UNITED NATIONS

ECONOMIC
AND
SOCIAL COUNCIL

GENERAL
E/CN.12/629/Add.1
21 November 1962
ORIGINAL: ENGLISH

ECONOMIC COMMISSION FOR LATIN AMERICA

THE MANUFACTURE OF BASIC INDUSTRIAL EQUIPMENT IN ARGENTINA

II. The production, transport and refining of petroleum and natural gas: the petrochemical industries

Note: This text has not been revised or edited. It should therefore be considered only a working draft.

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/1. Introduction

1. Introduction

The purpose of the present study is to estimate the extent of the demand for basic industrial equipment for the petroleum, natural gas and petrochemical industries in Argentina over the period 1962-1970 and to investigate the factors which condition the manufacture of such equipment within the country.

The demand for basic equipment has been assessed in terms of the quantity of each type of process equipment which will be required throughout the 1962-1970 period. The amounts of specification steels most commonly required for the fabrication of process equipment and the quantities of common steel have also been tentatively assessed in order to determine the minimum expected potential load on the manufacturing sectors of the steel industry.

The assessment of the potential demand for process equipment for the petroleum industry is based on prospective projects resulting from the forward estimates prepared by the Secretaría de Energía y Combustibles for the consumption of petroleum derivatives over the period and on the crude oil production programme released by Yacimientos Petrolíferos Fiscales (YPF), the whole corresponding to an overall growth rate of something like 5.6 per cent per annum in demand for crude.

The estimated demand for equipment covers the piping, valves and fittings required for the drilling and production programme of crude oil and natural gas plus the basic equipment demand for new refineries deemed necessary to provide for the yearly increase in the consumption of petroleum products. The requirements for maintenance of the equipment in operation during the period have been prognosticated on a tentative basis due to the scarcity of information available in this respect. They also include sufficient new refinery plant to replace old and obsolete equipment.

The total estimated demand of equipment includes further the additional storage facilities for crude oil and refined products deemed necessary for accompanying the programmed increases in the production of these materials.

For the time being, equipment for the transportation of crude oil (and/or products) otherwise than in pipelines have not been included in the study.

/The estimates

The estimates for basic equipment for the very considerable development in the gas industry have been based on information supplied by Gas del Estado. Emphasis is given to the installation of the Gasoducto del Sur with 1 720 kilometres of 30" pipeline, and the Gasoducto del Este with some 1 400 kilometres of main pipeline. Branch and distributing lines, gas compressing stations, gas treatment and gasoline recovery plants required alongside the existing or projected gas lines have been considered in the study.

The equipment required for the construction and/or expansion of gas terminals was not considered.

The amounts of plant and equipment to be installed by the petrochemical industry during 1962-65 for projects already approved by Government have been determined from the data available and supplied by the Ministry of Economy. In the absence of any approved scheme for the development of the petrochemical industry during 1966-70, the amounts of basic equipment which will be required over the period have been assumed for the purpose of this assessment to be the same as those which will be installed during 1962-65.

/2. Summary

2. Summary

The total capital expenditures in the petroleum, natural gas and petrochemical industries during the 1962-70 period are estimated to be in the vicinities of the following values:

	1962-70[a/] (US$)
Petroleum industry	706 000 000
Gas industry	432 000 000
Petrochemicals	188 000 000
Totals	1 326 000 000

a/ These figures are inclusive of the land, process, engineering equipment, civil construction and erection work.

The requirements for basic industrial equipment are anticipated to be in the neighbourhood of the following orders of magnitude:

	1962-65 (US$)	1966-70 (US$)	Total (US$)
Petroleum industry	156 923 000	258 300 000	415 223 000
Gas industry	107 720 000	157 429 000	265 149 000
Petrochemicals	51 250 000	51 250 000	102 500 000
Totals	315 893 000	466 979 000	782 872 000

In terms of tons of steel, the prospective situation is as follows:

	1962-65 (tons)	1966-70 (tons)	Total (tons)
Petroleum industry	540 897	884 214	1 425 111
Gas industry	315 620	624 110	939 730
Petrochemicals	41 500	41 500	83 000
Totals	898 017	1 549 824	2 447 841

/When the

When the total requirements for basic equipment are broken down into their respective different categories of equipment, it is noticed that in short, approximately 61.0 and 72.0 per cent (by value) of the total demand over the 1962-65 and 1966-70 periods are for pipes.

	1962-65		1966-70		1962-70	
	(US$)	(%)	(US$)	(%)	(US$)	(%)
Total piping	193 308 000	61.0	337 488 000	72.0	530 796 000	68.0
Total equipment	315 893 000	100	466 979 000	100	782 872 000	100

Although the demand for basic equipment for the 1962-65 period is for some 898 000 tons of fabricated steel with a bare material value of 316 million dollars, two refineries for the national petroleum industry, and the Gasoducto del Sur for the natural gas industry are to be financed and built by foreign interests, and it is understood that substantially the whole of the fabricated equipment for these projects would be imported by the foreign investors leaving only a few items to be supplied from domestic sources.

The petrochemical industry as so far developed is privately owned by foreign interests who would import the whole of the basic equipment required for the projects already authorized for installation during the period.

Under these circumstances, the quantity of equipment to be purchased in the country diminishes to some 75 million dollars, a value which represents only 24 per cent of the total expenditures anticipated during the period.

The equipment fabricating industry has made considerable progress during the last four years and there is little doubt that with assistance from the government and adequate co-operation from the overall contractors and investors, it can already produce and supply in excess of 80 per cent (by value) of the plant required for the new projects scheduled for the 1962-65 period.

Of course, the most severe obstacle to this aim is the shortage of domestic capital to finance the local purchasing of the equipment to be paid for in pesos. However, if no action is taken to assist the equipment manufacturing industry and if substantially the whole of the process equipment required during this period is to come from foreign sources, the Argentine industry will miss many valuable opportunities over the coming years to expand its resources and improve the quality of its workmanship in this field of activity.

/The estimated

The estimated requirements for basic equipment during the 1966-70 period calls for some 1 549 824 tons of fabricated steel with an estimated bare material value of 467 million dollars.

If the various problems associated with the adequate supply of steel are properly solved, if there is a reasonable expansion of some of the existing fabricating facilities to permit the production of a wider range of types of equipment, if adequate assistance and co-operation continues to be obtained from the overall contractors and engineering companies and mainly if the problems of financing expenditures to be made in national currency are conveniently solved, then, there exist concrete possibilities that the Argentine equipment fabricating industry can reach during the period a position of producing and supplying about 94 per cent (by value) of all the basic equipment required.

