyl and Chemical Industries (PVC Unit at Kota)	5
2. M/s. Ahmedabad Mfg. and Calico Printing Co. Ltd., Calico Chemicals & Plastics Division (PVC Unit at Bombay)	3
3. M/s. Alkali & Chemical Corporation of India (Polyethylene unit at Rishra)	6
4. M/s. Union Carbide India Ltd., (Part of their activities at Trombay Plant)	8
5. M/s. Chemicals & Plastics of India Ltd., (PVC Unit at Mettur)	2
B. *Synthetic Rubber*	
6. M/s. Synthetics & Chemicals Ltd. (SBR Plant at Bareilly)	20
TOTAL	44

Particulars of the units based on Petro-chemical feedstocks:

C. *Synthetic Fibre*	
1. M/s. Chemicals and Fibres of India Ltd. (Polyester fibre Unit at Bombay)	5
2. M/s. J. K. Synthetics, Kota (Nylong Unit)	5
3. M/s. Nirlon Synthetic Fibres and Chemicals Ltd. (Nylong Unit)	5
D. *Bombay Petro-chemical Schemes*	
1. M/s. NOCIL, PIL, Herdillia, Bombay	31
2. M/s. Union Carbide India Ltd., Bombay	10
TOTAL	56
GRAND TOTAL	100

2.19. It has been stated that the Polyethylene Plant of M/s U.C.I.L. has switched over to petro-chemical feedstocks *i.e.* ethylene from the naphtha cracker with effect from the beginning of 1967. The S.B.R. plant at Bareilly is likely to take to petro-chemical butadiene from N.O.C.I.L., Bombay to meet part of its requirements from the middle of 1968. Besides the above, the two existing P.V.C. units namely M/s Ahmedabad Manufacturing and Calico Printing Co. and M/s Shriram Vinyl and Chemicals Industries have been allowed to switch over to petro-chemical feedstocks and also to expand their capacities.

2.20. The Committee note that while an investment of the order of Rs. 56 crores was made in the petro-chemical industries in the private sector during the Third Plan period, nothing whatsoever was done in the public sector even though the need for public sector to take initiative in setting up basic industries had been realised around 1962-63. The Committee cannot but feel unhappy over the manner in which Government has handled the development of petro-chemical industry. Had Government taken timely action to implement the decision to set up petro-chemical complexes, the country would have by now, made substantial progress in the development of petro-chemical industries.

(ii) *Financial Targets during the Fourth Plan*

2.21. The total investment envisaged for the various schemes in the report of the working group was Rs. 254.14 crores (pre-devaluation), including an investment of the order of Rs. 17 crores in plastics fabrication and Rs. 79 crores in synthetic fibre industries. This could not be fully provided in the draft outline of the Fourth Plan by the Planning Commission on account of limited availability of resources. A total provision of Rs. 233 crores (Rs. 57 crores in the public sector and Rs. 176 crores in the private sector) has been made in the draft Fourth Plan as detailed below:

(Rupees crores)

Name of the Scheme	Investment in Public Sector			Investment in Private Sector		
	Rupees	Foreign Exchange	Total	Rupees	Foreign Exchange	Total
1. Gujarat Petro-Chemical Complex . .	30·00	17·00	47·00	..	..	..

(Rs. Crores)

Name of the Scheme	Investment in public sector			Investment in private sector		
	Rupee	Foreign Exchangn	Total	Rupee	Foreign Exchange	Total
2. Barauni Aromatics Extraction Plant	6·5	3·5	10·00			
3. Bombay Schemes and those at Koyali forming part of Gujarat Petro-chemical complex				64	30	94
4. Non-cellulosic synthetic fibre industry				40	21·5	61·5
5. Plastics fabrication industry . .	..	..	..	14	6·5	20·5
	36·50	20·50	57·00	118	58·00	176·0

Note: The above figures are post-devaluation.

2.22. The expenditure on the Bombay Schemes indicated in the table above represents are spill over of the Third Plan expenditure on the Bombay Petro-chemical Complex. It has been stated that "the provision made for the private sector schemes in the Draft Fourth Five Year Plan will be inadequate for meeting the spill over expenditure from the Third Plan and the expenditure on the other schemes during the Fourth Plan. However, since the Fourth Plan will now commence from a later date, fresh estimates for inclusion in the new Fourth Plan will have to be made."

2.23. The Bombay complex consists of the following major schemes in the private sector:—

(i) The 60,000 tonne Naphtha Cracker of M/s. Union Carbide India Ltd., which has already been commissioned in December, 1966 to produce Polyethylene, Acetylene, Benzene, etc.

(ii) The 225,000 tonne Naphtha Cracker of M/s. National Organic Chemicals Industries Ltd., in the Thana-Belapur area of Bombay which has been commissioned in January, 1968 to produce PVC, Acetone, Ethylene glycol, special alcohols, Butadiene, Benzene etc.

(iii) The unit of M/s. Polyolefins Industries Ltd., to produce high density polytheylene from ethylene of NOCIL and Ziegler Catalyst.

(iv) The unit of M/s. Herdillia Chemicals to produce phenol. phthalic anhydride, etc.

(v) Other schemes like the expansions of PVC by Calicos, production of VA and PVA originally approved in favour of M/s. Hoechst Dyes and Chemicals Ltd., but now being reconsidered for approval in favour of some other party. The expansion of polystyrene capacity by M/s. Polychem and other synthetic fibre units.

2.24. The total investment in the Bombay Petro-chemical Complex is expected to be of the order of about Rs. 100 crores.

2.25. It has been stated that in accordance with the recommendations of the Working Group Report and approvals granted, major units which will be implemented in the Fourth Plan (together with units in operation) will be as follows:—

Bombay: Phenol, acetone, high pressure and low pressure polyethylene, phthalic anhydride, PVC, ethylene oxide and glycols, benzene, 2-ethyl hexanol, butyl alcohol, acetic acid, diacetone alcohol, benzene, butadiene, phthalates, acetylene black, polyester, nylon, B.H.C., methanol.

Gujarat: Benzene, toluene, caprolactam, orthoxylene, DMT, mixed xylenes, polyethylene acrylonitrile, butadiene, polyester fibre, nylon fibre, acrylic fibre, PVA fibre, phthalic anhydride, phthalates, B.H.C. and possibly P.V.C., styrene and styrene polymers.

Rajasthan (Kota): P.V.C., Nylon fibre and acrylic fibre.

Mysore: Phthalic anhydride and phthalates.

Madras: Chlorinated hydrocarbons, PVC and BHC.

Andhra: Styrene and styrene polymers, polyester resins.

West Bengal: Polyethylene.

U.P.: Sythetic rubber

Bihar: Acrylic fibre.

2.26. The major schemes for petro-chemical manufacture to be implemented in the Public Sector during the Fourth Plan are (i) The Gujarat Aromatics Project (ii) The Gujarat Naphtha Cracker

and (iii) The Barauni Aromatics Extraction Plant. These have been discussed in a subsequent section.

2.27. The Committee have already emphasized the imperative need to accelerate the development of petro-chemical industries in the country in view of their importance to the National economy. They hope that in allocating funds during the Fourth Five Year Plan, Government would ensure that necessary resources are allocated to these industries on a priority basis.

D. Review of Progress in the setting up of Petro-Chemical Complexes

(i) *Bombay Complex*

2.28. The Bombay petro-chemical complex, which is in the private sector, consists of the following major schemes:

(a) M/s. Union Carbide India Limited (Polyethylene and cracker complex).

(b) M/s. National Organic Chemical Industries Ltd.

(c) M/s. Polyolefins Industries Ltd.

(d) M/s. Herdillia Chemicals Ltd.

The progress made in the setting up of these schemes is given below:

1. *M/s. Union Carbide India Limited, Bombay*

Crack 60,000 tons/year naphtha to produce:

(i) 9,000 tons polyethylene.

(ii) 3,000 tons butyl alcohol.

(iii) 1,400 tons acetic acid.

(iv) 600 tons ethyl acetate.

(v) 1,600 tons ethylhexanol.

(vi) 1,600 tons dioctyl phthalate.

The naphtha cracker was scheduled to be commissioned in early 1966 but was actually commissioned in December, 1966. Other production plants are expected to be ready by March, 1968.

2. *M/s. National Organic Chemical Industries Ltd., Bombay*

Cracking 2,25,000 tons/year naphtha to produce:

(i) 60,000 tons ethylene.

(ii) 35,000 tons propylene.

(iii) 14,000 tons benzene (and related quantities of xylene and toluene as extracted *via* the sulphalene process).

(iv) 700 tons dicyclopentendiene.

(v) 7,200 tons butadiene.

(vi) 2,700 tons methane.

(vii) 12,000 tons ethylene oxide.

(viii) (a) 10,000 tons ethylene glycol. (b) 600 tons by-product di-ethylene glycol.

(ix) 1,000 tons polyethylene glycol (400).

(x) 3,000 tons ethylene dichloride.

(xi) 30,000 tons vinyl chloride monomer.

(xii) (a) 20,000 tons polyvinyl chloride. (b) 5,000 tons processed PVC products.

(xiii) 1,500 tons iso-propanol.

(xiv) 11,000 tons acetone.

(xv) 2,800 tons diacetone alcohol.

(xvi) 3,700 tons methyl isobutyl ketone.

(xvii) 8,000 tons butanol.

(xviii) 8,000 tons 2-ethyl hexanol.

The project was expected to be completed by the end of 1967.

The naphtha cracker and a few plants of the project have now been commissioned on the 31st January, 1968.

3. *M/s. Polyolefins Industries Ltd., Bombay*

Ethylene from NOCIL's Cracker to produce:

(i) 20,000 tons high density polyethylene.

(ii) 5,600 tons processed polyethylene.

(iii) 320 tons Ziegler Catalysts.

The project was expected to be completed by August, 1967 but is now scheduled to be commissioned in early 1968.

4. M/s. Herdillia Chemicals Ltd., Bombay

(i) 10,000/15,000 tons phenol (from cumene).

(ii) 14,500/22,000 tons cumene (from benzene and propylene).

(iii) 6,000/9,000 tons acetone (co-product in the manufacture of phenol from cumene).

(iv) 2,000/5,000 tons diacetone alcohol.

(v) 6000 tons phthalic anhydride.

(vi) 3,000 tons phthalates.

(vii) Steel drums—black galvanised etc., in sufficient numbers to pack above products.

The project has been commissioned on the 18th February, 1968.

2.29. The Committee note that though according to the I.F.P. Report, the Bombay petro-chemical complex was to start up in 1966, only some of the major schemes of this complex were completed in 1967 while others will be completed by the middle of 1968. The delay is regrettable as they consider these schemes of fundamental importance in the development of petro-chemical industry which would greatly help the industrial development and the economy of the country. They have no doubt that the commissioning of the Bombay schemes will go a long way in meeting the demand of organic chemicals in the country and reducing their imports.

(ii) *Gujarat Complex*

2.30. The Gujarat Complex envisages a production of over 33 thousand tonnes/year of benzene and a paptha cracker to produce 80 thousand tonnes/year of ethylene etc. The scheme for this comcomplex was approved by Government in December, 1963. The progress in the execution of this scheme is as under:

The Gujarat Aromatics Project, the Naptha Cracker and the related downstream units were originally envisaged as an integrated complex to be implemented with technical and financial assistance from a group of foreign firms. Enquiries were sent to major manufacturers in U.S.A., Britain, Italy and Japan at the end of 1963. Two sets of preliminary proposals were received at the end of 1964; one was from a Consortium consisting of the Union Carbide Corporation, Dow Chemical Company and International Oil Company of U.S.A., and the other from Phillips Petroleum Company of U.S.A. together with Imperial Chemical Industries of Britain. Neither of the two proposals was completely in line with the information provided in the enquiry sent to them, but provided for acceptable alternative patterns of production and suitable technology. I.C.I. and Phillips withdrew their proposal towards the middle of 1965 since, in the altered financial situation in their countries, they were unable

to consider raising adequate resources. The preliminary proposal of the other Consortium was discussed in detail through the rest of 1965 and 1966, and the final proposal submitted in 1966 was not found acceptable by the Government of India. The negotiations came to a dead end on account of a number of vital issues, like management control, preferential treatment etc.

2.31. Under the circumstances mentioned above, it was decided to drop that proposal and take up the Aromatics project comprising the manufacture of:

(i) 33,000 tonnes per annum benzene.

(ii) 14,000 tonnes per annum toluene.

(iii) 21,000 tonnes per annum o-xylene.

(iv) 24,000 tonnes per annum D.M.T.

(v) 2,500 tonnes per annum mixed xylenes.

It was also decided to take up the Naphtha Cracker (Olefins Plant) for implementation entirely in the Public Sector, after purchasing the licence for process etc., on an outright basis.

The Aromatics project is estimated to cost Rs. 21 crores with a foreign exchange component of Rs. 8 crores. The Naphtha Cracker is estimated to cost Rs. 15 crores. A further investment of Rs. 100 crores will be involved in the downstream units in the private sector proposals connected with the Naphtha Cracker.

2.32. It has been stated that the benzene and toluene plants are under erection as part of the I.O.C.-Gujarat Refinery. As regards the erection of plants to manufacture xylenes and D.M.T. in the public sector, six competitive offers have been received and evaluated. Discussions have taken place about the foreign exchange financing of the most attractive of these competitive proposals and draft contracts have been prepared and discussed with the parties selected. It is anticipated that contracts will be concluded very shortly.

Proposals for the naphtha cracker have also been received. Preliminary competitive proposals for downstream units from private sector parties have been received and full financial and technical information is expected shortly. Thereafter these proposals will be fully evaluated and recommendations made to Government for approval.

2.33. It has been stated during evidence that the benzene-toluene plant under erection has Italian collaboration and the cost is being financed from the E.N.I. credit. The foreign exchange component covering the process, licensing and engineering is about Rs. 20.5 lakhs. The foreign exchange component of Italian equipment would be Rs. 60 lakhs (pre-devaluation). After devaluation, the total foreign exchange expenditure is about Rs. 125 lakhs. It has been stated by the representative of the Ministry that production in this plant is expected by the end of 1968.

2.34. The Ministry, in a note furnished later, has stated that the contract for O&P xylenes and D.M.T. plant has not yet been finalised. As regards naphtha cracker it has been stated during evidence that it is in an advanced stage of negotiations which have not been finalised.

2.35. The Committee are constrained to observe that the Gujarat petro-chemical complex which is in the public sector and which was approved by the Government of India in December, 1963 has not progressed satisfactorily. According to I.F.P. Report, the first stage of this complex was scheduled to start up from 1966. Even the Planning Group report had envisaged that the naphtha cracker would commence operation as early in 1968 as possible. It appears that the benzene and toluene plants would now be ready by the end of 1968. The other units viz. Xylenes and D.M.T. are nowhere in sight as the contracts for these units have not yet been finalised. The naptha cracker scheme is still under negotiation. On the other hand a number of units of the Bombay complex which is in the private sector and was approved about the same time in 1963, have been commissioned and the others are about to be commissioned by the middle of 1968. The delay in the setting up of the Gujarat complex has resulted in non-utilisation of naphtha from the Gujarat refinery and the import of organic chemicals which would have been produced in this complex. The Committee realise the difficulties in securing foreign colloboration for this project on acceptable terms. But they feel that time taken in discussing preliminary proposals for this complex i.e. about 3 years between 1964 and 1966 was too long. The Committee hope that concerted efforts will now be made to finalise the agreements for D.M.T. and Xylenes Units and the naptha cracker plant as early as possible so that these projects are expeditiously commissioned.