It is finally concluded that the present position in which a substantial part of the basic equipment required throughout 1962-65 will be imported, creates an adverse situation for the equipment fabricating industry, and consideration should be given as soon as possible to the problem of ensuring that a large proportion of the requirements for the projects to be undertaken in the period 1966-70 can and will be manufactured in Argentina.

The petroleum refining, natural gas and petrochemical industries require very large capital investments in plant and equipment.

For many years, until there is enough Argentine capital available to finance large investment schemes, they shall be probably banked, at least partly, by foreign capital. It is therefore important to give consideration to examining the steps which could be taken to enable, under such conditions of shortage of capital, the expansion of the equipment industry and ensure that in the near future, in the 1966-70 period, a major proportion of all the demand for basic equipment may be purchased from local manufacturers. Some conditions suggested to be implemented are briefly summarized as follows:

/(a) The development

(a) The development of the equipment industry will largely depend on the financial assistance that can be provided to this sector of activity, especially in the form of working capital granted at reasonable rates to enable the industry firstly to finance the manufacture of its products and secondly to finance competitively the sale of the fabricated products. Simultaneously, domestic capital should be made available to Argentine entrepreneurs (private or governmental), at attractive rates, in order to ensure a maximum percentage of expenditures in domestic currency in purchasing equipment and services payable for in pesos.

(b) The industry must endeavour to make itself fully competitive with foreign suppliers in respect of the adopted standards of quality, workmanship, conditions of delivery and cost of its products. To achieve this end, the manufacturers of equipment should arrange for: (1) adequate suppliers of basic raw materials in the forms and to the specifications required, at the lowest possible cost; (2) it must provide itself with adequate mechanical equipment so that it can fabricate equipment in the sizes and quality of finish required; (3) establish the best possible standards and techniques of organization in order to avoid wastes of time and labour, and be able to meet deliveries in time and at low costs.

(c) In order to make sure that the industry has the opportunity to quote for a major portion of the basic equipment required, it could be made a condition that investors only employ those contractors who have established a purchasing department in Argentina and who also carry out a large portion of the mechanical design in the country thus contributing to the transfer of know-how in the field of mechanical design, manufacturing requirements and standards. It could also be indicated that when authorization for new investments is sought, preferences should be in favour of schemes which make full use of Argentine manufacturing sources.

/3. Overall balance

3. Overall balance of the consumption of energy

(a) Forward estimates of the total consumption of energy

During the last ten years the production of energy in Argentina has been greatly dependent on the utilization of petroleum and wood as fuels. Mineral carbon, natural gas and hydroelectricity played only a minor part within the general energetic framework.

From 1951 to 1960, petroleum derivatives and wood have accounted for an average annual release of energy of the order of 150 000 million calories, a value which represents some 87 per cent of all the energy produced annually in the country during the period.

The complete picture reported by Dirección Nacional de Energía y Combustibles is the following:

Table 1

(Percentage)

Year	Petroleum derivatives	Natural gas	Wood	Mineral carbon	Hydroelectric	Total
1951	66.3	3.8	20.8	8.7	.4	100.0
1952	66.0	3.9	21.1	8.5	.5	100.0
1953	66.7	4.2	20.2	8.3	.7	100.0
1954	69.0	4.2	18.4	7.6	.8	100.0
1955	71.5	3.9	16.8	7.1	.7	100.0
1956	72.0	3.9	17.1	6.1	.9	100.0
1957	73.2	4.2	16.2	5.4	1.0	100.0
1958	74.8	4.1	15.0	4.9	1.2	100.0
1959	73.2	4.1	15.8	5.4	1.5	100.0
1960	71.2	6.6	16.0	4.6	1.6	100.0

(In thousands of t.e.p)

Year	Petroleum derivatives	Natural gas	Wood	Mineral carbon	Hydroelectric	Total
1951	8 818	509	2 763	1 161	53	13 304
1952	9 223	552	2 953	1 184	67	13 978
1953	9 436	594	2 854	1 177	99	14 160
1954	10 224	606	2 739	1 120	114	14 803
1955	11 266	616	2 648	1 114	105	15 750
1956	12 134	655	2 853	1 029	158	16 829
1957	12 894	730	2 853	945	182	17 604
1958	13 735	742	2 741	898	220	18 337
1959	12 982	736	2 808	958	271	17 754
1960	13 314	1 216	2 990	862	289	18 670

/It can

It can be observed that the consumption of petroleum derivatives grew steadily throughout the period, with the exception of 1959. The drop of 753 000 t.e.p. registered with reference to the previous year resulted from a substantial and general raise in the prices of petroleum derivatives by the end of 1958; as a consequence, consumption decreased (gasoline, for instance, had its price triplicated).

Between 1951 and 1958, the consumption of petroleum derivatives progressed at a yearly cumulative rate of 6.5 per cent. The average rate registered for the decade 1951-60 is of the order of 5.4 per cent.

As to wood, the consumption has not varied greatly from 1951 to 1960 (average = 2 820 t.e.p. per annum). Vegetable fuels are a relatively poor source of energy[1/] and the competition of richer fuels together with the exploitation of more economic processes for releasing energy explain why the burning of wood has not expanded during the period. On the other hand, the apparent low cost of vegetable fuels is the major reason for the ample quantities of wood consumed.

The low grade of the Argentine coal together with the adverse location of the important deposits known to date (all of which are in the Southern extreme of Patagonia, in the Rio Turbio area) accounted for the small utilization of mineral carbon. Besides this, the modernization of the Argentine railway system, with diesel, diesel-electric and electric equipment replacing most of the old coal burning steam engines also weighted against mineral carbon.

Hydroelectric resources are not any better located than the coal mines, always too far away from the consumption centres. Transmission problems have not always appeared economic enough to advise the construction of hydro-stations. As a consequence, the thermal solution (fuel oil) has been widely adopted.

1/

Wood	3 000	calories/kg	Natural gas	9 300	calories/m^3
Coal (domestic)	6 200	" "	Petroleum	10 500	" /kg
Coal (imported)	7 500	" "			

/The extensive

The extensive utilization of natural gas has also suffered from the large distances encountered between production and consumption areas. The construction of gas lines calls for enormous investments which were not easily available or economically justified during the period. In 1960 the line from Campo Duran (Salta) to Buenos Aires was put in operation and the consumption of natural gas jumped to about 65 per cent above the 1959 level.

The estimates for 1961-70 show some important modifications in the energy balance of the country.

The programmes scheduled by Gas del Estado for the construction of new lines, storage and distributing facilities will give importance to the utilization of natural gas. It is anticipated that gas will replace wood as the second largest source of energy in Argentina. Together with petroleum derivatives, both will account for more than 80 per cent of the energy to be produced from 1961 to 1970. The following are the estimates of Secretaría de Energía y Combustibles:

/Table 2

Table 2

(Percentage)

Year	Petroleum derivatives	Natural gas	Wood	Mineral carbon	Hydroelectric	Total
1961	69.0	10.0	13.2	6.4	1.4	100.0
1962	67.3	12.7	12.2	6.3	1.5	100.0
1963	67.8	13.6	11.4	5.8	1.4	100.0
1964	66.5	15.7	10.3	5.7	1.8	100.0
1965	61.3	20.8	9.3	6.5	1.9	100.0
1966	62.6	20.9	8.5	6.0	2.0	100.0
1967	63.3	21.2	7.9	5.5	2.1	100.0
1968	64.4	20.2	7.2	5.9	2.3	100.0
1969	65.8	19.1	6.4	6.1	2.6	100.0
1970	66.6	18.8	6.0	5.9	2.7	100.0

(In thousands of t.e.p)

Year	Petroleum derivatives	Natural gas	Wood	Mineral carbon	Hydroelectric	Total
1961	14 060	2 030	2 680	1 300	285	20 355
1962	14 330	2 700	2 610	1 340	315	21 295
1963	15 120	3 040	2 540	1 290	320	22 310
1964	15 920	3 780	2 470	1 360	440	23 970
1965	15 890	5 380	2 400	1 670	495	25 835
1966	17 120	5 720	2 330	1 630	550	27 350
1967	18 110	6 090	2 260	1 590	600	28 650
1968	19 510	6 120	2 190	1 800	700	30 380
1969	21 860	6 320	2 120	2 010	880	33 190
1970	22 620	6 360	2 050	2 000	920	33 950

/The consumption

The consumption of petroleum products is expected to continue expanding upwards at a yearly average cumulative rate of the order of some 5.6 per cent.2/

Although the modernization policy of the national railways has contributed and certainly will continue contributing to reduce the demand for mineral carbon, the efforts made to develop the steel making industry will balance and eventually take up a substantial part of the consumption of coal. Exploitation of the Rio Turbio area will greatly help to meet this end.

Wood is expected to continue losing ground to richer fuels, thus declining in importance. It is envisaged that by 1970 only half of the wood burnt in the early part of this decade will be used to produce energy.

In the electric sector, Argentina has been to date largely dependent on thermal power and the estimates for the coming ten years confirm this point. Although decreasing towards the end of the period, the relative importance of thermal electricity is still higher than the one anticipated for hydro-power. The ratios expected between the quantities of both forms of energy to be generated during the 1961-70 period vary from a maximum of 10.1 in 1961 to 7.1 by 1970.3/

2/ The above total value anticipated by Secretaría de Energía y Combustibles are in line with the estimates prepared by the Argentine Committee to the World Energy Conference which shall take place in Melbourne, Australia in October 1962. Also, they are in reasonable agreement with the figures submitted by the major distributors of petroleum products operating in the country. The jump shown from 1964 to 1965 in the consumption of natural gas is due to operation of Gasoducto del Sud, the completion of which has been prognosticated by Secretaría de Energía y Combustibles for the early months of 1965.

3/ The estimates submitted by Secretaría de Energía y Combustibles are as follows:

Year	Thermal electricity	Hydro-electricity		Total electricity
1962-64	90%	10%	100%	38 255 GWh
1965-67	88	12	100	49 163
1968-70	87	13	100	62 940

/(b) Forward estimates

(b) Forward estimates of the consumption of petroleum derivatives

The estimates of Secretaría de Energía y Combustibles for the total consumption of petroleum derivatives during the 1961-70 period were indicated in item (a) in terms of t.e.p. (tons of equivalent petroleum).

Assuming an average specific gravity of 0.90 for crude oil, the total demand of petroleum is equal to the following thousands of m^3 and B.p.d.:

Table 3

Year	Total petroleum derivatives (in thousands of t.e.p.)	(in thousands of m^3)	(in B.p.d.) a/ b/
1961	14 060	15 615	273 000
1962	14 330	15 935	278 000
1963	15 120	16 810	293 000
1964	15 920	17 700	309 000
1965	15 890	17 675	308 000
1966	17 120	12 040	332 000
1967	18 110	20 160	351 000
1968	19 510	21 710	378 000
1969	21 860	23 200	424 000
1970	22 620	25 080	439 000

a/ The conversion factor to transform t.e.p. per annum into B.p.d. is 0.0194 (1 t.e.p./annum = $\frac{1}{51.5}$ B.p.d.).

b/ Consumption of petroleum expressed in B.p.d. refers to calendar days (365 calendar days per year).

Broken down estimates of the consumption of the principal petroleum products during the 1961-70 period have also been prepared by Secretaría de Energía y Combustibles.

/Table 4

Table 4

(In thousands of m^3)

Year	Motor Naphtha	Kerosene Agricol	Gasoil Diesel	Fuel Oil	Other products	Total petroleum products
1961	2 880	1 615	2 730	6 680	1 510	15 615
1962	3 070	1 810	2 825	6 610	1 620	15 935
1963	3 280	1 825	3 005	6 950	1 750	16 810
1964	3 530	1 845	3 135	7 300	1 890	17 700
1965	3 770	1 865	3 180	6 810	2 050	17 675
1966	4 030	1 970	3 360	7 470	2 210	19 040
1967	4 300	2 045	3 535	7 870	2 400	20 160
1968	4 590	2 130	3 800	8 590	2 600	21 710
1969	4 900	2 215	4 045	9 230	2 810	23 200
1970	5 230	2 340	4 510	10 100	3 040	25 080 a/

a/ The projections calculated by some of the distributing companies differ moderately from the estimates prepared by Secretaría de Energía y Combustibles. The consumption of motor naphtha and gasoil/diesel as anticipated by such companies are from 20 to 35 per cent and from 20 to 60 per cent higher than the above values, respectively; the percentages referring to kerosene/agricol are estimated, on the average, as being 25 per cent lower and those for fuel oil, some 7 per cent below the levels given by Secretaría de Energía y Combustibles.

The demand for kerosene/agricol, gasoil/diesel and fuel oil over the next year will be considerably affected by the increasing substitution of natural gas as fuel in the domestic/commercial and industrial sectors. This is reflected in the low average growth rates for those products anticipated over the 1961-70 period.