(iii) *Barauni Aromatics Project*

2.36. The Barauni aromatics project is one of the schemes, tentatively approved for implementation in the public sector in the Fourth

Five Year Plan. Regarding the progress of this Plant, it has been stated that a feasibility study has been prepared by the Petro-Chemicals Division of the Oil and Natural Gas Commission according to which the project will be implemented in two phases during the period 1970 to 1973. In the first phase, ending by 1971, the production of 41,420 tonnes|year of benezens, 19,000 tonnes|year of cyclo-hexane and 7,000 tonnes|year of xylenes with an investment of Rs. 7.4 crores (foreign exchange component of Rs. 3.3 crores) is envisaged. In the second phase ending by 1973, an additional investment of Rs. 3.45 crores (foreign exchange component of Rs. 1.52 crores) is expected to result in the following product availability:

	Tonnes
(i) Benzene	56,500
(ii) Cyclo-hexane	30,000
(iii) Ortho Xylene	15,000
(iv) Para Xylene	25,000

In addition to benzene, ortho-xylene, and D.M.T., efforts are being made to promote a caprolactam plant scheduled to start production in the early years of the Fifth Plan. The above production programme will require 2,50,000 tonnes of naphtha from the reformer of which 91,000 tonnes will be returned to the Refineries as raffinate.

2.37. Pilot plant tests to fully determine the precise hydrocarbon composition of naptha which is essential to firm up the design basis is in progress. It has been stated that the processes proposed to be purchased for the almost identical project in Gujarat will be used in Barauni and this will lead to substantial savings in cost and time for implementation.

2.38. The Committee are glad to note that the processes to be used at Barauni Complex would be the same as at the Gujarat Complex which will no doubt result in considerable economies in costs of construction and operation. They hope that the pilot plant tests and other necessary investigations would be completed soon and the work on the first phase of the aromatics plant at Barauni commenced as soon as the agreement for the Gujarat Complex is finalised.

(iv) (a) *F.C.I's Methanol Unit, Trombay*

2.39. The Third Plan provisionally fixed a target of production of 40,000 tonnes of methanol in the country. It has been stated that "the scope of the Trombay Project of the Fertilizer Corporation of India was enlarged to set up a 100 tonnes|day Methanol Plant estimated to cost over Rs. 4.5 crores to meet the country's defence and industrial requirements. A contract for the execution of the plant on a turn-key basis was awarded to Messrs Girdler Corporation of U.S.A. on 1-9-1964. The Plant has gone into production from October, 1966. The commissioning of the plant was delayed due to U.S. Port strike and equipment and catalyst failures. The estimated cost of the plant also increased from Rs. 4.5 crores to Rs. 6.02 crores." Subsequently the F.C.I. has entered into a contract with M|s. Catalyst and Chemicals Inc. for the supply of their latest catalyst, which is under trial runs.

2.40. The Ministry have, in a written note stated:

> "The 100 tonnes per day Methanol Plant at Trombay is not working to rated capacity (33,000 tonnes|year). The plant is now working at 45 tonnes per day capacity. This production rate is expected to go up to 60 tonnes per day shortly. The trouble in the plant is mainly due to the unsatisfactory performance of the reformer tubes, in addition to some other troubles."

The annual loss in production on the basis of 300 days running at 60 tonnes per day on a continuous basis, would amount to about Rs. 1.5 crores.

2.41. As to the setting up of a second Methanol Plant with 100 tonnes/day capacity (as planned earlier), the Committee have been informed that no decision has yet been taken as the installed capacity of 100/ton/day at Trombay is considered adequate for meeting the internal demand till about the end of the Fourth Five Year Plan. In a written note, it has been further stated that 'if the Trombay plant runs to rated capacity *viz.*, at 100 tonnes per day, there may not be any need to import methanol for any of the existing consumers. There are however, proposals to increase the production of formaldehyde and some other chemicals based on methanol. If and when these proposals materialise the demand for methanol will increase beyond Trombay's capacity of 100 tonne/day. There are proposals to expand Trombay's capacity, but these have not yet been finalised.'

2.42. The Committee have been informed that the imports of methanol from 1960-61 to March, 1967 were of the following order:

	Kilolitres	Value (in lakhs)
1960-61	597·8	6·0
1961-62	869·0	9·3
1962-63	3479·8	18·8
1963-64	4018·8	26·4
1964-65	9883·5	48 7
1965-66 . .	9254·6	50·0
June '66 to March '67	3196·6	34·8

2.43. The Committee consider it unfortunate that the Methanol Plant of the Fertilizer Corporation of India at Trombay is working at about half its rated capacity, resulting in an annual loss in production amounting to about Rs. 1.5 crores. Since this plant was set up on a turn-key basis, the Committee would urge that the foreign collaborators should be obliged to fulfil the contractual obligation. Suitable measures should also be taken to ensure that the plant attains its maximum rated capacity at an early date.

2.44. The Committee would further suggest that the demand for methanol should be assessed in a realistic manner, and if necessary, steps to instal additional capacity for methanol production be taken well in time to avoid its imports.

(b) *Price of Methanol*

2.45. The current prices at which methanol is sold by the Trombay Unit of the F.C.I. are stated to be as follows:

(a) For formaldehyde manufacturers—Rs. 950/- tonne.

(b) For others:

(i) 1,000 tonnes and above per year—Rs. 1,560/- tonne.

(ii) Less than 1,000 tonnes per year—Rs. 2,060/- tonne.

(iii) Sale in Drums—Rs. 2,080 tonne.

2.46. As regards the import price of methanol and the price prevailing in other countries, the Committee have been informed that the imported c.i.f. price of methanol (according to the information available with the Fertilizer Corporation) from the U.S. A.I.D. sources is $95 which works out to Rs. 712.50 per tonne ($95x Rs. 7.50), and adding import duty at 50 per cent, the landed cost works out to Rs. 1,068 per tonne.

2.47. The price (in rupee equivalent) in other countries is stated to be as follows:—

	Rs./tonne
U.S.A.	650/-
Belgium	625/-
France	650/-
Germany	550/-
Holland	560/-
Italy	740/-
Britain	630/-

2.48. The Committee regret to observe that the price of methanol charged by the Trombay Unit of the Fertilizer Corporation of India is much higher compared to the price prevailing in other countries. The Committee urge that the reasons for the high prices charged by this unit should be investigated and effective measures taken to reduce them so as to make it available at cheaper rates to the consumers.

E. A Review of Manufacturing Schemes

(i) *Methyl Methacrylate proposals*

2.49. From the detailed statement furnished by the Ministry indicating the particulars of applications for the setting up of petrochemical units, it nas been noticed that the following applications

are under consideration of the Government for the production of methyl methacrylate:

Name of the applicant	Date of receipt of application by Govt.
1. M/s. Atul Drug House Ltd.	4-6-64
2. M/s. Pandit Kanhayalal Punj .	6-8-64
3. M/s. N. G. Bangur, Calcutta	11-8-64
4. M/s. Synthchemicals .	7-9-64
5. M/s. N. G. Bangur, Calcutta .. .	16-12-66
6. M/s. Rohm & Haas Philadelphia .	21-12-66
7. M/s. Modi Spg. & Wvg. Mills Co. Ltd. .	23-12-66
8. M/s. Pandit Kanhayalal Punj .	13-1-67
9. M/s. Century Chemicals, Bombay	13-1-67
10. M/s. Kilachand Devchand & Co. .	19-1-67
11. M/s. Vadilal Lallubhai Mehta ·	23-1-67
12. M/s. Synthchemicals	23-1-67
13. M/s. Punj Sons Pvt. Ltd. .	24-1-67

2.50. It will be seen that out of the above proposals, four are pending consideration of Government since June-September, 1964. Asked to state the reasons for keeping these applications pending for over three years, the Special Secretary of the Ministry stated during evidence:

> "All these five applicants used acetone as the basic raw-material and initially there was some doubt as to when this chemical would be available and that caused some degree of uncertainty. Thereafter there was further delay because there was some doubt as to whether methyl mathacrylate should be exclusively produced by a public sector undertaking or licences should be issued for its production....."

Supplementing the above statement, the Secretary of the Ministry stated:

> "We would like to accept the criticism that this could have been dealt with more expeditiously. I am informed that

it was in early 1966 that we decided that Hindustan Organic Chemicals need not go into this and I think, we could soon thereafter have decided what to do with these pending applications. I think, to that extent criticism is justified and we accept it.....Now a decision has been taken to license one or two parties."

2.51. As to the latest position, it has been stated that 'The question of approving one party for the setting up of a methyl methacrylate plant in Bombay is still under examination and a decision on this is expected to be taken shortly'.

2.52. The Committee note that considerable quantities of methyl methacrylate are being imported in the country and the imports have increased from Rs. 30.71 lakhs in 1960-61 to Rs. 53.25 lakhs in 1964-65. In this connection, the Committee note that the Planning Group (1964) had observed in their Report that the methyl methacrylate plant could initially be sized to produce about 5000 tons/year of resign and recommended that the plant should be erected for commissioning in 1966-67.

2.53. The Committee deprecate the delay in taking final decision on the application for the manufacture of methyl methacrylate, particularly when intermediate product acetone which is the raw material and an outlet for this secondary or tertiary product will be produced on a commercial scale from April, 1968 in the N.O.C.I.L. complex, which has since been commissioned. This is indicative of lack of proper and coordinated planning for the utilisation of the secondary products of the basic complex at Bombay. The Committee urge that decision to licence one of the parties for the manufacture of methyl mathacrylate should be taken without further delay.

(ii) *Production of Caprolactam*

2.54. Caprolactam is the starting raw material for the manufacture of polyamides fibre *viz.*, nylon. The Committee have been informed that in 1960 licences were issued to the following two parties for the manufacture of caprolactam and nylon yarn:

(i) M/s. Nanuthai Industries (P) Ltd. Bombay (Now M/s. Nirlon Synthetic Fibres and Chemicals Limited, Bombay).

(ii) M/s. Prabhulal Bhikhabhai and Co. Bombay (Now M/s. Gujarat Polyamides).

Each of these units was licensed for the manufacture of 5000 tons/annum of caprolactam though M/s Nirlon Synthetic Fibres & Chemicals Ltd., Bombay were given a subsequent license to expand the capacity to about 8250 tonnes/annum. During evidence in November, 1967, it was stated that these two plants for the manufacture of caprolactam were not commissioned and in fact their licences were revoked only a month ago because no progress had been made nor was likely to be made. Asked to state the reasons for taking seven years in revoking these licences the Ministry have in a written note stated as under:

(i) "M/s. Nanubhai Industries (P) Ltd. (Now M/s. Nirlon Synthetic Fibres & Chemicals Limited, Bombay).

On 15th July, 1960, this firm was given an industrial licence (No. L/23/5/N-199/60 dated 15-7-1960), for substantial expansion:

Capacity after expansion:

5 million lbs. nylon yarn per annum.

10 million lbs. caprolactam per annum.

The firm however applied for a higher capacity since after negotiations with their prospective collaborators they understood that these capacities were not economical. On 14-1-1965, the firm was given a fresh licence for further expansion, as follows:—

(Licence No. L/23/5/87/Tex(F)/65 dated 14-1-1965)

After expansion:

Caprolactam—25 tons per day.

Nylon tyre cord—4 tons per day.

Nylon textile yarn—7 tons per day.

In May 1965, it was first noticed by Secretary (Industry) that the negotiations with M/s. Allied Chemicals are not likely to materialise soon as they were not in a position to give a performance guarantee for the caprolactam plant and that the firm is likely to proceed only with nylon expansion first. The licence was, however, valid till 14th January, 1966. Hence action to partly revoke the same to omit caprolactam was taken as soon as the papers were received on transfer from the Ministry of Commerce on 8th February, 1966.

On account of some procedural difficulties in cancelling a portion of an industrial licence, a show-cause notice for revoking the entire licence including nylon yarn for which they had taken 'effective steps', was issued on 5th April, 1966. Their representation received in May, 1966 was examined in detail. After further correspondence and discussions with the firm, a note to the Licensing Committee

was sent on 17-7-1967. Minutes were received by the end of September, 1967 and the item of manufacture *viz.*, caprolactam was deleted by issue of a formal amendment letter from this Ministry on 3-11-1967.

(ii) M/s. Prabhulal Bhikhabhai and Co., Bombay (Now M/s. Gujarat Polyamides).

An industrial licence was issued to M/s. Prabhulal Bhikhabhai and Co., Bombay on 16th February, 1960 (L/23/5/N-192/60, dated 16th February, 1960) for the following items:—

Nylon yarn—5 tons per day.

Caprolactam—5,000 tonnes per annum.

On 2nd August, 1960, they were told that their proposals for financing the project are not acceptable to Government. Various further proposals were submitted in the time between 1960 and 1967 but none of them were found acceptable. The firm was first given a show-cause notice on 13-5-1963 before revoking the licence. But on the recommendations of the State Government extension was granted upto 31-3-1966 for taking effective steps and 31-3-1967 for completion of the project.

Further proposals for import of plant for caprolactam under French credit, Italian investment etc. were received but not accepted by Government. The case was transferred to Ministry of Petroleum and Chemicals in February, 1966.

The question of deletion of the item caprolactam from the licence was first considered in March, 1966 and in September, 1966 the firm was asked to give reasons for non-implementation of the scheme. In January, 1967, they asked for extension for completion of their schemes with caprolactam scheme. This was examined in detail and it was decided to delete caprolactam from the industrial licence. A note to the Licensing Committee was sent on 2nd May, 1967. The Minutes were received in July, 1967 and the licence amended to delete the item on 7-9-1967.

The main reasons for deletion of caprolactam as furnished by Government are as follows:

(i) Government's anticipation that these two schemes would materialise during the Third Plan and make the country self-sufficient for this basic raw material was belied.

(ii) There was no satisfactory progress on the part of the firm regarding implementation of the scheme to manufacture caprolactam.

(iii) With the availability of benzene and ammonia at Baroda in sight, the scheme of Gujarat State Fertilizers Com-

pany to produce caprolactam was attractive and a letter of intent was issued to them on 22nd November, 1968 for the manfacture of 15,000 tonnes/annum of caprolactam and according to the estimates of demand for caprolactam by 1970-71, there will be no need for another unit apart from this."

2.55. It will be seen that the licences for the manufacture of caprolactam and nylon yarn in respect of the above two units were for integrated schemes. While these units went ahead with their schemes for the manufacture of nylon yarn they made no progress regarding the implementation of the scheme for the production of caprolactam. On the other hand, the licences for the production of the basic raw material *viz.*, caprolactam were revoked after a period of seven years.

2.56. The Committee have been informed that at present the following three plants manufacturing nylon yarn are based on imported caprolactam:—

(i) M/s. J. K. Synthetics Limited, Kota.

(ii) M/s. Nirlon Synthetic Fibres & Chemicals Limited, Bombay.

(iii) M/s. Plastics & Packaging Limited, Poona.

2.57. These three plants have been allowed expansion in capacity as under:—

		Expansion of Capacity allowed	
		From	to
1. M/s. J. K. Synthetics Ltd., Kanpur (at Kota)	Nylon Yarn	660 tonnes	1760 tonnes per annum
2. M/s. Nirlon Synthetic Fibres & Chemicals Ltd., Bombay	Nylon Tyre Cord	1·6 tonnes per day	4 tonnes
	Nylon Yarn	5·2 tonnes per day	7 tonnes per day.
3. M/s. Plastics Packaging (P) Ltd., Poona.	Nylon Yarn	180 tonnes	756 tonnes per annum.

2.58. Besides the expansion in capacity allowed to these three plants, Government have also licensed the following eight units for the production of nylon yarn/tyre cord which are also based on caprolactam, by releasing foreign exchange mostly from within the consortium credits.

Sl. No.	Name of the Plant	Feedstock	Product manufactured	Capacity per year (tonnes)	Month/year of completion/expansion or probable completion	Amount of foreign exchange allocated
1	2	3	4	5	6	7
						Rs. in Lakhs.
1.	M/s. J. K. Synthetic Ltd. Kota, Rajasthan.	Caprolactam	Nylon Staple fibre.	1,800	Expected to be completed by the end of 1968.	280
2.	M/s. Century Enka Ltd., Poona.	Do.	Nylon textile filament yarn.	700		154·14
3.	M/s. Arthur Import & Exports Co. Ltd., Bombay.	Do.	Do.	1,100	From the progress made by the party it is doubtful if the scheme will be implemented.	238
4.	M/s. Gujrat Polyamides Ltd., Nandesari Ind. Colony, Distt. Surat.	Do.	Do.	1,800	Expected to be completed by the end of 1969.	499·07
5.	M/s. Modi Spg. Wvg. Ltd., Modinagar.	Do.	Do.	1,800	Expected to be completed by the middle of 1968.	n.a.
6.	M/s. Stretchlon (P) Ltd., Bombay.	Do.	Do.	540	Expected to be completed by the middle of 1970.	n.a.
7.	M/s. Nirlon Synthetic Fibres & Chemicals Ltd., Bombay.	Do.	Nylon tyre cord	1,300	Expected to be completed by the end of 1968.	100
8.	M/s. J. K. Synthetic Ltd., Kota, Rajasthan.	Do.	Do.	1,000	Expected to be completed by the end of 1968.	160·6

Most of these units are expected to be commissioned in 1968.

2.59. As to the arrangements made for the manufacture of caprolactam in the country, it has been stated that "Studies of the economics of manufacture and location, taking into account availability of low cost raw materials, were made in 1966 and proposals made by all parties were examined carefully. The proposal of Gujarat State Fertilizer Company Limited, to manufacture 15,000 tonnes per annum was selected since they would themselves be producing ammonia, sulphuric acid, oleum, inert gas and would be able to utilise the by-products economically and at low cost. This integration with their specific ammonia/fertiliser facilities together with an adjacent source of benzene also results in significant savings in investment which, it has been seen, is one of the major bottlenecks in the early implementation of projects. Close contact is kept with the Gujarat State Fertilizer Company Ltd. to ensure that the project is going according to schedule and it has also been agreed within Government that the necessary high priority will be given to release of foreign exchange. Cost calculations indicate that the costs of production of caprolactam from the Gujarat State Fertilizer Company's project will be competitive."

2.60. Asked about the latest position in the setting up of the caprolactam plant by the Gujarat State Fertilizer Company, it has been stated that "contracts have not yet been entered into. The letter of intent is being extended upto the 22nd March, 1968. The unit is expected to be commissioned in 1970, if as anticipated, the contracts with collaborators and machinery are concluded by the end of March, 1968."

2.61. It has been stated that the requirements of caprolactam for all the nylon yarn/cord units will have to be met by imports till the commissioning of the Gujarat State Fertilizer Company's plant by 1970-71.

The Committee have been informed that the import of caprolactam has been of the following order since 1962-63:—

Period	Qty. (tonnes)	Value (in lakhs Rs.)
1962-63	367	12·0
1963-64	840	37·8
1964-65	1410	63·5
1965-66	1681	76·0
1966-67	2356	106·0

The quantity and value of annual imports of caprolactam from 1967-68 to 1969-70, as estimated by the Ministry of Petroleum and Chemicals is indicated below:—

Period	Quantity (tonnes)	Value (Rs. lakhs)
1967-68	3850	178
1968-69	8800	390
1969-70	12000	500

The demand for caprolactam by 1970-71 on the basis of the completion of the nylon yarn/tyre cord plants according to plans is estimated at about 15,000 to 17,000 tonnes per annum. It is expected that the caprolactam plant of the Gujarat State Fertiliser Co. Ltd. will be in production by this time in which case no imports will be required. If however there is a delay in the commissioning of the caprolactam plant annual imports of the order of Rs. 6 crores will be necessary.

2.62. The Committee are perturbed to observe that eleven nylon yarn/cord units, based on caprolactam have been set up/licensed in the country without simultaneously ensuring the indigenous supply of the main raw material viz. caprolactam with the result that caprolactam is being imported and will continue to be imported at a considerable cost till 1971 which would strain the foreign exchange position of the country. The import of caprolactam in 1955-56 amounted to Rs. 76 lakhs and in 1966-67 to Rs. 106 lakhs. With the commissioning of all the eleven units the imports of this raw material will increase further and is expected to go up to Rs. 5·00 crores in 1969-70. It appears to the Committee that the basis for licensing these units was the anticipated manufacture of indigenous caprolactam by the two units viz. M/s. Nirlon Synthetic Fibres and Chemicals Ltd. and M/s. Gujarat Polyamides Ltd., to whom licences were issued for the manufacture of nylon yarn/cord and the production of 5000 tonnes each of caprolactam as early as 1969. These two units were intended to produce caprolactam not only to meet their own requirements of feedstock for the production of nylon yarn/cord, but also to meet the requirements of other similar units which were licensed later on. It is not clear to the Committee why these two units were allowed to go ahead with the setting up of the plants for the manufacture of nylon fibre and cord although they had made no progress in the setting up of the integrated unit for the production of basic raw material viz. caprolactam. It took seven years for the Government to revoke the licences of these units for the manufacture of caprolactam. The holding of licences by these units all these years foreclosed capacity in this line and blocked the

entry of other entrepreneurs who may have taken up its manufacture in the mean time. The period of validity of the licences was extended from time to time. Further the Committee are also unable to appreciate why the capacity of the three units for the manufacture of nylon yarn was expanded and some other units licensed to be set up based on caprolactam, when no progress had been made for its indigenous manufacture. The Committee consider that proper care was not taken by the administrative Ministry/licensing authorities in this regard resulting in heavy maintenance imports for keeping these industries running. The Committee recommend that a thorough enquiry should be made into this matter with a view to fix responsibility.

F. Control on Pricing of Petrochemical Products

2.63. The Committee have been informed that 'The Indian prices of petro-chemicals are higher than international prices mainly because of the following reasons:

(i) Higher cost of plant and machinery due to the additional freight element since most of it has to be imported.

(ii) Higher operating costs due mainly to higher raw material costs.

(iii) The demand in the initial stages is not big enough to justify the erection of plants so as to exploit economices of size and keep cost of production as low as in the more advanced countries."

2.64. The Committee desired to know the extent to which our domestic prices of various chemicals are higher than international prices and the reasons therefor. The same have not yet been furnished by the Ministry.

2.65. The Committee note that at the time of grant of licence, production costs and selling prices are taken into account. Asked whether any watch is kept on the production costs and selling prices of petro-chemicals to ensure that these are in conformity with the original stipulations, it was stated that the production of petro-chemicals is just commencing and it is intended to keep a watch on the production costs and selling prices. In the case of synthetic rubber, the production of which is at present based on alcohol, the costs of production and selling prices have been studied very carefully by the Ministry in consultation with the Directorate General of Technical Development and expert assistance also obtained from the Cost Accounts Branch of the Ministry of Finance. By agreement

with the manufacturers selling prices are fixed on the basis of decisions taken on the results of the above studies. Plastics are included in the list of commodities covered by the Essential Commodities Act.

2.66. During evidence it was stated that "in a number of cases there was no control over the prices. Government has, of course, the measure of mopping up some of the excess profits through a levy of non-recoverable excise duty." It was further stated that "There is no uniform practice, for example, we have the case of synthetic rubber. There is a certain measure of Government control on price and if there is to be any revision, they have to come to the Government. Synthetic rubber which is now being produced is subject to such price control. There are various items also. There is also the possibility of referring a particular case to the tariff commission for study of costs, study of profit margin and so on."

2.67. The Committee are glad to note that Government is intending to keep a watch on the production costs and selling prices of petrochemicals. Since the cost of production and selling prices are taken into account at the time of sanctioning the schemes and issuing of licences, it is necessary that Government should exercise a broad control over prices to ensure that after the commissioning of the plants, the prices are generally in conformity with the original stipulations. The Committee consider that such a step will help to keep the rising prices under control to a large extent.

G. Export Obligations

2.68. It has been stated in the Report of the Planning Group that under existing arrangement with Government, plastic resin manufacturers have undertaken to export sufficient resin or goods fabricated from resin, to cover repayment of foreign currency loans utilised to finance the erection of their plants.

2.69. The Special Secretary of the Ministry stated during evidence that 'the number of units involved (under this arrangement of export obligation scheme) was four *viz.*, (i) U.C.I.L. who have got finance from the Export-Import Bank, (ii) The Alkali Chemical Corporation of India who have got the finance from outside consortium sources, (iii) D.C.M. and (iv) the Calicos, both of whom have got the finance similarly. With regard to their export obligations, it was stated that there was an undertaking with these firms except Calico's which was licensed before the particular scheme of exports started. There was, however, no financial or penal sanction to enforce it. In all these cases, enforcement was stated to be satisfactory. As regards stipulating similar conditions in the case of other petro-chemical units, it has been stated that "the possibility of such a stipulation is always examined. But, as a general view it is our opinion in the Ministry that at the present stage of the development of petro-chemicals it is not possible to do this on a very large scale."

2.70. Regarding the safeguards for the fulfilment of export obligations, it has been stated that 'there are two actions which are taken: one is a bank guarantee. Bank guarantee is all right in certain cases. In other cases, because of the financial limits and margins expected by the financial institutions and banks, it is not possible to have a bank guarantee. In such cases what they attempt to do is to get an undertaking that in the event they are not able to meet the export stipulations, we will make available such quantities of products to the S.T.C. or any Government agency as will earn this amount of foreign exchange from exports.'

2.71. It was further stated that the question of stipulating legal sanction in the licence, in this regard was under discussion with the Ministry of Law. As to the latest position, it has been stated that "in accordance with the existing provisions of the Industries (Development and Regulation) Act, licence issued under the Act exhausts itself as soon as the undertaking has been established or the substantial expansion has been effected. It was the view of the Ministry of Law that as the provisions of the Act stand at present, it would not be proper to incorporate any condition in the licences relating to action to be taken subsequent to the establishment of the undertaking. In view, however, of the extreme importance at presnt of providing for increased exports wherever possible, even by compelling the units to do so, the question of including a condition regarding exports in the licence, has been examined, in consultation with the Ministry of Law. That Ministry has advised that if Section 11 and 13 of the Act are amended to provide that licences under the Act will be necessary not only for establishing an undertaking, but also for continuing to operate such undertaking after establishment, then it would be in order for the Government to include in the the licences condition regarding exports etc.

The proposal to amend the Act suitably for the purpose, along with certain other proposals for amendment, is under consideration in the Ministry of Industrial Development and Company Affairs."

2.72. The Committee regret to note that the existing provisions under the Industries (Development and Regulation) Act and Rules made thereunder do not provide for any stipulation in the nature of legal sanction, to force the entrepreneur to earmark a certain portion of his product for export, although he may have agreed to abide by the export obligation at the time of the issue of licence. The Committee hope that the proposal to amend the Industries (Development and Regulation) Act would be finalised by the Ministry of Industrial Development and Company Affairs at an early date so that effective action could be taken in the event of wilful default in fulfilling export obligations.

III. RAW MATERIAL AVAILABILITY AND IMPORTS

A. Raw Materials for Petrochemicals

(i) *Naphtha*

3.1 Naphtha is the main feedstock for the production of petrochemicals. It is defined as a fraction in boiling range of gasoline and light kerosene and is produced by the refineries. The first three refineries in the country were set up in the private sector between the years 1954 to 1957. Thereafter the public sector refineries were established in the 1960's at Gauhati, Barauni, Gujarat and Cochin. The total production of motor gasoline and naphtha by these refineries and their export from the year 1955 to 1966 is given below:

(In tonnes)

	Total Production	Export
1954	162,016	..
1955	797,212	73,343
1956	963,138	82,078
1957	1039,554	206,337
1958	983,228	213,796
1959	942,615	174,900
1960	1035,951	204,883
1961	1054,266	193,573
1962	1138,322	206,008
1963	1361,822	364,759
1964	1429,318	363,915
1965	1492,665	333,400
1966	1949,685	720,147

3.2 Asked to indicate the steps taken by Government to put these feedstocks to the best use during the Second Plan period the Ministry have in a written note stated that,

> "The surplus of naphtha and Mogas during the period was exported as exports were the only use to which the sur-

plus could be put to in the prevailing circumstances. From the above figures of production, demand and exports, it will be seen that naphtha of the order of about 2000,000 tonnes/annum was surplus to our requirements only from 1957 onwards when the throughout capacities of the coastal refineries were expanded. The availability of naphtha feedstocks at this level being assured, development of fertilizer and petrochemical industries based on naphtha was planned immediately thereafter. In view of the inevitable timelag between planning for an implementation of the projects, the surplus naphtha has been exported. The surplus naphtha from 1957 onwards could not be anticipated earlier as the demand for P.O.L. products had not stabilised and the refineries expanded their throughput capacities mainly to cater to the P. O. L. demand."

3.3. Asked to state why the petrochemical industries were not planned along with the commissioning of the coastal refineries, the Senior Industrial Adviser, D. G. T. D. stated during evidence:—

"Until about 1950 or 1954 the thinking of the erstwhile Ministry of Commerce and Industry was that it will have to be based largely upon alcohol which was available in plenty. At that time none of the coaltar products like benzene, toluene, naphthalene and other materials were available. It was in this connection the Alcohol Committee was set up under the Chairmanship of Dr. A. Nagaraja Rao.... It was only later that Rourkala, Durgapur and Bhillai Steel plants were established and from the coke oven plants attached to them large quantity of benzene and other materials became available. Then the thinking took a slightly different turn. Then we thought that in addition to basing the organic chemical industry on alcohol it could be based on aromatic materials available from these coke oven by-products. It was at this stage that oil exploration commenced in this country....Consequently as the refining capacity was increased, the availability of raw materials for petro-chemical industry also increased. When we refine a crude we get various fractions in different proportions—naphtha in large quantities middle oil fractions and other products also in smaller proportions. We found around 1958 that naphtha or motor gasoline which we obtained would be surplus to our requirements because the number of automobiles in the country was limited.

While in naphtha the country will be surplus, we will be deficit in the middle fractions particularly, kerosene, furnace oil and other products. This was a happy coincidence at that time, because we found readily available naphtha which could be conveniently used not only for the production of fertilisers, but also for the production of various organic materials. At that time serious thinking was given to this aspect and the Kane Committee was appointed....."

3.4. The Committee note that naphtha of the order of 200 thousand tonnes per annum became surplus to the requirements of the country from 1957 onwards and had to be exported as no petro-chemical complexes were planned in the country to utilise this naphtha simultaneously with its availability in substantial quantities in 1957. In fact the first Committee to consider the development of petro-chemical industries in the country was set up only in 1960. The Committee regret that there has been no forward planning in this respect. As already observed by the Committee the planning for the petro-chemical industries should have been thought of simultaneously with the setting up of the coastal refineries in the country.

(ii) *Naphtha Availability during the Fourth Plan*

3.5. The estimated total production of naphtha and its demand together with surplus|deficit during the years 1967 to 1971 is given below:

Figures in thousand tonnes

	1967	1968	1969	1970	1971
Total Production	2490	2798	3152	3516	3811
Demand	1476	1818	2216	3218	4373
Surplus/Deficit	+1014	+980	+936	+298	—562

3.6. It has been stated that if all the naphtha consuming projects of the Fourth Plan are completed according to schedule, there would be a deficit of the order of 562 thousand tonnes of naphtha by the end of 1971. The total demand for fertiliser and petrochemical products by 1971 is expected to be 2.903 million tonnes. The requirements as motor gasoline will be 1.48 million tonnes Elucidating the position during evidence the Secretary of the Ministry stated that:

"The actual requirements in 1971 of naphtha will have to be determined in the light of the progress of fertiliser projects which have still not reached the stage of getting

into execution. Also whether we should allow refining capacity of the order of 21 m. or 24 m. tons to be operative in 1971, is a decision which we will have to take in due course of time. We believe that by and large we have enough reserve refining capacity in the country to meet naphtha shortages upto a certain point....the question would have to be considered whether we should import naphtha at that time if there is a shortage, or whether we should import crude oil and refine more of it in the country and make more naphtha. We are reviewing these matters almost every 6 months, so as to be in a good time to take the necessary decision to safeguard the supply position....I think, we can state quite definitely that in 1970-71, we shall not have deficit of naphtha. In 1971-72, there might be. This is still open for further study."