/Table 5

Table 5

(Percentage growth rates)

Year	Motor Naphtha	Kerosene Agricol	Gasoil Diesel	Fuel Oil	Other products	Total petroleum
1961-65	7.0	3.7	3.9	0.5	-	3.5
1966-70	6.8	4.7	6.6	8.2	-	7.3
1961-70	6.9	4.2	5.4	4.7	-	5.6

A comparison has been tentatively made by Secretaría de Energía y Combustibles between the forward projections of the demand and the prospective production of petroleum derivatives. The results in terms of the excess of potential production over anticipated demand is summarized as follows:

Table 6

(In thousands of m^3)

Year	Motor Naphtha	Kerosene Agricol	Gasoil Diesel	Fuel Oil	Other products	Total petroleum
1961	+ 0.10	- 0.55	- 0.30	+ 0.40	-	- 1.10
1962	+ 0.30	- 0.30	- 0.20	+ 1.10	-	+ 1.10
1963	+ 0.30	- 0.25	- 0.15	+ 1.20	-	+ 1.30
1964	+ 0.55	- 0.05	- 0.20	+ 0.50	-	+ 0.70
1965	+ 0.35	-	- 0.20	+ 1.00	-	+ 0.90
1966	+ 0.05	- 0.10	- 0.20	+ 0.50	-	-
1967	+ 0.18	- 0.05	- 0.30	+ 0.50	-	-
1968	+ 0.10	-	- 0.40	+ 0.40	-	- 0.3
1969	+ 0.10	+ 0.10	- 0.48	+ 0.30	-	- 0.5
1970	+ 0.05	+ 0.05	- 0.60	-	-	- 1.1

/4. Major development

4. Major development programmes scheduled for the 1962-70 period

(a) Crude oil production

The drilling programme for the production of crude oil is being planned on a scale large enough to provide self-sufficiency in terms of anticipated product requirements from 1962 onwards.

To meet the estimated total demand of the order of 68 120 m^3 over the period 1962-65 (inclusive) a comprehensive drilling programme may be established by YPF. Part of the programme will be carried out by YPF themselves and part by private interests as in previous years.

Briefly speaking, the number of wells considered to be drilled from 1962 to 1965 add up to about 6 053 perforations.

Table 7

Area	1962	1963	1964	1965	Total
Santa Cruz	469	519	519	519	2 026
Chubut	62	62	62	62	248
Neuquen	85	85	85	85	340
Mendoza	52	52	52	52	208
Centre	5	-	-	-	5
Salta	11	11	11	11	44
Contracts	720	767	800	900	3 187
Total	1 399	1 496	1 529	1 629	6 053

The total lengths are foreseen of the order of 10 053 000 m, calculated with basis on the average depths normally encountered in each of the areas.

/Table 8

Table 8

Area	Total number of wells	Average depths	Total length of wells
Santa Cruz	2 026	1 657 m.	3 357 000 m.
Chubut	248	2 000	496 000
Neuquen	340	1 217	414 000
Mendoza	208	2 650	551 000
Centre	5	2 000	10 000
Salta	44	4 090	180 000
Contracts	3 187	1 583	5 045 000
Total	6 058	-	10 053 000 m.

For the 1966-70 period, the drilling programme cannot be anticipated with exactitude for the time being. Nevertheless, it is expected that forward projections of the programme scheduled for 1962-65 may provide a first approximation for estimating roughly the number of new wells to be drilled during the period.

If the average depths of each area remain constant and the number of perforations during 1962-65 are uniformly extrapolated, the result will be a prospective total length of the order of 14 266 000 m. spread over some 8 645 perforations throughout the 1966-70 period.

Table 9

Area	1966	1967	1968	1969	1970	Total
Santa Cruz	519	519	519	519	519	2 595
Chubut	62	62	62	62	62	310
Neuquen	85	85	85	85	85	425
Mendoza	52	52	52	52	52	260
Centre	-	-	-	-	-	-
Salta	11	11	11	11	11	55
Contracts	900	950	1 000	1 050	1 100	5 000
Total	1 629	1 679	1 729	1 779	1 829	8 645

/Table 10

Table 10

Area	Total number of wells	Average depths	Total length of wells
Santa Cruz	2 595	1 657 m.	4 300 000 m.
Chubut	310	2 000	620 000
Neuquen	425	1 217	517 000
Mendoza	260	2 650	689 000
Centre	-	2 000	-
Salta	55	4 090	225 000
Contracts	5 000	1 583	7 915 000
Total	8 645	-	14 266 000 m.

(b) Natural gas production, processing and transportation

As the drilling programme for crude oil advances during the 1962-70 period, the availability of natural gas will gradually increase, in parallel with the production of petroleum.

The main productive areas of crude oil and natural gas are located in Argentina far away from the consuming centres. The possibilities for processing and using increasing quantities of gas will depend largely on the proposed programmes for construction of new gas lines and expansion of the existing system.

The gas transportation system in operation at present is already small to meet the demand. Gas del Estado has several projects under consideration for expanding and/or developing new facilities.

In the Southern zone, for instance, the production of natural gas is considerably in excess of gas line capacity, which is at present limited to some 380 000 t.e.p./annum, and in consequence large quantities of gas are being wasted. During 1961 the loss was estimated to be equivalent to 60 000 t.e.p./annum of refined gas, and in 1963 the loss will be probably twice as great.

/To meet

To meet this situation and to provide for the transportation of increasing quantities of gas which will be available as the production of crude petroleum increases, Gas del Estado propose to construct a 30" line from Pico Truncado to Buenos Aires, known as the Gasoducto del Sur. This line will have a nominal capacity of 10 000 000 m^3/day.

If necessary in the future, the capacity of this line may be raised to some 15 000 000 m^3/day through the installation of additional compressing stations. For the moment, such a possibility is not being contemplated by Gas del Estado.

The project prepared by Gas del Estado includes the construction of a 30" gas line having 1 720 kilometres in length; 24" branches to Buenos Aires and La Plata will have 108 kilometres in length, and the branches to Balcarce-Necochea and Mar del Plata are to be divided between 240 kilometres of 16" line, and 67 kilometres of 14" diameter.

The project also includes a pipeline system for the collection of gas at the oil fields and transportation to treatment plants for the extraction of CO_2 and the manufacture of propane, butane and natural gasoline, together with storage facilities for these products.

In the Northern zone, the gas line Campo Duran-Buenos Aires is already operating near full capacity. (Although the production of natural gas in the fields of Salta is not enough to meet the demand, gas from Bolivia is being imported to Campo Duran and transmitted to Buenos Aires.)

The expansion projects programmed by Gas del Estado include the installation of 4 additional compressing stations intended to raise the capacity of the duct Campo Duran-Buenos Aires to 9 000 000 m^3/day by 1964 and the construction of a parallel line going from B. Ville to Pacheco.

The Gasoducto del Este is another project being considered by Gas del Estado for the 1966-70 period. The line will serve Metan, Resistencia and San Lorenzo with an approximate length of some 1 400 kilometres.

Parallel with the expansion of the transportation system it will be necessary to extend storage and distributing facilities in order to make use of the increased volume of gas which will be available.