3.7. As to the study of the requirements of naphtha during the Fifth Plan, it has been stated that "no detailed study of the deficit/surplus of naphtha in the Fifth Plan period has yet been made, since this would depend upon the additional refining capacity to be set up, which in turn will depend upon the estimated P. O. L. demand in the country." Elucidating this during evidence the Secretary of the Ministry stated that:

"The Energy Survey Committee has given estimates of oil consumption might upto 1980-81 on various assumptions of industrial growth, of growth of national income in different situations etc. They have estimated the likely requirements of oil and this is likely to be revised again. The whole energy picture is going to be studied afresh with reference to coal, oil, electricity, hydro-power and all these forms of energy....At the moment, we are also engaged in a study of refining capacity from 1971-76. We want to get as clear a picture as possible about the situation that is likely to emerge, as this will give us the position on refinery capacity, the requirements of naphtha to be planned, the requirements of import, etc."

3.8. The Committee are glad to note that the whole energy picture in the country is being studied afresh and that the Government are busy making an estimate of the forecast of the naphtha requirements upto 1975-76. This becomes important in view of the requirements of naphtha for the production of fertilisers which are in great demand. The Committee urge that these studies should be completed as early as possible so as to enable the planning of production of petro-chemicals and fertilisers on a realistic basis.

The Committee have no doubt that in this study the World trends in the consumption of naphtha and its availability and price in future would also be kept in view. It is also necessary to consider the utilisation of natural gas in a larger measure for the production of fertilisers and petrochemicals.. In this connection the Committee understand that in the U.S.S.R. acetylene from natural gas has become fairly popular. The Committee therefore, suggest that feasibility of utilisation of natural gas for this purpose in this country may also be considered.

3.9. The Committee further note that in West Germany there has been a tendency for the larger petro-chemicals firms to adopt processes that could utilise any number of feedstocks such as whole crude, natural gas, coke oven gas or naphtha in order to take advantage of the cheapest feedstock in the market. The Committee hope that this changing pattern would be kept in view while selecting the processes for the manufacture of petro-chemicals in the country.

(iii) *Naphtha Price*

3.10. The I.F.P. Team in 1963 had stated that "Petro-chemical production is economically unattractive if naphtha feed is priced at more than Rs. 90—100 per tonne. A figure of Rs. 80 per tonne, inclusive of taxes and transport was assumed as a basis for economic calculations." Asked about the terms and conditions including price, at which naphtha feedstock is proposed to be supplied to petro-chemical and fertiliser plants, the Ministry of Petroleum and Chemicals has, in a written note, stated as under:—

> "In the absence of a separate posting for naphtha in the Persian Gulf, the pricing of naphtha was based on the import parity price of Bunker C Fuel oil after making calorific value adjustments. To the ex-refinery price thus arrived at, a marketing mark up of ten per cent is added. Initially the freight to be added to the price was with reference to the nearest port but later the various refinery points were made the starting points for the calculation of railway freight.
>
> Unlike the other petroleum products, the price of naphtha has not been related to the posted price in the Persian Gulf. Since the use of naphtha is confined almost exclusively for fertilizers and petro-chemicals, a special price equivalent to the posted price in the Persian Gulf for Bunker C Fuel was fixed as the ex-refinery price. To further help the fertilizer projects, it was decided that the

price build-up will not be on the basis of the port parity, *i.e.* the landed cost at the port, plus rail freight to the point of consumption. On the other hand, it was assumed that every refinery will be a pricing point on the assumption that the ex-refinery price will be the same everywhere, irrespective of whether the refinery is located at the port or in the interior.

Unlike other petroleum products, naphtha when used as a feedstock for fertilizer and petro-chemicals is exempt from basic and other duties, except for a nominal 5 per cent *ad valerom* excise duty."

3.11. The Committee were informed that the price of naphtha was increased by Government with effect from 3-3-1967. This was stated to have been done as the various forecasts regarding the sale of oil products assumed by Talukdar Committee had not been fulfilled. The Secretary of the Ministry stated during evidence that "As a result of various steps which the Government had taken to stop import of oil products by the private oil companies and entrusting of import to IOC alone there was a substantial change in their share in the total market. This had been assumed at a certain percentage by the Talukdar Committee. In fact it was much less. For these reasons Government had to consider revising some of the figures which the Talukdar Committee had adopted. At that point we decided not to increase the prices of products like kerosene or motor-spirit or high-speed diesel which had been subjected to some price increase following devaluation, but to deal with products like naphtha in respect of which there was no change in price after devaluation. We tried to place the burden on products like naphtha or jute batching oil or similar industrial commodities rather than on products of common consumer use."

3.12. It was further stated that "Our old price or naphtha 75 rupees a tone is by international standards, a very low price. Our internal price today is much lower than the price at which we may be able to import naphtha. We have kept it as low as possible consistently with the economics of the refining operations."

3.13. The details of the prices at which naphtha is at present supplied by ESSO and Burmah Shell refineries to the petro-chemical industries as furnished by the Ministry of Petroleum and Chemicals are shown below:

"M/s. ESSO supply naphtha to F.C.I. billing them at the provisional price (effective from 1-11-67) of Rs. 106.97 per

metric ton exclusive of excise duty and sales tax; However, Fertilizer Corporation of India are making payments only at the rate of Rs. 80.39 per metric ton exclusive of excise duty and sales tax pending a bilateral agreement for the rate.

M/s. Burmah Shell supply naphtha to M/s. NOCIL at the rate of Rs. 131.30 per metric ton exclusive of duties, taxes, delivery charges with effect from 15th October, 1967. Variations in AFRA is reflected in build up which is being recalculated because of the changes in AFRA after 15th October, 1967.

M/s. ESSO supply naphtha to M/s. Union Carbide at the provisional rate of Rs. 106.97 per metric ton exclusive of excise duty and sales tax. This is as per the Government ceiling price on naphtha as feedstock."

3.14. The Committee note that the price of naphtha as charged by the ESSO and Burmah Shell Refineries from the petro-chemical industries varies from each other. While the ESSO bills at the provisional rate of Rs. 106.97 per tonne, the Burmah Shell charged at the rate of Rs. 131.30 per tonne. Since the price of naphtha which is the principal raw material for the petro-chemical and fertiliser industries, has a vital bearing on the prices of intermediates and end-products, the Committee recommend that Government should keep a close watch and exercise effective control over the price of naphtha so as to ensure that it is available to the basic petro-chemical industries at competitive prices and that the prices of the end-products to the consumer are economical.

(iv) *Transport costs of Naphtha*

3.15. The Committee have been informed that:

"The Railway Board have also given freight concession for the movement of naphtha in a few cases with a view to keeping the cost of this essential raw material as low as possible. The general question of extending this rail concession in all cases where naphtha moves as feedstock for fertilizers is under discussion with the Railway Board."

3.16. With regard to the latest position, it was stated during evidence in November, 1967 and later on in a written note in January, 1968 that the matter was still under consideration of the Railway Board.

3.17 The Committee are glad that the Railway Board has given freight concession for the movement of naphtha in a few cases. They hope that the question of extending this concession in all cases where naphtha moves as a feedstock for fertilizers and petro-chemical manufacture would be given due consideration and an early decision taken in the matter.

B. Import of Petro-Chemicals

3.18. According to the statistical data compiled by the Kane Committee, the foreign exchange spent on direct and indirect imports of important organic chemicals and derivatives in 1960, was placed at about Rs. 30 crores, as detailed below:

	Rs. in lakhs
1. Phthalic Anhydride	65
2. Methyl alcohol	50
3. Chlorohydro carbons	30
4. Acetic Acid	200
5. Ethylene oxide	90
6. Polyethylene	10
7. Vinyls	90
8. Styrene monomer	160
9. Phenol	60
10. D.D.B.	20
11. B.H.C.	5
12. D.D.T.	930
13. Methyl methacrylate	40
14. Cellulose Plastics	150
15. Acetones	30
16. Synthetic elastomers	700
17. Caprolactam (Nylons)	100
18. Ethylene dichloride	30
19. Carbon black	65
20. Aniline	45
TOTAL	28·65 lakhs

3.19. The yearly import bill on account of petro-chemicals was estimated at Rs. 51 crores in 1965-66 and Rs. 140 crores in 1970-71 by the I.F.P. team in their Report.

3.20. The value of imports of some important organic chemicals from 1961-62 to 1965-66 as given in the Brochure of Statistics (Third Five Year Plan) compiled by the Ministry of Commerce is given below:

(Value in lakhs of Rs.)

	1961-62	1962-63	1963-64	1964-65	1965-66
1. Synthetic or regenerated fibres	28	1,67	4,36	2,66	2,08
2. Synthetic Rubber .	2·71	2,57	2,38	1,13	1,09
3. Organic Chemicals .	21·15	20,45	18,08	19,41	20,69
4. Plastic materials, regenerated cellulose and artificial fibres . . .	7·77	6,48	4,71	6,46	5,80
5. Chemical materials and products . . .	5·09	4,55	5,24	5,01	6,88
TOTAL .	64·72	35,72	34,77	34,67	36,54

3.21. Details of the import of some of the selected petro-chemicals for the period 1961-62 to 1965-66 as furnished by the Ministry of Petroleum and Chemicals in a written note are given below:

(Value in lakhs of Rs.)

	1961-62	1962-63	1963-64	1964-65	1965-66
1	2	3	4	5	6
Acetone .	6·14	15·08	14·33	21·14	20·3
Phenol	34·95	31·26	37·29	38·65	71·78
Methanol . .	9·3	18·8	26·4	48·7	50·0
Phthalic anhydride	44·19	36·64	20·88	47·80	46·34
Ethyleneglycol .	4·49	6·39	9·37	13·25	24·8
Carbon black	205·76	213·34	180·62	129·16	65·57
P.V.C.	104·4	104·1	30·4	35·9	34·7

1	2	3	4	5	6
Polyethylene .	96	45·6	19	72·68	44·43
Polystyrene .	60·64	16·65	3·21	4·72	4·17
M.M.A. .	36.51	37·22	36·84	43·25	28·72
Caprolactam		12·0	37·8	63·5	76·0
D.M.T.		..	..	..	77·5
D.D.B. . .			2·90	0·99	3·20
Alkyl benzenes .	..	..	..	..	2·31
TOTAL .	602·38	537·28	419·04	529·74	549·82

3.22. The Committee have been further informed that the total value of imports of organic chemicals during the Fourth Plan period (1966—71) has been estimated at Rs. 186 crores (pre-devaluation). Detailed estimates of probable imports for 1975-76 have not yet been worked out. Based on certain projections made by the Perspective Planning Division in September, 1966, the probable level of imports of organic chemicals in 1975-76 is placed at Rs. 25 crores (pre-devaluation).

3.23. The Committee note that the imports of organic chemicals in the country have been quite high. In view of the ever increasing utilisation of petro-chemicals and their potential to save scarce foreign exchange through import substitution, the Committee urge that effective measures should be taken to develop petro-chemical industries on a high priority basis, specially those which would help to save imports of fibres, non-ferrous metals, synthetic rubbers etc.

IV. ORGANISATION

A. Coordinating agency for petro-chemicals

4.1. Kane Committee, (1961) was of the opinion that it was essential to build up the necessary technical knowledge not only with regard to production, separation etc. of aromatics from petroleum feedstocks but also with regard to diverse aspects of the petro-chemical industries in the organisations such as Development Wing, Department of Oil (Erstwhile Ministry of Steel, Mines and Fuel) and the Planning Commission which were closely associated with the development of the petro-chemical industries in the country.

4.2. In 1963, the Study Team of the I.F.P (Dr. Henny's Team) had recommended the setting up of a petro-chemical coordination agency to coordinate and expedite the development of petro-chemical complexes with functions such as:

'(i) Keeping the overall petro-chemical development plan uptodate and revised in the light of:

(a) new processes which may be developed,

(b) new sources of raw material which might become available,

(c) new product demand patterns which might evolve.

(ii) Obtaining planning permission for the complexes.

(iii) Preparing, before the negotiations, as detailed a layout, description, material balance and economics of the complex as is necessary for successfully coordinating the negotiations.

(iv) Ensuring that early phases of a complex are installed in such a way that they do not prejudice later phases.

(v) Effecting liaison to allow for the inevitable interaction of petro-chemical industry on both the refinery and fertilizer industries, where raw materials, by-products and utility services are to a large extent inter-dependent.

(vi) Preparing short lists of suitable candidates who might, because of their qualifications, usefully be solicited for participation in segments of the complex.

(vii) Submitting the list of recommended candidates for each segment after completion of negotiations.

(viii) Approving the allocation of foreign currency from the revolving fund, for those segments developing on the public sector.

(ix) Coordinating the harmonious development of the common offsite and utility systems as well as assuring that programmes of construction are kept up to date and on schedule.

(x) Coordinating of plant startups to ensure that units ready to operate are not kept idle for lack of raw material from other upstream units.'

4.3. Regarding the action taken on the recommendations made in the Report of Petro-chemicals Committee (Kane Committee) and the Study Team of the I.F.P., it has been stated that 'a Technical Cell has been established in the Ministry of Petroleum and Chemicals with an Adviser, Petro-chemicals, assisted by a Project Officer with special knowledge and experience of this industry. This Cell works closely with the Petro-chemicals Division of the Oil and Natural Gas Commission, the Project Division of the Indian Institute of Petroleum, Directorate General of Technical Development and the Industry and Minerals Division of the Planning Commission.'

4.4. During evidence it has been stated by the representatives of the Ministry that "basically the approach of the I.F.P. Team recommending integrated coordination has been accepted though it has not been implemented by the formation of a centralised single agency. At the moment these various functions are performed through three or four agencies who work in close liaison with each other. The main agencies are the Adviser in the Ministry of Petroleum and Chemicals, the Division in the Indian Institute of Petroleum, the Division in the O.N.G.C. and liaison also with the D.G.T.D. and Planning Commission. In practice we have found that because the various organizations in these agencies have been responsible for particular jobs and also maintaining very close contact with each other, we are able to perform the function of an integrated agency with fair degree of satisfaction. Now that we are approaching a stage where we will emerge in a bigger way in the public sector in petro-chemicals, particularly with the Gujarat Complex, we will proceed further and a decision has already been made in principle that a Corporation will be set up for the petro-chemical part of the public sector." It was further stated that "even after the setting

up of the Corporation, the activities of the other units will continue because there will always be a margin when we will be exploring new schemes and making research through the Indian Institute of Petroleum—Projects Division." Explaining the position further the Secretary of the Ministry stated that "the actual implementation of concrete schemes and approved projects, development of downstream units, will be undertaken by the Petro-chemical Corporation. There is really a twofold function to perform. There is something which Government must continue to do at all times, that is to say, control the development broadly of the industry, regulate its growth, approve projects, financing and so on. All these will be performed by the Adviser in the Ministry. Then there is the stage of implementation.... The two instruments which the Government is using and developing today for fulfilling these objectives are: firstly, the Indian Institute of Petroleum which has now built up a specialised Petro-chemical Division for research and developmental work, training facilities, etc. Secondly, there is Engineers India Limited which we are building up as a design and engineering agency for performing these functions. So there are promotional, developmental, training functions which the Indian Institute of Petroleum is carrying out and which is best fitted to carry out these. Engineers India Limited is meant for designs and engineering; a Petrochemical Corporation for actual implementation and control and ownership; and the Ministry to perform what are really Governmental functions. I do not think all these (functions) could be combined in one. It would not be convenient. As the thing has grown, the division of responsibility in this manner seems natural also."