/(c) Transport of

(c) Transport of crude oil and products

The total quantity of crude to be refined in 1962 by YPF is estimated to be 11 550 000 m^3. Of this amount approximately 50 per cent will come from the Chubut and Cañadon Seco fields and will be refined at La Plata and San Lorenzo. In 1965 it is estimated that the crude to be refined will be 22 800 000 m^3 of which some 70 per cent will come from these fields. In 1970 the crude to be refined is estimated to be 25 000 000 m^3 of which 85 per cent is expected to come from the same Southern areas. These crude supplies will be transported by sea.

In 1962 crude from Mendoza amounting to 2 800 000 m^3 (equivalent to 25 per cent of the total refined by YPF) will mainly be handled at the new refinery at Lujan de Cuyo, now under construction (2 300 000 m^3 per annum); the remaining 500 000 m^3 per annum will be transported from Mendoza to San Lorenzo by rail.

The construction of a pipeline from Mendoza to Buenos Aires originally projected as a crude supply line to be operated in reverse as a products pipeline at a later stage, has been postponed and both crude and products will be transported by rail during the coming years.

This projected line of 950 kilometres which was intended to carry some 2 000 000 tons of crude or products per annum has been rendered unnecessary for the time being by the construction of the refinery. It would appear that Mendoza production is expected to decrease, and crude estimates indicate that by 1965 production may be in line with refinery capacity. It may be, however, that the line would be justified as a products line after 1965 and this matter is still under consideration by YPF.

Under these circumstances the basic equipment required for this project has not been included in the forward demand up to 1965, but it has been tentatively included in the 1966-70 steel forecast.

The pipeline from Campo Duran is considered to be of adequate capacity up to 1970 and the capacity of the Neuquen (Challaco) Puerto Rosales crude pipeline is sufficient for the crude supplies expected from that area. The only oil pipeline under consideration at the present time is a small crude oil line of about 150 kilometres connecting Colonia Catriel to Villa Regina.

/(d) Crude oil

(d) Crude oil and products storage

The growth in production of crude oil and refined products over the 1962-65 and 1966-70 periods will make it necessary to provide additional storage facilities.

Crude oil storage capacity is expected to be 2 560 000 m^3 by the end of 1962, and because of the small apparent growth rate (3.5 per cent) in the demand for crude during 1962-65 this will provide adequate capacity until the end of 1965 so that it will not be necessary to install further tankage during this period.

However, as from 1966, when the apparent growth rate of the crude oil demand increases to 7.25 per cent over the period, it will be necessary to provide additional storage each year. Assuming that it is desirable to maintain an average storage time of 7 to 8 weeks in terms of the anticipated crude oil production, this will amount to 1 212 000 m^3 over the period 1966-70.

The total storage capacity for refined products is expected to be 2 647 000 by the end of 1962 and further additions are planned for 1963, and 1964, to increase the capacity up to 2 793 000 m^3 by the end of 1964. This will be sufficient to maintain an average storage time of 8 weeks until the end of 1965, but a further addition of 63 000 m^3 capacity should be provided in 1965 in preparation for 1966.

In the following period 1966-70 it will be necessary to increase the storage capacity each year, and assuming that it is desirable to maintain an average storage time of 8 weeks in terms of anticipated production it will be necessary to add 1 244 000 m^3 of storage capacity, i.e. a total increase of 1 456 000 m^3.

(e) Refining capacity

The refining facilities at present available in Argentina add up to a total capacity for processing crude oil of the order of 391 310 B.p.s.d. (values referring to end of 1961).4/

4/ Normal refinery operations are based on 330 working days per annum, remaining 35 days being allowed for annual maintenance work, with major overhauls at two or three yearly intervals depending on the plant available.

/These 391 310

These 391 310 B.p.s.d. break down into 56 per cent owned by YPF and 46 per cent by private companies.

In terms of thousands of m^3 per annum, the planned extensions known to date, up to 1965, are as follows:

Table 11

(In thousands of m^3/annum)

Year	YPF	Private	Total
1962	11 550	9 110	22 660
1963	12 550	9 110	21 660
1964	12 550	9 110	21 660
1965	13 700	9 110	22 810

The increased refinery capacity over the period 1962-65 will consist of a new refinery of 1 000 000 m^3 per annum for the manufacture of lubricating oil to be built by 1963 and a new refinery with a capacity of 2 650 000 m^3/annum or 50 000 BSD to be built by 1965. The lubricating oil refinery will be financed and owned by the Continental Oil Co. (USA) and will be operated on behalf of YPF. The 50 000 BSD refinery will also be financed by international capital and operated in a similar manner. Part of this additional capacity will enable YPF to retire old units with a capacity of 1 500 000 m^3/annum so that the total actual increase in refinery capacity by 1965 will be 2 150 000 m^3/annum.

The annual capacities of the Argentine refineries and their programmed expansions known to date compare with the net crude oil demand as follows:

/Table 12

Table 12

(In thousands of m^3/annum)

Year	Demand for petroleum derivatives	Programmed refining capacity	Balance
1962	15 935	20 660	+ 4 725
1963	16 810	21 660	+ 4 850
1964	17 700	21 660	+ 3 960
1965	17 675	22 810	+ 5 135
1966	19 040	22 810	+ 3 770
1967	20 160	22 810	+ 2 650
1968	21 710	22 810	+ 1 100
1969	23 200	22 810	- 0 390
1970	25 080	22 810	- 2 270

It would appear that refinery capacity will be adequate until 1968 but it will then be necessary to provide another 50 000 BSD capacity (2 650 000 m^3/annum) bringing the total capacity up to 25 460 000 m^3/annum.

Therefore, a minimum programme anticipated over the period 1962-70 for the construction of new refineries is expected to include, at least, the following three major projects:

1.a 20 000 B.p.d. lubricating oil refinery in 1963-64

2.a 50 000 B.p.d. refinery in 1965-66

3.a 50 000 B.p.d. refinery in 1968-69

/Table 13

Table 13

(In thousands of m^3/annum)

Year	Refinery capacity available	Refinery capacity to be added (major projects)	Total programmed refining capacity
1962	20 660	-	20 660
1963	20 660	1 000	21 660
1964	21 660	-	21 660 a/
1965	20 160 a/	2 650	22 810
1966	22 810	-	22 810
1967	22 810	-	22 810
1968	22 810	2 650	25 460
1969	25 460	-	25 460
1970	25 460	-	25 460

a/ It is expected that some units of the La Plata refinery with a total capacity of 1 500 000 m^3/annum will be dismantled for obsolescence.