4.5. The Committee note that the work relating to planning and development and research in petro-chemicals in the country is at present being done by the following:

(i) Technical Cell in the Petro-chemical Division of the Ministry of Petroleum and Chemicals.

(ii) Project Division and Petro-chemical Division of the Indian Institute of Petroleum, Dehradun. (under CSIR).

(iii) Petro-chemicals Division in the O.N.G.C., New Delhi.

(iv) Industry and Minerals Division (Chemicals Section) in the Planning Commission.

(v) Directorate General of Technical Development.

The Committee consider that the setting up of so many agencies to deal with petro-chemicals results in the dispersal of already scarce expertise in this important and growing industry and is not

conductive to taking of expeditious decisions regarding the planning and development of this industry in the country. Moreover, the existence of multifarious organisations tends to blur responsibility. Such an arrangement is also likely to result in over-lapping of functions, duplication of efforts and wastage of resources. It appears that the existence of all these agencies is a matter of historic growth rather than of rational and deliberate planning. The justification for having Divisions/Sections in the O.N.G.C., Planning Commission and D.G.T.D. requires to be examined closely. The Committee recommend that the whole matter regarding the organisations necessary for planning and development of petro-chemicals in the country should be thoroughly examined with a view to having a well coordinated set up for integrated and expeditious development of this industry.

B. Petro-chemical Corporation

4.6. In December, 1964, the Working Group recommended that the ultimate objective of a public sector in petro-chemicals should be to evolve a fully integrated organisation with its own competence in:—

(i) Process evaluation;

(ii) Project design and process engineering;

(iii) Research and Pilot Plant Studies;

(iv) Plant operation;

(v) Application technology and technical service; and

(vi) Distribution and marketing.

4.7. According to the Report such an organisation can develop only gradually but the objective must be clear at the start so that each step is taken in the right time.

4.8. The Committee have been informed that the benzene and toluene plants of the Gujarat complex in the public sector are under erection as a part of the I.O.C.—Gujarat Refinery.

4.9. As to the operation of the benzene and toluene plant at Koyali as a part of the I.O.C.—Gujarat Refinery, it was stated during evidence that "the question whether this organisation should be an integral part of the refinery or whether it should come in the petro-chemical organisation, is being actively studied. There are certain problems of sales tax on transfer of products from one factory to

another, the economics of doing a particular operation in the I.O.C. or petro-chemical Corporation. Explaining further the Secretary of the Ministry stated that "if naphtha is being transferred from the Gujarat refinery to the petro-chemical complex, they do charge on the transfer but the subsequent intermediates will be owned by the petro-chemical complex and will be free of sales tax. Which is more advantageous, whether it is better to make transfer at the point of naphtha or intermediate—these are the matters which will be coming up for decision."

4.10. The Committee are constrained to observe that in spite of the recommendations made by the I.F.P. Team in 1963 and the Working Group in January, 1965 for the setting up of an integrated organisation for petro-chemicals in the public sector, no such organisation has yet been set up. On the other hand benzene and toluene plants are being erected as a part of the I.O.C.—Gujarat Refinery which gives the impression that the organisational matters regarding the setting up of petro-chemical complex in public sector are being dealt with in an ad hoc manner. The slow progress in the setting up of petro-chemical complex in the public sector may partly be attributable to the absence of a central organisation. The Committee urge that the setting up of a petro-chemical Corporation which is stated to have been agreed to in principle, should be expedited so that the work of organising petro-chemical complexes in the public sector is undertaken systematically in right earnest.

C. Contracting Agency for engineering and construction of Petro-chemical Plants

4.11. The IFP Study Team in 1963 recommended the creation of an Indian major contracting entity for the construction of petro-chemical complexes. According to the Report of this Team, building the petro-chemical industry presented India with a unique opportunity to create an all-India major contracting company. Such a company was to undertake the following work:—

(i) Basic process engineering;

(ii) Detailed mechanical engineering;

(iii) Purchasing, expediting and inspection;

(iv) Construction, erection and site supervision; and

(v) Start-up.

4.12. Regarding the creation of the contracting organisation for the building up of a petro-chemical industry in the country, it has

been stated that "there are a number of Indian firms capable of undertaking engineering, design and erection of petro-chemical plants in varying degrees. Care is taken to advise entrepreneurs the extent of such work which can be carried out in the country and their proposals to purchase such services from overseas are screened in order to maximise work in India. Government has established a public sector company—M/s. Engineers India Limited which will be the major contracting entity for the purpose of process engineering, detailed engineering, procurement, erection and start up. This Company has developed rapidly and will continue to develop further. It has been further stated that M/s. Engineers India Limited are working in close collaboration with Oil and Natural Gas Commission in connection with the detailed engineering, indigenous equipment procurement and construction of the Aromatics Complex scheduled to be put up at Koyali, Gujarat. Facilities for catalytic reforming ortho-xylene fractionation, paraxylene crystallisation, meta xylene isomerisation and D.M.T. production are envisaged in the complex.

Similarly M/s. Engineers India Limited are closely associated with the Oil and Natural Gas Commission for the detailed engineering procurement and construction of the proposed naphtha cracker to be set up at Koyali, Gujarat State.

Besides the above M/s. Engineers India Limited are also expected to assist the Gujarat Industrial Development Corporation in drawing up a master plan for the entire petro-chemical complex envisaged at Koyali, Gujarat."

4.13 The Committee are happy to note that M|s. Engineers India Limited have been closely associated with the detailed engineering, procurement of indigenous equipment and construction of the Aromatics complex and the naphtha cracker at Koyali, Gujarat. The Committee note that in these matters, this organisation is working in close collaboration with the O. N. G. C. They are unable to appreciate why the two organisations in the public sector viz., O. N.G. C. and Engineers India Limited are working in the same field. It appears that expertise in design engineering is dispersed in various organisations like the Project Division of the Indian Institute of Petroleum, the O. N. G. C. and M|s. Engineers India Ltd. The Committee suggest that the expertise in design engineering should be integrated in one organisation, which shou'd undertake all work relating to process engineering, detailed engineering, erection etc. of petro-chemical complexes.

V. TECHNOLOGICAL AND ENGINEERING ASPECTS

A. Process Know-how and technology

5.1. The Committee have been informed that one of the main factors standing in the way of rapid development of petro-chemical complexes in the country, has been the lack of know-how and technology which has invariably to be imported. The Committee note that in the case of petro-chemical industries set up in the private sector, the know-how has mostly been imported on royalty basis. They have been informed that the petro-chemical complex in the public sector at Koyali in Gujarat will be set up after purchasing the licence for process etc., on an outright basis. The process being purchased for the Gujarat complex will also be used in Barauni and will lead to substantial saving in costs and time for implementation. During evidence the Special Secretary of the Ministry stated that "as for know-how and technology, while the overall position remains much as it was, here again by more experience and more contacts and more trial and error, we are today much better informed to give guidance both to the private enterpreneur and the public sector projects than we were some time ago."

5.2. Asked about the measures taken by Government to keep abreast of the latest process know-how in petro-chemical industry so as to guard against obsolescent technology, the Ministry has in a note stated that "Apart from regular scrutiny of technical journals, direct contacts are maintained with prominent process licensors and engineering companies. The data obtained is translated to Indian costs based on continuous analysis of costs in India. Studies are made of alternative raw materials and production costs based on these alternatives. Similar studies are made of international trends. Assistance of National Laboratories is also sought in analysis of technological developments . . . Services of the Indian Investment Centre with offices in U.S.A. and West Germany are also utilised."

5.3. In this connection, the Committee understand that Japan which started the petro-chemical industries in the early fifties, had to rely heavily on imported technology in this new and sophisticated industry and spent about 16 per cent of the total expenditure during the first development programme on royalty and licence for imported know-how and technical assistance. At the same time a Research Body called the 'Research Organisation of Polymer Raw

Materials' composed of 22 Chemical Companies working in close co-operation with engineering companies, was set up in Japan. As a result a number of processes substituting the imported know-how were developed in that country with the result that they have been able to complete with and even improve upon the existing know-how. Japan has thus not only been able to reduce substantially foreign know-how costs but is also in a position to offer processes in competition with those from other developed countries. In fact, Japan has emerged as a leader in petro-chemical industries by freely purchasing technology from abroad and innovating on the same through her own genius and is in a position today to export a great deal of this innovation as 'grant backs'.

5.4. The Committee are glad to note that Government are purchasing know-how on an outright basis in respect of the petro-chemical complexes which are being set up in the public sector. The Committee would, however, like to emphasise that in purchasing know-how, Government should guard against acquiring obsolescent technological processes which may some times be available at low initial cost, as that would put the country at a distinct economic disadvantage in comparison with other advanced countries. The Committee would further urge that Government should emulate the example of Japan in improving upon imported technology as continued dependence on borrowed technology, apart from putting the country at a competitive disadvantage, is also harmful technically and economically. The indigenous innovation on imported technology would not only save scarce foreign exchange which is to be paid in the shape of royalty etc. but would also make the scientists and technologists self-reliant and confident. The Committee hope that Government would take effective measures for the development of indigenous technology in this vital industry as early as possible.

B. Research in Petro-Chemicals

5.5. Research work on petro-chemicals in the country is being undertaken mainly by the Indian Institute of Petroleum, Dehra Dun, National Chemical Laboratory, Poona, Regional Research Laboratory, Hyderabad and Central Electro-Chemical Institute, Karaikudi. Advisory Committees are stated to have been formed by these Laboratories and Institutes to assist in the programming of practical research and development work. The work is confined to practical projects which appear to be essential and where commercial production has fair chances of being realised as an early date. A few processes are stated to have been developed by those institutes/laboratories and plants based on these are being engineered.

5.6. Asked as to how liaison is maintained between the Ministry of Petroleum and Chemicals and these Laboratories/Institutes, the Ministry have, in a written note stated that "liaison with the Indian Institute of Petroleum is maintained by representation of the Ministry's personnel on the Scientific Advisory Council and the Executive Council. Liaison with all the three Laboratories *viz.*, Indian Institute of Petroleum, Dehradun, National Chemical Laboratory, Poona and Regional Research Laboratory, Hyderabad as well as C.S.I.R. Laboratories working in allied fields such as the Central Electro-chemical Institute, Karaikudi has been improved recently by having regular meetings to delineate specific areas of work of short, medium and long term interest, phased in respect of time and budget and regular review of progress. Engineers (India)—an engineering design and construction organisation—is also associated in this programme since their close association with process development and pilot plant work will expedite commercial exploitation."

5.7. It is well recognised that petro-chemical industry is characterised by rapid technological developments and therefore, proper establishment of the industry in the country must be supported by research carried out within the country. The Committee are glad to learn that research in petro-chemicals has been undertaken in some institutes|laboratories. They, however, consider that the existing arrangements of co-ordination between the various organisations engaged in research on petro-chemicals require to be further strengthened for mutual benefit and to avoid overlapping and duplication of research efforts and expenditure.

5.8. The Committee further suggest that arrangements should be made to give wide publicity to the research carried out and facilities available in these organisations by bringing out annual reports and technical bulletins from time to time for the benefit of the industry.

C. Design and Engineering Capacities

(*i*). *Indigenous Fabrication Facilities*

5.9. Regarding the indigenous capacities to prepare process and detailed engineering design, the Ministry of Petroleum and Chemicals have in a written note stated that 'it is now possible to do the complete design of offsites and in respect of battery limits, practically all the civil, structural and electrical design, a major portion of the instrument design or detailed engineering and in certain cases some part of the process engineering. In general this development has now reduced the foreign exchange expenditure on such services by almost half. In regard to the preparation of fabrication drawings fabrication of equipment, fabrication design capacity in the

fabrication shops has to be increased substantially especially in the field of heat exchangers, reactors and trav column. This is being done to some extent and is now being accelerated further. Delivery periods have also become shorter.'

5.10. Regarding the latest position about the indigenous availability of equipment and fabrication facilities for petro-chemical plants etc., it has been stated that a survey was conducted by the Indian Institute of Petroleum, Dehradun in March, 1966. According to that survey, "until about two to three years ago, foreign exchange engineering design and construction costs averaged between 15% to 25% of the total capital cost and such services were required for both battery limits and offsites. Rapid development of engineering design and construction companies in India has resulted in engineering of offsites to be fully carried out in India and certain parts of the engineering design of battery limits plant have also been transferred to work to be carried out in India. The foreign exchange engineering design and construction costs have now been brought down from 15 per cent—25 per cent to 10 per cent—15 per cent. During the next two years, it is anticipated that this will be further reduced to between 7 per cent and 10 per cent.

The foreign exchange component in regard to plant and equipment varies a great deal from plant to plant. Thus while the foreign exchange component of a cracker involving cryoscopic and high pressure equipment is high, the foreign exchange component of a polyethlene plant has come down substantially.

On an average, while engineering design and plant and equipment together came to around 50 per cent to 55 per cent of the total capital cost some two years ago, the percentage has come down to around 40 presently and by 1970-71, it is expected to reduce further to 30."

5.11. Asked about the views of Government in regard to the establishment of a consortium to undertake turn-key contracts for the fabrication of complete chemical and fertilizer plants, as suggested at the seminar of the Chemical Plant Manufacturers Association. the Ministry have in a written note stated that "the development of comprehensive engineering design and construction organisations enables the choice of proper technology, maximisation of domestic engineering and construction services and indigenous equipment. This development also assists chemical plant manufacturers to locate the gaps in their activities which need to be filled up and it becomes possible for Government, engineering organisations and plant manufacturers to evolve measures to cover this gap rapidly. Some progress in this direction has already been made and further measures to achieve this objective are in progress.'

5.12. During evidence, the Senior Industrial Adviser of the Ministry of Industrial Development and Company Affairs stated that 'the manufacture of chemical plants has been included in the 59 priority industries so that whatever raw materials are required would be permitted to be imported if they are not available locally.'

5.13. Citing the example of Durgapur Plant to point out the efforts towards maximising indigenous fabrication of equipment the Secretary of the Ministry stated during evidence that 'We have been able to arrange for local fabrication of a large number of stainless steel vessels, pressure vessels etc., by permitting the import of stainless steel, certain special qualities of alloy steel, etc., so that the vessels and other equipment can be locally fabricated. In the case of Durgapur we have been able to save Rs. 4-5 crores of foreign exchange on the basis of importing certain raw materials and arranging for local fabrication. There is difficulty both about finances—foreign as well as rupees—because of the general situation.'

5.14. It was further stated during evidence that 'Today, we are implementing two major projects for the manufacture of refinery and chemical plant and equipment. We hope, therefore, to be more self-reliant when we come to Barauni. Even at that time, it is not possible to completely eliminate imports. We hope that we will be able to eliminate imports for pressure vessels, heat exchangers etc. The need for increasing self-sufficiency in the matter of plant and equipment certainly has been very much in the minds of the Government; and for self-reliance in oil and chemical industries, we have taken steps to achieve this objective.'

5.15. The Committee are happy to note that it is now possible to do complete design of off-sites and practically all the civil. structural and electrical design including a major portion of the instrument design or detailed engineering in respect of battery limits in the country itself. In certain cases some parts of the process engineering can also be undertaken within the country. All these factors have reduced the foreign exchange expenditure on such services by almost half. The Committee note that to facilitate indigenous fabrication of plant and equipment, the import of raw material required by the Chemical Plant manufacturers has also been included in the priority industries. The Committee hope that this trend would continue to be encouraged, as it would go a long way in making the country self-reliant in this respect. In this connection, the Committee would urge that the suggestion made at the Seminar of the Chemical Plant Manufacturers Association to set up a Consortium to undertake turn-key contracts for the manufacture of complete chemical

and fertilizer plants, should be given earnest consideration and encouragement by Government.

(ii) *Plastic Machinery for Conversion Industry*

5.16. The Japanese Petro-chemical Delegation which visited India in 1964 on a request from the Indian Investment Centre and the Indian Refineries Ltd., had, *inter alia* recommended that 'the latest equipment for plastics extrusion, injection, blow moulding, calendering and lamination, should be introduced and thereafter know-how for designing and manufacturing such equipment should be introduced for undertaking domestic production.'

5.17. It has been stated that 'considerably new equipment for the processing of plastics has been imported. Domestic manufacture of automatic extruders and injection moulding machines has been established and such manufacturers have been encouraged to expand and diversify their manufacture to produce blow moulding equipment.'

5.18. The Ministry have further stated that 'there are three units at present manufacturing Plastic Working Machinery (Injection Moulding Machines and Extruders) in the organised sector. The names of these units, their licensed capacity and production are given in the following table:

Name	Licensed Capacity	Nos.	Production '66		Production Jan.—Sept. '67	
			Qty. Nos.	Value Rs./lacs	Qty. Nos.	Value Rs./lacs
1. M/s. R. H. Windsor India Ltd., Bombay.	Inj. moulding Extruders	108 60	56	40·13	60	43·5
2. M/s. Engel India Machines and Tools Ltd., Calcutta.	Inj. moulding Extruders	150 Nil	44	34·5	31	30·25
3. M/s. Kril Standard Pvt. Ltd.,	Inj. moulding Extruders	100 Nil	Yet to go into Production			

It has also been stated that it takes some time for an engineering unit to gear up its production to the full capacity. As these units started production hardly two years back, it will take them

some more time to achieve the full production capacity. From the latest production returns, it is seen that these units are fully booked to their present production capacity at least three or four months in advance. M|s. Kril Standard Private Limited at Baroda is expected to go into production shortly. Apart from the above, there are a few units in the small scale sector manufacturing simple type of machines.

5.19. The Committee are glad to note that indigenous capacity for the manufacture of major machinery required for processing plastics has been established in the country. They hope that this fully meet the growing requirements of plastic processing units in the country thereby obviating the need for imports on this account.

D. Requirements of trained technical personnel

5.20. The Study Team of the I.F.P. in 1963 had estimated the requirements of senior trained technical personnel (*i.e.*, Senior Engineers, and foremen) for the four Petro-chemical Complexes (*viz.*, Gujarat, South India, Barauni and East India) at 622 by 1970.

5.21. Regarding the steps taken to assess the requirements of technicians and to train them, the Ministry of Petroleum and Chemicals have, in a written note, stated that "the requirement of operators, foremen and engineers was assessed in the I.F.P. Study. This has been taken into account in the overall manpower planning and specific planning for technologists and trained craftsmen. The Indian Institute of Petroleum has organised courses for theoretical and practical training and orientation of graduate engineers. Existing and potential manufacturers have trained staff in India and overseas and all process licenses and collaboration arrangements provide for training of nucleus personnel in well operated plants either in the country or overseas. It will be possible to enlarge and intensify in plant training in India for personnel required in future complexes in the plants being commissioned now. Training programmes have also been started by a number of operating chemical companies who are prepared to offer the use of such facilities to other companies. Government is establishing an Institute for training tool, die and mould makers in order to train artisans and foremen in this branch of the petro-chemical conversion industry."

5.22. Besides, the Indian Intitutes of Technology in Bombay and Kanpur also hold courses in special aspects such as reactor design and heat exchange system. Some Universities and Institutes of Technology also arrange regular courses for training engineers and

technologists in special fields of petro-chemical intermediates and processing of these intermediates into saleable products.

5.23. Apart from the manpower requirements for the basic complexes, as assessed by the I.F.P. Team, the recommendations of the Study Group of I.F.P. and I.I.P., constituted in 1965, assessed the estimates for 1970-71 in the processing industries, as under:

	Engineers	Foremen	Operators	Helpers
Plastics	1,472	5,492	20,864	24,136
Rubber	214	502	21,200	9,247
Synthetic Detergents	21	45	300	240
Synthetic Fibres	79	308	3,390	802
TOTAL	1,786	6,347	45,754	34,425

5.24. The Committee note that a broad estimate of the requirements of senior trained technical personnel for the petro-chemical complexes to be set up in the public sector as well as the requirements of technical manpower for the processing industries in plastics, rubber, synthetic detergents and synthetic fibres has been made. They are glad to note that a Training Institute for imparting training moulds dies and tools for plastic processing is being set up at Guindy in Madras. The Committee urge that the Institute should be set up at an early date so as to meet the requirements of the technical personnel for the plastics industry.

5.25. The Committee also suggest that necessary arrangements to provide training facilities for the technical manpower required by rubber processing and other petro-chemical industries may also be made by Government as the required number of skilled and trained personnel for these new industries may not be available in the country.

5.26. The Committee would further point out that the four main types of training for the senior technical personnel to meet the requirements of petro-chemical complexes in the public sector were suggested by the I.F.P. team in 1963. These were:—

'(a) On-site training during the plant construction period.

(b) Practical training in factories in India, principally for foremen.

(c) Training courses in Indian technical institutes under the guidance of India and foreign instructors, principally for junior engineers and foremen.

(d) Overseas training for senior engineers and specialized engineers such as instrument engineers. This part of the training is to be arranged by foreign engineering companies process licensors and equipment suppliers.'

The Study Team had also observed that "Failure to obtain and train the necessary number of Indian personnel will make it necessary to hire overseas personnel and employ them both on shift work and in executive positions. To replace an Indian engineer by a foreign one will be extremely expensive." The Committee agree with the above observations and recommend that necessary arrangements to provide for the training of senior personnel for the petrochemical complexes should be made by Government at an early date and the Committee informed of the action taken in the matter.

VI. MISCELLANEOUS

Central Health Legislation

6.1. The Refineries, Fertilizer Plants and Petro-chemical complexes emit a variety of foul gases and some of the effluents are potentially dangerous. The disposal of untreated effluents results in pollution of water also.

On water pollution control, the Draft Outline of the Fourth Five Year Plan has stated:

> "With rapid growth of industries and urban areas the danger of pollution of the rivers and natural streams has increased. As these are also the major sources of drinking water, there is an immediate need for abatement of river stream pollution by proper control at the State, Regional and Central levels. The Ministry of Health has prepared a draft legislation. Early enactment and enforcement of this legislation in all the States is essential for the preservation of public health."

6.2. On the desirability of the enactment of a uniform central legislation on the disposal of effluents and emission of foul air from the plants, the Secretary of the Ministry stated during evidence:

> "There are recognised international standards for design, engineering, for the treatment of waste products—effluents.. The State Governments have a special concern with this matter. Most plants are planned so as to eliminate hazards on account of pollution....But I would not like to say that there is no room for further thinking. We will consult the Ministry of Health. We will go into this further."

6.3. Rapid industrialisation, particularly the setting up of the refineries, fertiliser plants and petro-chemical complexes in the country is bound to create the problem of air and water pollution, as these industries especially, petro chemicals plants, emit a variety of foul gases and discharge potentially dangerous effluents. There is therefore an urgent need to guard against air and water pollution, particularly in areas where these industries are concentrated. The Committee consider that if the poisonous effluents and obnoxious

gases are allowed to be discharged untreated, they are bound to pose a big health hazard to the population in the areas surrounding these complexes.

The Committe, however, note that a central legislation to deal with the disposal of industrial wastes and foul gases from plants is under consideration of Government. They urge that the Ministry of Petroleum and Chemicals should vigorously pursue the matter with the Ministry of Health so that a central legislation on effluent disposal criteria is enacted soon.

VII. CONCLUSION

7.1. The importance of the petro-chemical industry to the economy of a developing country can hardly be over-emphasised. The petro-chemical industries provide the basis for many consumer industries since most of them rely in one way or another on petro-chemical intermediates or end-products. Petro-chemicals are the starting point of plastics, synthetic fibres, synthetic rubber and a whole range of other products in the wonder World of synthetics.

7.2. The petro-chemical industry has made phenomenal progress in all the technologically advanced countries during the past two decades. The significance of petro-chemicals in the industrialisation and economic betterment of a developing country like ours is all the greater. In the years to come petro-chemicals are bound to occupy an increasingly important place in our scheme of industrialisation as the petro-chemical feedstocks are extremely versatile in their application for Defence, Industry and Construction, Irrigation and Agriculture and effecting import substitutions. They also provide great scope for developing a wide range of small and medium scale industries. The petro-chemical industry has a powerful impact on the industrial economy and the living standard of a country. The new petro-chemicals complexes projected for the Fourth and Fifth Five Year Plans will not only act as a catalyst for the rapid growth of the entire spectrum of organic chemical industries, but they will also provide essential products for numerous related and ancillary industries, thereby contributing to increase in National wealth and opening up numerous avenues for gainful employment of technical personnel and labour.

7.3. Although the petro-chemical industry is a sequel to petroleum processing and refinery operations yet the development of petro-chemicals in the country has not gone hand in hand with the setting up of the refineries which produce naphtha—the main feedstock for petro-chemical industries. While the agreements for the setting up of the three coastal refineries in the private sector were entered into in 1951 and the refineries were also commissioned between the years 1954 to 1957, the first Committee to plan the development of petro-chemicals in the country was set up only in 1960.

Thereafter, the matter was examined by three more Teams/Groups during the years 1963 and 1964. The result has been that naphtha from the refineries became surplus to indigenous requirements from 1956 onwards, and is being exported ever since. On the other hand, petro-chemcials continue to be imported in large quantities.

7.4. The Committee regret to observe that this important industry which could play a significant role in the economy of the country, did not receive the attention that it deserved from the very beginning with the result that no significant headway has been made in the setting up of petro-chemical industries and the country has to depend for most of its requirements in petro-chemicals on imports. It is only after a time lag of about a decade that the petro-chemical industry is now engaging the attention of Government.

7.5. The progress in the setting up of petro-chemical complexes in the country especially in the public sector, has not been very satisfactory. Except for the Methanol Plant which has been set up in the Trombay Unit of F.C.I. nothing has so far been done in the public sector in the field of petro-chemicals. The Committee note that while some units of the petro-chemical complex in the private sector at Bombay (NOCIL) have been commissioned recently and commercial production may start towards the end of 1968, the public sector complex at Koyali (Gujarat) is still in its preliminary stages. It is unfortunate that public sector which should have been the pace-setter in this industry, has lagged behind. The Committee hope that determined and effective measures would be taken to set up the complexes at Koyali and Barauni at an early date so as to make up for lost time. It would, however, be quite sometime before the country catches up and finds a place on the international petro-chemical map.

7.6. There is one point about petro-chemical industry which deserves special attention. According to the statement made by the Secretary of the Ministry of Petroleum and Chemicals during evidence the public sector will set up petro-chemical complexes to supply basic raw materials to other industries.

7.7. The Committee feel that there is not much to be gained in planning petro-chemical complexes unless the establishment of such complexes is synchronised with the establishment of other units—consumer and ancillary industries—which utilise the products of the basic complex. Since the petro-chemical products are to be used as intermediates in other industries it is obvious that unless the other industries are also developed simultaneously, petro-chemical production will suffer.

7.8. In para 2.62 the Committee have already pointed out how planning has erred in licensing a number of consumer industries without simultaneously arranging for the production of intermediate raw materials within the country. Unless adequate attention is paid to proper scheduling and coordination of petro-chemical projects, there is likelihood of similar mistakes being repeated now in the reverse direction. The Committee would, therefore, stress the importance of maintaining close co-relation between the basic manufacturing and the secondary and tertiary programmes in the planning of petro-chemical complexes.

7.9. The Committee note that fast technological improvements are taking place in petro-chemical industry which is highly sophisticated. The scope for technological research and innovation is very wide. In fact technological innovations and obsolescence are the very characteristics of petro-chemical industry. The developing countries trying to enter the petro-chemicals field have to encounter a large number of initial difficulties. There is need to safeguard against acquisition of already obsolescent processes. The Committee realise that basic research in this field is expensive and, therefore, purchase of advanced technology in the early stages is a necessity. In the beginning, the country will have to import a large quantity of technological equipment as well as process engineering "know-how". Simultaneously an intensive research and development programme must be started so that the drain on foreign exchange is reduced to the minimum. It is obvious that the progress in the direction of developing our own know-how cannot be expected to be quick but there should be no continued dependence on imported technology also.

7.10. The Committee, therefore, cannot too strongly emphasise that an extensive research and development programme should be organised in this field. For this purpose, they suggest that Government should encourage and strengthen purposeful and industry-oriented research in petro-chemicals, so as to improve and innovate upon purchased know-how with the ultimate objective to do away with dependence on imported technology and to make the country self-reliant without always relying on foreign technical collaboration and know-how.

NEW DELHI—I;
March 6, 1968.
Phalguna 16, 1889 (Saka).

P. VENKATASUBBAIAH,
Chairman,
Estimates Committee.

APPENDIX I

(*Vide* Para 1.21)

Composition and terms of reference of Government Committee/ Groups

1. *The Petro-Chemical Committee.* (1960-61)

(i) *Composition*

The Committee consisted of the following:—

(1) Dr. G. P. Kane, Senior Industrial Adviser (Chemicals), Development Wing, Ministry of Commerce and Industry.	*Chairman*
(2) Shri K. K. Sahni, Joint Secretary Ministry of Steel, Mines and Fuel.	
(3) Dr. J. S. Ahluwalia, Chemical Engineer, Ministry of Steel, Mines and Fuel. (now O.S.D., Indian Institute of Petroleum).	*Member*
(4) Shri K. Vyasulu, Chief (Industry) Planning Commission.	*Member*
(5) Dr. A. Seetharamiah, Development Officer (Leather and Rubber)— now Industrial Adviser (Chemicals), Development Wing, Ministry of Commerce and Industry.	*Member Secretary.*

(ii) *Terms of Reference*

(a) An assessment of the types and quantities of materials whose production may have to be organised in petrochemical industries;

(b) To evolve a suitable pattern for development in India in the context of the integrated pattern of production of petro-chemicals in advanced countries;

(c) To assess the extent to which the aromatic as fell as aliphatic raw materials may have to be produced as petrochemicals during the period 1961 to 1971;

(d) To recommend the pattern of development of petro-chemical industries in the country.

II. *Institute Francais Du Petrole (French Institute of Petroleum) Study-Team*: (1962-63)

(i) *Composition*:

A team headed by Dr. H. E. Henny, Chemicals Division (Industrial Applications) I.F.P.France.

(ii) *Terms of Reference*:

(1) To examine to what extent the existing and licensed industrial units, both in the private and the public sectors, will meet the country's estimated 1966 and 1971 demands for petro-chemicals (including fertilizers) to be produced from petroleum or gas and wherever necessary, put forward proposals, along with related investment estimates, for starting new units or for increasing the capacities of existing units, to meet the deficit in petrochemicals. In assessing the exisiting and potential productive capacity in the country, suitable allowances will be made for the production that will result from the maximum possible utilization of indigenous raw materials emanating from the coal and steel industries and from the fermentation industries.

(2) Keeping in view the hydrocarbon raw materials likely to be available from petroleum in the country in general, and particularly in the Gujarat, Gauhati and Barauni areas, and of natural gas and associated petroleum liquids in the Assam and Gujarat areas, to recommend an immediate as well as a long-term programme for the production of petrochemicals with a view to making the fullest and the most advantageous use of the available raw materials. Imported hydrocarbon raw materials may also be considered, wherever necessary, on a short-term basis.

(3) To recommend specific proposals regarding:

(a) What particular petro-chemicals should be produced in what quantities, by what processes and what stages.

(b) The areas where production should be centred and the raw materials to be used in those respective areas.

(c) The utilization of the by-products.