(f) Petrochemicals

Over the past two or three years considerable attention has been given to the possibility of manufacturing synthetic rubber in Argentina, and these activities have now led to the authorization of the PASA complex (Petroquímica Argentina S.A.) for the manufacture of 30 000 tons per annum of SBR together with a further 10 000 tons of one of the new synthetic rubbers, probably Cis. polybutadiene.

The complex will manufacture the styrene required for the SBR from benzene and ethylene which they will produce from petroleum distillates. There will be some 7 000 tons of styrene available for the plastics market, and also a surplus of benzene for sale. The complex includes further plant for the manufacture of some 12 000 tons per annum of carbon black (furnace).

The PASA complex will be established at San Lorenzo. Site preparation is now in hand, the first units will be erected by 1964 and the whole complex by 1965.

IPAK (Industrias Petroquímicas Argentinas Kopper), have projects for the manufacture of polyethylene and styrene which will be in operation within the next two years. They will produce about 7 000 tons per annum of polyethylene and 15 000 of styrene. These plants will be built in the vicinity of La Plata refinery from which a part of the ethylene required will be drawn.

DUPERIAL are installing a plant for the manufacture of 10 000 tons per annum of polyethylene and will also produce 15 000 tons of carbon disulphide from natural gas. The DUPERIAL plant will be built in the vicinity of San Lorenzo.

DURANOR are installing a plant at Rio Tercero for the manufacture of 8 000 tons per annum of phenol from benzene.

The above are the major projects known to date for the 1962-65 period.

A preliminary estimate indicates the possibility of an investment of the order of 100 000 000 dollars during 1966-70, i.e. approximately the same as that for 1962-65 (excluding DUPERIAL). Therefore, in the absence of a definite programme it has been assumed that the capital expenditure of the petrochemical industry in the 1966-70 period will be the same as during 1962-65.

/5. Basic equipment

5. Basic equipment required over the 1962-70 period

(a) Crude oil production

The basic equipment required for the 1962-70 drillings have been estimated with basis on the number of new wells programmed and/or anticipated for the period.

The total depths to be drilled from 1962 to 1970 result in the vicinity of 24 279 000 m^3, spread over some 14 700 wells.

A complete list of the equipment required for this sector of the petroleum industry is rather complex to determine. The number of equipment items deemed necessary lead to quite an extensive list for they would greatly vary according to the conditions peculiar to each area, to the method of drilling adopted, to the type of well resulting, etc. Due to the scarcity of information in this connexion, the estimates given in this study were concentrated on the prospective demand for casing, tubing, crude gathering pipe, fittings and valves.

The casing was assumed to conform to specification API 5A, with an average nominal diameter of 7" and a linear weight of 35 kg/m (23lb/ft).

Twenty per cent of the casing pipe was assumed to be of welded construction and 80 per cent of seamless type, a hypothesis reasonably in agreement with the current practice in the petroleum industry. It has been further assumed that 100 per cent of the wells are to be cased.

/Table 14

Table 14

CASING

Year	Depths to be cased	Casing required		
		Total	Seamless	Welded
1962	2 337 000 m	81 800 tons	65 400 tons	16 400 tons
1963	2 484 000	86 900	69 500	17 400
1964	2 537 000	88 800	71 000	17 800
1965	2 695 000	94 300	75 500	18 800
1966	2 695 000	94 300	75 500	18 800
1967	2 774 000	97 100	77 800	19 300
1968	2 853 000	99 900	80 000	19 900
1969	2 932 000	102 600	82 000	20 600
1970	3 012 000	105 400	84 000	21 400
Total	24 319 000 m	851 100 tons	680 700 tons	170 400 tons

The tubing is also expected to conform to specification API 5A, Grades J-55 and N-80, both of seamless construction. The average nominal diameter was taken as $2\frac{1}{2}$" and the linear weight in the vicinity of 10 kg/m (6.5 lb/ft). It has been further estimated that only 80 per cent of the wells drilled during the period shall result productive and that, as a rule, all productive wells are to require integral tubing.

Table 15

TUBING

Year	Depths to be tubed	Tubing required		
		Total	Seamless	Welded
1962	1 870 000 m	18 700 tons	18 700 tons	-
1963	1 980 000	19 800	19 800	-
1964	2 030 000	20 300	20 300	-
1965	2 160 000	21 600	21 600	-
1966	2 160 000	21 600	21 600	-
1967	2 220 000	22 200	22 200	-
1968	2 280 000	22 800	22 800	-
1969	2 350 000	23 500	23 500	-
1970	2 400 000	24 000	24 000	-
Total	19 450 000 m	194 500 tons	194 500 tons	-

/The piping

The piping required for the crude gathering system has been estimated as conforming to specification API 5L, with an average nominal diameter of 3" and a linear weight of 9.8 kg/m (6.6 lb/ft). Welded construction will be probably required in about 80 per cent of the cases while seamless construction will take the balance.

The criterion adopted for estimating the total lengths required is that, on the average, each productive well is to call for about one mile of crude gathering line. (Oil wells are considered to account, on a first approximation, for some 85 per cent of all productive wells.)

Table 16

CRUDE GATHERING PIPING

Year	Number of crude oil productive wells	Piping required		
		Total	Seamless	Welded
1962	1 190	1 870 tons	390 tons	1 480 tons
1963	1 275	2 000	400	1 600
1964	1 300	2 040	410	1 630
1965	1 380	2 170	440	1 730
1966	1 380	2 170	440	1 730
1967	1 425	2 240	450	1 790
1968	1 470	2 310	460	1 850
1969	1 510	2 375	475	1 900
1970	1 560	2 450	490	1 960
Total	12 490 wells	19 625 tons	3 955 tons	15 670 tons

Valves and fittings were estimated with basis on an average value of 2 500 kg per flowing well (the number of flowing wells is not expected to be greater than 10 per cent of all productive wells obtained in the period).

/Table 17

Table 17

FITTINGS AND VALVES

Year	Number of flowing wells	Fittings and valves required
1962	119	297 tons
1963	128	320
1964	130	325
1965	138	345
1966	138	345
1967	143	358
1968	147	368
1969	151	378
1970	156	390
Total	1 250 wells	3 126 tons

As to the value of the above equipment, the following unitary prices have been assumed, referred to the average FOB levels of the American industry.

Line pipe	US$	190.00/ton
Casing		280.00 "
Tubing		260.00 "
Fittings and valves		1 150.00 "

/The overall

The overall summarized situation is the following:

Table 18

CRUDE OIL PRODUCTION

	(1962-65)		(1966-70)	
	Weight in tons	Approximate cost material (dollars)	Weight in tons	Approximate cost material (dollars)
Valves	1 287	1 480 000	1 839	2 120 000
Piping	351 800 a/	80 500 000 a/	499 300 a/	115 000 000 a/
	80 400 b/	21 000 000 b/	114 100 b/	29 600 000 b/
	8 080 c/	1 500 000 c/	11 545 c/	2 200 000 c/
Total	441 567	104 480 000	626 784	148 920 000

a/ Casing.

b/ Tubing.

c/ Crude gathering.