(d) The aproximate investment cost and running costs broken down into approximate rupee and foreign exchange components. The cost calculations will take

into consideration the Indian construction costs and the costs of feedstocks (including existing duties, if any, therein) and of intermediate products, etc. and will be sufficiently accurate and detailed to enable Government to arrive at definite conclusions regarding the economic feasibilities of the particular projects.

(e) The feasible selling price of the products.

(f) The export possibilities for the chemicals to be manufactured.

4. To advise the Commission on request, on any specific proposals for petrochemical development that may be formulated by or for the Commision.

III. *Planning Group for Petro-Chemicals*

(i) *Composition*

1. Shri P. R. Nayak,
Chairman, Oil & Natural
Gas Commission. — *Chairman and Convener*

2. Dr. S. H. Zaheer,
Director General,
C.S.I.R., New Delhi. — *Member*

3. Dr. G. P. Kane,
Deputy Director General
(Chemicals), Directorate General
of Technical Development. — *Member*

4. Shri N. N. Kashyap,
Joint Secretary,
Ministry of Petroleum and
Chemicals. — *Member*

5. Shri L. Kumar,
Senior Industrial Adviser
(Petrochemicals),
Directorate General of Technical
Development. — *Member*

6. Shri M. Satyapal,
Director (Industry),
Planning Commission. — *Member*

7. Shri C. Balasubramanian
Deputy Secretary,
Ministry of Industry. *Observer*

At the instance of the Chairman, it was later decided to include the following persons in the Group:

8. Dr. M. G. Krishna, Deputy Director,
Indian Institute of Petroleum - *Member*

9. Shri B. Subha Rao, Under Secretary,
Ministry of Petroleum *Alternate to*
& Chemicals. Shri N. N. Kashyap

10. Dr. J. S. Ahluwalia,
Assistant Director, Indian
Institute of Petroleum *Member*

(ii) *Terms of Reference*:

1.0. *Scope*

The Group will:

1.1. make a critical review of the estimates of demand for petro-chemicals during the Third and Fourth Plan periods;

1.2. review the progress of scehemes already under implementation and estimate the position likely to be reached at the end of the Third Plan;

1.3. review the availability of petrochemical feedstocks during the Third and Fourth Plan periods taking into account crude oil refining capacity and availability of natural gas;

1.4. recommend schemes for fulfilling any shortfalls in Third Plan Targets taking into account 1.1. and 1.2; and

1.5. recommend a phased programme of development for meeting Fourth Plan targets, including location, optimum size, investment, etc.

2.0. In preparing its report, the Group will give its special attention to:

2.1. Availability of naphtha for petrochemicals taking into account the plans for fertiliser plants during the Third and Fourth Plan periods;

2.2. the phasing of petrochemical projects with the object of dovetailing the demand and production of petrochemicals;

2.3. the economics of petrochemicals production and the necessity for reduction of excise duties on intermediates, reduction in rail transport cost for naphtha etc.

2.4. the development of consulting and design organisations in the country;

2.5. estimating the technical personnel required for the construction and operation of plants.

IV. *Working Group for Planning the manufacture of Petro-Chemicals during the Fourth Plan Period*

(i) *Composition*

(a) *Working Group*

1. Shri Nakul Sen
Secretary,
Ministry of Petroleum
& Chemicals, — *Chairman*

2. Shri P. R. Nayak
Chairman,
Oil & Natural Gas
Commission,
New Delhi. — *Member*

3. Shri R. R. Bahl,
Officer on Special
Duty (Petrochemicals)
Oil & Natural Gas
Commission,
New Delhi. — *Member*

4. Dr. A. Nagaraja Rao,
Adviser (Industry & Minerals),
Planning Commission,
New Delhi. — *Member*

5. Shri M. Satyapal,
Director (Chemicals),
Industry & Mineral Division,
Planning Commission,
New Delhi. — *Member*

6. Shri N. N. Kashyap,
Managing Director.
(Refineries Division)
Indian Oil Corporation,
New Delhi. — *Member*

7. Dr. Ajit Mazoomdar,
Joint Secretary,
Department of Coordination,
Ministry of Finance,
New Delhi. *Member*

8. Dr. G. P. Kane,
Deputy Director
General (Chemical),
Department of Technical
Development,
Ministry of Industry & Supply,
New Delhi. *Member*

9. Shri S. Samaddar,
Deputy Secretary,
Ministry of Petroleum
& Chemicals,
New Delhi. *Member*

10. Dr. M. G. Krishna.
Director,
Indian Institute of Petroleum,
New Delhi. *Member*

11. Dr. J. S. Ahluwalia,
Assistant Director,
Indian Institute of Petroleum,
New Delhi. *Member*

12. Shri L. Kumar.
Adviser (Petrochemicals),
Ministry of Petroleum
& Chemicals,
New Delhi. *Member*

(b) *Sub Group*

1. Shri R. R. Bahl.
2. Dr. G. P. Kane.
3. Dr. Ajit Mazoomdar.
4. Shri M. Satyapal.
5. Shri L. Kumar.

(ii) *Terms of Reference*:

The Planning Group constituted *vide* Office Memorandum No. 5 (9)/63—Ind. Coord., of the Ministry of Industry dated the 1st October, 1963, submitted in April, 1964, a report on the development of

petro-chemicals industries during the Fourth Plan period and the early years of the Fifth Plan. This was discussed with the Planning Commission and concerned Ministries.

A number of developments had since taken place and as such a Working Group was set up to reassess the present position with special attention to the following:

(1) Minimum targets of manufacture of petrochemicals which must be achieved by 1970/71 for the country as a whole.

(2) Location of manufacturing units to meet the minimum targets with particular reference to:

(a) production at the lowest possible investment and operating cost;

(b) continued availability of raw materials; and

(c) regional demands of petrochemicals so far as these can be anticipated.

(3) The capital investment and foreign exchange required for the above programme.

(4) The role of the public and private sectors in this field.

(5) Advance action required to be taken during the Fourth Plan for the schemes envisaged to be completed in the early years of the Fifth Plan.

APPENDIX II

Summary of Recommendations/Conclusions

S. No.	Reference to Para No. of the Report	Summary of Recommendations Conclusions
(1)	(2)	(3)
1	1.24	The Committee consider that the development of petro-chemical industries in the country should have been planned at the time of setting up of the three refineries in the private sector in 1954—57. They regret that there was absence of integrated planning on the part of the Government which only thought of setting up the refineries to meet the demand for petroleum products but did not simultaneously consider the development of the petro-chemical industry in which vast developments were taking place in the developed countries and which were increasingly being used to supplement or substitute conventional raw materials. The Committee note that during the Second and Third Plan periods large quantities of organic chemicals which could be produced from petro-chemicals were imported from abroad. Moreover, naphtha which is the base for the production of petro-chemicals was surplus in the country from 1956 itself and exports of naphtha of the order of about 200,000 tons per annum were made from 1957 to 1962 and over 300,000 tonnes from 1962 onwards. Had the development of petro-chemicals been thought of along with the setting up of these refineries surplus naphtha could have been put to good use for the production of petro-chemicals which would have saved considerable foreign exchange which is now being spent on their imports.
2	1.29	The Committee note that in view of the highly capital intensive nature of the petro-chemical industry, basic petro-chemical projects which would supply raw material to other units, like naphtha cracker, aromatics extraction plant etc., are mostly being set up in the public sector and that downstream units which would manufacture end products, would generally be set up in

(1)	(2)	(3)
		the private sector. Since the petro-chemical industries have a profound impact on the industrial economy of the country and since these industries offer vast scope for substitution of conventional raw materials such as cotton, wool, rubber, steel, cement, non-ferrous metals, vegetable oils and fats, it is imperative that Government should take effective measures for the rapid development of these industries. The Committee would like to emphasise that public sector should take initiative in accelerating the pace of development in this regard wherever considered necessary.
3	2.12	The Committee regret to observe that against the tentative target of 85,000 tonnes of plastics to be manufactured during the Third Plan period, the capacity licensed was about 71,000 tonnes and the actual production was 27,000 tonnes only. The Committee find that the imports of plastics i.e., P.V.C., polyethylene and polystyrene during the last year of the Third Plan (1965-66) was of the order of 3,860 tonnes valuing Rs. 83·30 lakhs. They consider that had the plastic units been commissioned in time, the heavy imports on account of plastics could have been largely eliminated. They hope that concerted measures would now be taken to set up these thermoplastics units without further delay.
4	2.17	The Committee realise that in view of the altered circumstances, it is necessary to readjust the targets to correspond to the realities of the economic situation prevailing in the country. They would, however, stress that the final targets of production of petro-chemicals during the Fourth Plan should be realistic and co-related to the demand of organic chemicals as nearly as possible, so as to make the country self-sufficient in this vital sphere.
5	2.20	The Committee note that while an investment of the order of Rs. 56 crores was made in the petro-chemical industries in the private sector during the Third Plan period, nothing whatsoever was done in the public sector even though the need for public sector to take initiative in setting up basic industries had been realised

(1)	(2)	(3)
		around 1962-63. The Committee cannot but feel unhappy over the liesurely way Government has handled the development of petro-chemical industry. Had Government taken timely action to implement the decision to set up petro-chemical complexes, the country would have by now, made substantial progress in the development of petro-chemical industries.
6	2.27	The Committee have already emphasized the imperative need to accelerate the development of petro-chemical industries in the country in view of their importance to the National economy. They hope that in allocating funds during the Fourth Five Year Plan, Government would ensure that necessary resources are allocated to these industries on a priority basis.
7	2.29	The Committee note that though according to the I.F.P. Report, the Bombay petro-chemical complex was to start up in 1966, only some of the major schemes of this complex were completed in 1967 while others will be completed by the middle of 1968. The delay is regrettable as they consider these schemes of fundamental importance in the development of petro-chemical industry which would greatly help the industrial development and the economy of the country. They have no doubt that the commissioning of the Bombay schemes will go a long way in meeting the demand of organic chemicals in the country and reducing their imports.
8	2.35	The Committee are constrained to observe that the Gujarat petro-chemical complex which is in the public sector and which was approved by the Government of India in December, 1963 has not progressed satisfactorily. According to I.F.P. Report, the first stage of this complex was scheduled to start up from 1966. Even the Planning Group report had envisaged that the naphtha cracker would commence operation as early in 1968 as possible. It appears that the benzene and toluene plants would now be ready by the end of 1968. The other units viz. Xylenes and D.M.T. are nowhere in sight as the contracts for these units have not yet been finalised. The naphtha cracker scheme is still under negotiation. On the other hand a number of units of

(1)	(2)	(3)
		the Bombay complex which is in the private sector and was approved about the same time in 1963, have been commissioned and the others are about to be commissioned by the middle of 1968. The delay in the setting up of the Gujarat complex has resulted in non-utilisation of naphtha from the Gujarat refinery and the import of organic chemicals which would have been produced in this complex. The Committee realise the difficulties in securing foreign collaboration for this project on acceptable terms. But they feel that time taken in discussing preliminary proposals for this complex i.e. about 3 years between 1964 and 1966 was too long. The Committee hope that concerted efforts will now be made to finalise the agreements for D.M.T. and Xylenes Units and the naphtha cracker plant as early as possible so that these projects are expeditiously commissioned.
9	2.38	The Committee are glad to note that the processes to be used at Brauni Complex would be the same as at the Gujarat Complex which will no doubt result in considerable economies in costs of construction and operation. They hope that the pilot plant tests and other necessary investigations would be completed soon and the work on the first phase of the aromatics plant at Barauni commenced as soon as the agreement for the Gujarat Complex is finalised.
10	2.43	The Committee consider it unfortunate that the Methanol Plant of the Fertilizer Corporation of India at Trombay is working at about half its rated capacity, resulting in an annual loss in production amounting to about Rs. 1.5 crores. Since this plant was set up on a turn-key basis, the Committee would urge that the foreign collaborators should be obliged to fulfil the contractual obligation. Suitable measures should also be taken to ensure that the plant attains its maximum rated capacity at an early date.
11	2.44	The Committee would further suggest that the demand for methanol should be assessed in a realistic manner, and if necessary, steps to instal additional capacity for methanol production be taken well in time to avoid its imports.

(1)	(2)	(3)
12	2.48	The Committee regret to observe that the price of methanol charged by the Trombay Unit of the Fertilizer Corporation of India is much higher compared to the price prevailing in other countries. The Committee urge that the reasons for the high prices charged by this unit should be investigated and effective measures taken to reduce them so as to make it available at cheaper rates to the consumers.
13	2.53	The Committee deprecate the delay in taking final decision on the applications for the manufacture of methyl methacrylate, particularly when intermediate product acetone which is the raw material and an outlet for this secondary or tertiary product will be produced on a commercial scale from April, 1968 in the N.O.C.I.L. complex, which has since been commissioned. This is indicative of lack of proper and coordinated planning for the utilisation of the secondary products of the basic complex at Bombay. The Committee urge that decision to licence one of the parties for the manufacture of methyl methacrylate should be taken without further delay.
14	2.62	The Committee are perturbed to observe that eleven nylon yarn/cord units, based on caprolactam have been set up/licensed in the country without simultaneously ensuring the indigenous supply of the main raw material viz., caprolactam with the result that caprolactam is being imported and will continue to be imported at a considerable cost till 1971 which would strain the foreign exchange position of the country. The import of caprolactam in 1965-66 amounted to Rs. 76 lakhs and in 1966-67 to Rs. 106 lakhs. With the commissioning of all the eleven units the imports of this raw material will increase further and is expected to go up to Rs. 5.00 crores in 1969-70. It appears to the Committee that the basis for licensing these units was the anticipated manufacture of indigenous caprolactam by the two units viz. M/s. Nirlon Synthetic Fibres and Chemicals Ltd. and M/s. Gujarat Polyamides Ltd., to whom licences were issued for the manufacture of nylon yarn/cord and the production of 5000 tonnes each of caprolactam as early as 1968. These two units were intended to produce caprolactam not only

(1)	(2)	(3)
		to meet their own requirements of feedstock for the production of nylon yarn/cord, but also to meet the requirements of other similar units which were licensed later on. It is not clear to the Committee why these two units were allowed to go ahead with the setting up of the plants for the manufacture of nylon fibre and cord although they had made no progress in the setting up of the integrated unit for the production of basic raw material viz., caprolactam. It took seven years for the Government to revoke the licences of these units for the manufacture of caprolactam. The holding of licences by these units all these years foreclosed capacity in this line and blocked the entry of other entrepreneurs who may have taken up its manufacture in the meantime. The period of validity of the licences was extended from time to time. Further the Committee are also unable to appreciate why the capacity of the three units for the manufacture of nylon yarn was expanded and some other units licensed to be set up based on caprolactam, when no progress had been made for its indigenous manufacture. The Committee consider that proper care was not taken by the administrative Ministry/licensing authorities in this regard resulting in heavy maintenance imports for keeping these industries running. The Committee recommend that a thorough enquiry should be made into this matter with a view to fix responsibility.
15	2.67	The Committee are glad to note that Government is intending to keep a watch on the production costs and selling prices of petro-chemicals. Since the cost of production and selling prices are taken into account at the time of sanctioning the schemes and issuing of licences, it is necessary that Government should exercise a broad control over prices to ensure that after the commissioning of the plants, the prices are generally in conformity with the original stipulations. The Committee consider that such a step will help to keep the rising prices under control to a large extent.
16	2.72	The Committee regret to note that the existing provisions under the Industries (Development and Regulation) Act and Rules made thereunder

(1)	(2)	(3)
		do not provide for any stipulation in the nature of legal sanction, to force the entrepreneur to earmark a certain portion of his product for export, although he may have agreed to abide by the export obligation at the time of the issue of licence. The Committee hope that the proposal to amend the Industries (Development and Regulation) Act would be finalised by the Ministry of Industrial Development and Company Affairs at an early date so that effective action could be taken in the event of wilful default in fulfilling export obligations.
17	3.4	The Committee note that naphtha of the order of 200 thousand tonnes per annum became surplus to the requirements of the country from 1957 onwards and had to be exported as no petro-chemical complexes were planned in the country to utilise this naphtha simultaneously with its availability in substantial quantities in 1957. In fact the first Committee to consider the development of petro-chemical industries in the country was set up only in 1960. The Committee regret that there has been no forward planning in this respect. As already observed by the Committee the planning for the petro-chemical industries should have been thought of simultaneously with the setting up of the coastal refineries in the country.
18	3.8	(i) The Committee are glad to note that the whole energy picture in the country is being studied afresh and that the Government are busy making an estimate of the forecast of the naphtha requirements upto 1975-76. This becomes important in view of the requirements of naphtha for the production of fertilisers which are in great demand. The Committee urge that these studies should be completed as early as possible so as to enable the planning of production of petro-chemicals and fertilisers on a realistic basis. The Committee have no doubt that in this study the World trends in the consumption of naphtha and its availability and price in future would also be kept in view.
19	(Sub-para)	(ii) It is also necessary to consider the utilisation of natural gas in a larger measure for the production of fertilisers and petro-chemi-

(1)	(2)	(3)
		cals. In this connection the Committee understand that in the U.S.S.R. acetylene from natural gas has become fairly popular. The Committee therefore, suggest that feasibility of utilisation of natural gas for this purpose in this country may also be considered.
20	3.9	The Committee further note that in West Germany there has been a tendency for the larger petro-chemicals firms to adopt processes that could utilise any number of feedstocks such as whole crude, natural gas, coke-oven gas or naphtha in order to take advantage of the cheapest feedstock in the market. The Committee hope that this changing pattern would be kept in view while selecting the processes for the manufacture of petro-chemicals in the country.
21	3.14	The Committee note that the price of naphtha as charged by the ESSO and Burmah Shell Refineries from the petro-chemical industries varies from each other. While the ESSO bills at the provisional rate of Rs. 106.97 per tonne, the Burmah Shell charges at the rate of Rs. 131.30 per tonne. Since the price of naphtha which is the principal raw material for the petro-chemical and fertiliser industries, has a vital bearing on the prices of intermediates and end-products, the Committee recommend that Government should keep a close watch and exercise effective control over the price of naphtha so as to ensure that it is available to the basic petro-chemical industries at competitive prices and that the prices of the end-products to the consumer are economical.
22	3.17	The Committee are glad that the Railway Board has given freight concession for the movement of naphtha in a few cases. They hope that the question of extending this concession in all cases where naphtha moves as a feedstock for fertilizers and petro-chemical manufacture would be given due consideration and an early decision taken in the matter.
23	3.23	The Committee note that the imports of organic chemicals in the country have been quite high. In view of the ever increasing utilisation of petro-chemicals and their potential to save scarce foreign exchange through import substitu-

(1)	(2)	(3)
		tion, the Committee urge that effective measures should be taken to develop petro-chemical industries on a high priority basis, specially those which would help to save imports of fibres, non-ferrous metals, synthetic rubbers etc.
24	4.5	The Committee note that the work relating to planning and development and research in petro-chemicals in the country is at present being done by the following: (i) Technical Cell in the Petro-Chemical Division of the Ministry of Petroleum and Chemicals. (ii) Project Division and Petro-Chemical Division of the Indian Institute of Petroleum, Dehradun. (under CSIR). (iii) Petro-chemicals Division in the O.N.G.C., Dehradun. (iv) Industry and Minerals Division (Chemicals Section) in the Planning Commission. (v) Directorate General of Technical Development. The Committee consider that the setting up of so many agencies to deal with petro-chemicals results in the dispersal of already scarce expertise in this important and growing industry and is not conducive to taking of expeditious decisions regarding the planning and development of this industry in the country. Moreover, the existence of multifarious organisations tends to blur responsibility. Such an arrangement is also likely to result in over-lapping of functions, duplication of efforts and wastage of resources. It appears that the existence of all these agencies is a matter of historic growth rather than of rational and deliberate planning. The justification for having Divisions/Sections in the O.N.G.C., Planning Commission and D.G.T.D. requires to be examined closely. The Committee recommend that the whole matter regarding the organisations necessary for planning and development of petro-chemicals in the country should be thoroughly examined with a view to having a well coordinated set up for integrated and expeditious development of this industry.

(1)	(2)	(3)
25.	4.10	The Committee are constrained to observe that in spite of the recommendations made by the I.F.P. Team in 1963 and the Working Group in January, 1965 for the setting up of an integrated organisation for petro-chemicals in the public sector, no such organisation has yet been set up. On the other hand benzene and toluene plants are being erected as a part of the I.O.C.—Gujarat Refinery which gives the impression that the organisational matters regarding the setting up of petro-chemical complex in public sector are being dealt with in an *ad hoc* manner. The slow progress in the setting up of petro-chemical complexes in the public sector may partly be attributable to the absence of a central organisation. The Committee urge that the setting up of a petro-chemical Corporation which is stated to have been agreed to in principle, should be expedited so that the work of organising petro-chemical complexes in the public sector is undertaken systematically in right earnest. The Committee are happy to note that M/s. Engineers India Limited have been closely associated with the detailed engineering, procurement of indigenous equipment and construction of the Aromatics complex and the naphtha cracker at Koyali, Gujarat. The Committee note that in these matters this organisation is working in close collaboration with the O.N.G.C. They are unable to appreciate why the two organisations in the public sector *viz.* O.N.G.C. and Engineers India Limited are working in the same field. It appears that expertise in design engineering is dispersed in various organisations like the Project Division of the Indian Institute of Petroleum, the O.N.G.C. and M/s. Engineers India Ltd. The Committee suggest that the expertise in design engineering should be integrated in one organisation, which should undertake all work relatinf to process engineering, detailed engineering, erection etc. of petro-chemical complexes.
27.	5.4	The Committee are glad to note that Government are purchasing know-how on an outright basis in respect of the petro-chemical complexes which are being set up in the public sector. The Committee would, however, like to emphasise that in purchasing know-how, Government

(1)	(2)	(3)
		should guard against acquiring obsolescent technological processes which may some times be available at low initial cost, as that would put the country at a distinct economic disadvantage in comparison with other advanced countries. The Committee would further urge that Government should emulate the example of Japan in improving upon imported technology as continued dependence on borrowed technology, apart from putting the country at a competitive disadvantage, is also harmful technically and economically. The indigenous innovation on imported technology would not only save scarce foreign exchange which is to be paid in the shape of royalty etc. but would also make the scientists and technologists self-reliant and confident. The Committee hope that Government would take effective measures for the development of indigenous technology in this vital industry as early as possible.
28	5.7	It is well recognised that petro-chemical industry is characterised by rapid technological developments and therefore, proper establishment of the industry in the country must be supported by research carried out within the country. The Committee are glad to learn that research in petro-chemicals has been undertaken in some institutes/laboratories. They, however, consider that the existing arrangements of coordination between the various organisations engaged in research on petro-chemicals require to be further strengthened for mutual benefit and to avoid overlapping and duplication of research efforts and expenditure.
29	5.8	The Committee further suggest that arrangements should be made to give wide publicity to the research carried out and facilities available in these organisations by bringing out annual reports and technical bulletins from time to time for the benefit of the industry.
30	5.15	The Committee are happy to note that it is now possible to do complete design of off-sites and practically all the civil, structural and electrical design including a major portion of the instrument design or detailed engineering in respect of battery limits in the country itself. In certain cases some parts of the process engineering can also be undertaken within the country. All

(1)	(2)	(3)
		these factors have reduced the foreign exchange expenditure on such services by almost half. The Committee note that to facilitate indigenous fabrication of plant and equipment, the import of raw material required by the Chemical Plant manufacturers has also been included in the priority industries. The Committee hope that this trend would continue to be encouraged, as it would go a long way in making the country self-reliant in this respect. In this connection, the Committee would urge that the suggestion made at the Seminar of the Chemical Plant Manufacturers Association to set up a Consortium to undertake turn-key contracts for the manufacture of complete chemical and fertilizer plants, should be given earnest consideration and encouragement by Government.
31	5.19	The Committee are glad to note that indigenous capacity for the manufacture of major machinery required for processing plastics has been established in the country. They hope that this will fully meet the growing requirements of plastic processing units in the country thereby obviating the need for imports on this account.
32	5.24	The Committee note that a broad estimate of the requirements of senior trained technical personnel for the petro-chemical complexes to be set up in the public sector as well as the requirements of technical manpower for the processing industries in plastics, rubber, synthetic detergents and synthetic fibres has been made. They are glad to note that a Training Institute for imparting training in moulds, dies and tools for plastic processing is being set up at Guindy in Madras. The Committee urge that the Institute should be set up at an early date so as to meet the requirements of the technical personnel for the plastics industry.
33	5.25	The Committee also suggest that necessary arrangements to provide training facilities for the technical manpower required by rubber processing and other petro-chemical industries may also be made by Government as the required number of skilled and trained personnel for these new industries may not be available in the country.

(1)	(2)	(3)
34	5.26	The Committee would further point out that the four main types of training for the senior technical personnel to meet the requirements of petro-chemical complexes in the public sector were suggested by the I.F.P. Team in 1963. These were: '(a) On-site training during the plant construction period. (b) Practical training in factories in India, principally for foremen. (c) Training courses in Indian technical institutes under the guidance of Indian and foreign instructors, principally for junior engineers and foremen. (d) Overseas training for senior engineers and specialized engineers such as instrument engineers. This part of the training is to be arranged by foreign engineering companies process licensors and equipment suppliers. The Study Team had also observed that "Failure to obtain and train the necessary number of Indian personnel will make it necessary to hire overseas personnel and employ them both on shift work and in executive positions. To replace an Indian engineer by a foreign one will be extremely expensive." The Committee agree with the above observations and recommend that necessary arrangements to provide for the training of senior personnel for the petro-chemical complexes should be made by Government at an early date and the Committee informed of the action taken in the matter.
35	6.3	Rapid industrialisation, particularly the setting up of the refineries, fertiliser plants and petro-chemical complexes in the country is bound to create the problem of air and water pollution, as these industries especially, petro-chemicals plants, emit a variety of foul gases and discharge potentially dangerous effluents. There is therefore an urgent need to guard against air and water pollution, particularly in areas where these industries are concentrated. The Committee consider that if the poisonous effluents

(1)	(2)	(3)
		and obnoxious gases are allowed to be discharged untreated, they are bound to pose a big health hazard to the population in the areas surrounding these complexes. The Committee, however, note that a central legislation to deal with the disposal of industrial wastes and foul gases from plants is under consideration of Government. They urge that the Ministry of Petroleum and Chemicals should vigorously pursue the matter with the Ministry of Health so that a central legislation on effluent disposal criteria is enacted soon.
36	7.4	The Committee regret to observe that this important industry which could play a significant role in the economy of the country, did not receive the attention that it deserved from the very beginning with the result that no significant headway has been made in the setting up of petro-chemical industries and the country has to depend for most of its requirements in petro-chemicals on imports. It is only after a time lag of about a decade that the petro-chemical industry is now engaging the attention of Government.
37	7.5	The progress in the setting up of petro-chemical complexes in the country especially in the public sector, has not been very satisfactory. Except for the Methanol Plant which has been set up in the Trombay Unit of F.C.I. nothing has so far been done in the public sector in the field of petro-chemicals. The Committee note that while some units of the petro-chemical complex in the private sector at Bombay (NOCIL) have been commissioned recently and commercial production may start towards the end of 1968, the public sector complex at Koyali (Gujarat) is still in its preliminary stages. It is unfortunate that public sector which should have been the pace-setter in this industry, has lagged behind. The Committee hope that determined and effective measures would be taken to set up the complexes at Koyali and Barauni at at an early date so as to make up for lost time. It would, however, be quite some time before the countryy catches up and finds a place on the international petro-chemical map.

(1)	(2)	(3)
38	7.7	The Committee feel that there is not much to be gained in planning petro-chemical complexes unless the establishment of such complexes is synchronised with the establishment of other units—consumer and ancillary industries—which utilise the products of the basic complex. Since the petro-chemical products are to be used as intermediates in other industries it is obvious that unless the other industries are also developed simultaneously, petro-chemical production will suffer.
39	7.8	The Committee have, in para 2.62, pointed out how planning has erred in licensing a number of consumer industries without simultaneously arranging for the production of intermediate raw materials within the country. Unless adequate attention is paid to proper scheduling and coordination of petro-chemical projects, there is likelihood of similar mistakes being repeated now in the reverse direction. The Committee would, therefore, stress the importance of maintaining close co-relation between the basic manufacturing and the secondary and tertiary programmes in the planning of petro-chemical complexes.
40	7.9	The Committee note that fast technological improvements are taking place in petro-chemical industry which is highly sophisticated. The scope for technological research and innovation is very wide. In fact technological innovations and obsolescence are the very characteristics of petro-chemical industry. The developing countries trying to enter the petro-chemical field have to encounter a large number of initial difficulties. There is need to safeguard against acquisition of already obsolescent processes. The Committee realise that basic research in this field is expensive and, therefore, purchase of advanced technology in the early stages is a necessity. In the beginning, the country will have to import a large quantity of technological equipment as well as process engineering "know-how". Simultaneously an intensive research and development programme must be started so that the drain on foreign exchange is reduced to the minimum. It is obvious that the progress in the direction of

(1)	(2)	(3)
		developing our own know-how cannot be expected to be quick but there should be no continued dependence on imported technology also.
41	7.10	The Committee cannot too strongly emphasise that an extensive research and development programme should be organised in this field. For this purpose, they suggest that Government should encourage and strengthen purposeful and industry-oriented research in petro-chemicals, so as to improve and innovate upon purchased know-how with the ultimate objective to do away with dependence on imported technology and to make the country self-reliant without always relying on foreign technical collaboration and know-how.

APPENDIX III

(*Vide* Introduction) ..

Analysis of recommendations contained in the Report.

I. CLASSIFICATION OF RECOMMENDATIONS

A. Recommendations for improving organisation and working:

Serial Nos. 2—8, 10, 11, 13, 14, 16—22, 24—26, 28—41.

B. Recommendations for effecting economy:
Serial Nos. 1, 9, 12, 15, 23 & 27.

II. ANALYSIS OF MORE IMPORTANT RECOMMENDATIONS DIRECTED TOWARDS ECONOMY

S. No.	S. No. as per Summary of Recommendations (Appendix II)	Particulars
(1)	(2)	(3)
1.	1	The petro-chemical industry is a sequel to petroleum processing and refinery operations. Yet the development of petro-chemicals has not gone hand in hand with the setting up of refineries in the country between 1954—57. Co-ordinated planning could have put surplus naphtha to good use, thereby saving considerable foreign exchange spent on the import of petro-chemicals.
2.	15	It is imperative that Government should exercise a broad control over prices of petro-chemical products once the plants are commissioned to ensure that these are in conformity with the original stipulations. Such a step would keep a check on rising prices.
3.	23	Market potential and versatile nature of petro-chemicals to save scarce foreign exchange through import substitution calls for concerted measures to develop the petro-chemical industries, specially those which help to save imports of scarce fibres, non-ferrous metals, synthetic rubbers etc., on a high priority basis.

(1)	(2)	(3)
4	27	Obsolescence and technological innovations are the very characteristics of petro-chemical industry. There is need to safeguard against acquisition of obsolescent processes, which could obviously put the country at a distinct economic disadvantage. Moreover, continued dependence on imported technology is also harmful technically and economically. Therefore, an intensive research and development programme should be organised in this vital field as early as possible so that the drain on foreign exchange is reduced to the minimum.

GMGIPND—LS I—3313 (Aii) LS— 19-3-68—1339.