(b) Natural gas production, processing and transportation

It is rather difficult to determine the actual quantities of collecting pipe required per gas producing well since in most cases the gas is to be fed almost directly into the gas lines or piped to a natural gasoline plant. Nevertheless, according to information submitted to CEPAL, the pipe required for the collecting system over the period 1962-65 is estimated to be in the neighbourhood of 9 000 tons.

The minimum quantities of valves and fittings needed over the same period are of the order of 85 tons.

It will be necessary to extend the gas collecting system in the period 1966-70. The basic equipment deemed required for this purpose is roughly estimated to be of the order of 4 000 tons of pipe and 35 tons of valves and fittings (minimum values).

/Table 19

Table 19

NATURAL GAS COLLECTING SYSTEM

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material (dollars)	Weight in tons	Approx. cost material (dollars)
Valves	85	123 000	35	54 000
Piping	9 000	1 620 000	4 000	740 000
Total	9 085	1 743 000	4 035	794 000

As to the project prepared by Gas del Estado for Gasoducto del Sud, the main line will require 290 000 tons of pipe, 30" in diameter.

The branch lines for Gasoducto del Sud and Gasoducto del Este will probably consume 520 000 tons of pipe, according to estimates of Gas del Estado.

Compression plant of 157 000 HP for gas collection and transportation is to be installed by 1965, to be increased to some 40 000 HP in the 1966-70 period.

In the Northern zone, in addition to Gasoducto del Este, Gas del Estado exports that the new line going from B. Ville to Pacheco will consume some 60 000 tons of pipe, 24" in diameter.

In parallel with the new gas pipelines and as it turns to be necessary to extend the gas distribution system throughout the 1966-70 period, the projected lines for this purpose will require a further 100 000 tons of pipe, approximately.

A summary of the equipment required over 1962-70 is shown in the following table:

/Table 20

Table 20

NATURAL GAS TRANSPORTATION

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material	Weight in tons	Approx. cost material
Compressors and drivers	-	25 600 000 a/	-	7 200 000 b/
Valves	420 c/	1 274 000 c/	-	-
	115 d/	353 000 d/	75 d/	235 000 d/
Piping	290 000 c/	63 500 000 c/	-	-
	-	-	60 000 e/	13 200 000 e/
	-	-	620 000 d/	136 000 000 d/
Total	290 535	90 727 000	680 075	156 635 000

a/ Gasoducto del Sud.
b/ Gasoducto del Sud system - Campo Duran-Buenos Aires gas line.
c/ Gasoducto del Sud, main line.
d/ Gasoducto del Sud - Gasoducto del Este.
e/ Gasoducto B. Ville to Pacheco.

The project for Gasoducto del Sud also includes the construction of treatment plants for the extraction of CO_2 and the manufacture of propane, butane and natural gasoline, together with storage facilities for these products. The equipment estimated for these plants adds up to some 15 250 000 dollars, to be distributed as follows:

/Table 21

Table 21

NATURAL GAS TREATMENT PLANTS

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material (dollars)	Weight in tons	Approx. cost material (dollars)
Storage tanks	6 000	1 800 000	-	-
Pressure vessels	1 360	1 092 000	-	-
Heat exchangers	590	880 000	-	-
Furnaces	560	434 000	-	-
Pumps and drivers	- [a]	828 000	-	-
Compressors and drivers	- [a]	4 016 000	-	-
Valves	1 050	1 410 000	-	-
Piping	3 140	2 362 000	-	-
Structural steel	600	286 000	-	-
Instrum. and c. valves	- [a]	702 000	-	-
Steam generators	1 190	892 000	-	-
Turbogenerators	-	-	-	-
Electric distribution	- [a]	548 000	-	-
Miscellaneous	1 510	-	-	-
Total	16 000	15 250 000	-	-

a/ Not expressed in tons because weights of these items are difficult to estimate with accuracy.

(c) Transport of crude oil and products

The line connecting Colonia Catriel to Villa Regina is estimated to require some 6 000 tons of steel pipe. This project is being considered by YPF for the 1962-65 period. The projected line from Mendoza to Buenos Aires is estimated to require about 60 000 tons of steel pipe (1966-70 period).

Maintenance of the existing crude pipeline system is anticipated to consume approximately 10 000 additional tons of steel per annum.

/A summary

A summary of the piping required over the 1962-70 period is shown in the following table:

Table 22

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material (dollars)	Weight in tons	Approx. cost material (dollars)
Piping	6 000 a/	1 068 000 a/	-	-
	-	-	60 000 b/	10 680 000 b/
	40 000 c/	7 120 000 c/	50 000 c/	8 900 000 c/
Total	46 000	8 188 000	110 000	19 580 000

a/ Pipeline Colonia Catriel-Villa Regina, main line.
b/ Pipeline Mendoza-Buenos Aires, main line.
c/ Maintenance of existing pipeline system.

(d) Crude oil and products storage

Assuming that a reasonably constant storage time is to be maintained throughout, i.e. 7 to 8 weeks for crude oil and 8 weeks for refined products, it will be necessary to add 1 212 000 m^3 to the present crude oil storage capacity and 1 456 000 m^3 to the existing refined products storage facilities. The amounts of steel which are required for these purposes are estimated to be approximately 26 600 and 45 500 tons respectively, with a total of 72 100 tons. Of this amount 6 750 tons will be required in the period 1962-65, and 65 350 tons during 1966 and 1970. The cost of this tankage, field fabricated and erected is estimated to be 7 575 000 dollars for crude oil and 13 390 000 dollars for products, a total of 20 965 000 dollars. The cost during 1962-65 is estimated to be 1 980 000 dollars and 18 985 000 dollars during the period 1966-70.

/Table 23

Table 23

ANALYSIS OF CRUDE STORAGE REQUIREMENTS, 1962-70

(Basis minimum storage time 7 weeks, maximum 8 weeks)

Year	Storage capacity m^3	Crude supply	Total storage as per cent of crude supply	Total storage required basis 13.5 per cent crude 7 weeks	Total storage required basis 15 per cent crude 8 weeks	Additional storage m^3	Additional storage barrels	Number of tanks 100 000 barrels
1962	2 560	17 100	15.0		2 565			
1963	2 560	18 100	14.2		2 715			
1964	2 560	18 400	14.0		2 760			
1965	2 560	18 600	13.8		2 790			
1966	2 560	19 040	13.47	2 565	2 850	290 000	1 812 600	18
1967	2 850	20 200	14.10	2 727	3 030	180 000	1 125 000	11
1968	3 030	21 700	13.96	2 930	3 255	225 000	1 406 250	14
1969	3 255	23 200	14.03	3 132	3 480	235 000	1 468 780	15
1970	3 480	25 080	13.92	3 386	3 762	282 000	1 762 500	18
Total						1 212 000	7 575 000	76

Basis of tankage allocation, steel content and cost.

Average capacity 100 000 bls.

Average weight 350 tons.

Average cost per barrel US$ 1.0 (field fabricated and erected).

Average cost per tank US$ 100 000.

Per cent floating roofs 30.

/Table 24

Table 24

ANALYSIS OF PRODUCTS STORAGE REQUIREMENTS, 1962-70

(Basis 8 weeks = 15 per cent total supply)

Year	Storage capacity m^3	Products supply	Total storage as per cent products	Storage required basis 15 per cent products 8 weeks	Additional storage m^3	Additional storage barrels	Number of tanks 50 000 barrels
1962	2 647	17 100	15.47		126 000	787 500	16
1963	2 773	18 100	15.32		23 000	143 750	3
1964	2 793	18 400	15.2				
1965	2 793	18 600	15.0	2 790	63 000	393 750	8
1966	2 856	19 040	15.0	2 856	174 000	1 087 500	20
1967	3 030	20 200	15.0	3 036	226 000	1 412 500	30
1968	3 256	21 710	15.0	3 256	224 000	1 400 000	28
1969	3 480	23 200	15.0	3 480	282 000	1 762 500	35
1970	3 762	25 080	15.0	3 762	338 000	2 112 500	42
Total					1 456 000	9 110 000	182

Basis of tankage allocation steel content and cost.
Average capacity 50 000 barrels.
Average weight 250 tons.
Average cost per barrel US$ 1.4 (field fabricated and erected).
Average cost per tank US$ 70 000.
Per cent floating roofs 20.

A resumé of the values involved is as shown below:

Table 25

CRUDE OIL AND PRODUCTS STORAGE

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material (dollars)	Weight in tons	Approx. cost material (dollars)
Storage tanks	-	-	26 600 a/	7 575 000 a/
	6 750 b/	1 980 000 b/	38 750 b/	11 410 000 b/
Total	6 750	1 980 000	65 350	18 985 000

a/ Crude oil.
b/ Refined products.

/(e) Refinery equipment

(e) Refinery equipment

The new refinery to be built by 1963 for the manufacture of lubricating oil with motor naphtha, kerosene, gasoil/diesel and some fuel oil as by-products is expected to cost about 36 000 000 dollars.

The equipment for this refinery is estimated to be of the order of 53 per cent of the total investment, i.e. 19 000 000 dollars, with an approximate gross weight of 19 000 tons.

Table 26

REFINERY EQUIPMENT

(20 000 BPD refinery)

	(1962-65)	
	Weight in tons	Approx. cost material (dollars)
Storage tanks	6 560	2 200 000
Pressure vessels	2 500	2 000 000
Heat exchangers	1 000	1 540 000
Furnaces	1 400	1 145 000
Pumps and drivers	-a/	1 100 000
Compressors and drivers	-a/	1 200 000
Valves	1 120	1 645 000
Piping	3 400	2 470 000
Structural steel	900	475 000
Instrum. and c. valves	-a/	1 500 000
Steam generators	1 500	1 200 000
Turbogenerators	-	-
Electric distribution	-a/	1 495 000
Miscellaneous	840	700 000
Total	19 220	18 670 000

a/ Not expressed in tons because weights of these items are difficult to estimate with accuracy.

/The second

The second refinery - still in the project stage - is to be designed to manufacture normal refinery products, with ample flexibility, that is control of the ratio of distillate products to fuel oil. This refinery will have a crude input capacity of 2 640 000 m^3 per annum or approximately 50 000 barrels per stream day. The normal investment in a complete refinery of this size, including shipping facilities, would be of the order of 50 000 000 dollars and the steel required would be about 27 000 tons. The cost of the basic equipment for this refinery is estimated to be 23 500 000 dollars.

The third refinery envisaged for 1968 has been considered on a first approximation with a total equipment cost also in the neighbourhood of 23 500 000 dollars.

Table 27

REFINERY EQUIPMENT

(50 000 BPD refineries)

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material (dollars)	Weight in tons	Approx. cost material (dollars)
Storage tanks	8 750	2 745 000	8 750	2 745 000
Pressure vessels	2 375	1 900 000	2 375	1 900 000
Heat exchangers	1 385	2 080 000	1 385	2 080 000
Furnaces	2 500	1 900 000	2 500	1 900 000
Pumps and drivers	-a/	1 400 000	-a/	1 400 000
Compressors and drivers	-a/	1 000 000	-a/	1 000 000
Valves	2 075	2 800 000	2 075	2 800 000
Piping	6 225	4 500 000	6 225	4 500 000
Structural steel	1 560	780 000	1 560	780 000
Instrum. and c. valves	-a/	1 400 000	-a/	1 400 000
Steam generators	1 800	1 360 000	1 800	1 360 000
Turbogenerators	-	-	-	-
Electric distribution	-a/	1 340 000	-a/	1 340 000
Miscellaneous	690	400 000	690	400 000
Total	27 360	23 605 000	27 360	23 605 000

a/ Not expressed in tons because weights of these items are difficult to estimate with accuracy.

/The life

The life of refinery equipment is greatly dependant on maintenance. Useful life is normally assumed to be 10 years for the purpose of calculating the cost of depreciation but in fact the actual duration is much greater, especially where there is a shortage of capital and the cost of money is sufficiently expensive to justify the operation of obsolete plant. Therefore, maintenance plays an important part in keeping process units in perfect physical condition until the day they are shut down for dismantling.

In the absence of definite information to the quantities of plant required for maintenance of the existing refineries and for replacement of old and obsolete equipment, it has been roughly estimated that an average of 47 210 000 dollars will be spent during the 1966-70 period for these purposes.

Figures applicable to the 1962-65 period could not be anticipated and, for this reason, are not shown in this report.

Table 28

MAINTENANCE AND REPLACEMENT OF REFINERY EQUIPMENT

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material (dollars)	Weight in tons	Approx. cost material (dollars)
Storage tanks	-	-	17 500	5 490 000
Pressure vessels	-	-	4 750	3 800 000
Heat exchangers	-	-	2 770	4 160 000
Furnaces	-	-	5 000	3 800 000
Pumps and drivers	-	-	-[a]	2 800 000
Compressors and drivers	-	-	-[a]	2 000 000
Valves	-	-	4 150	5 600 000
Piping	-	-	12 450	9 000 000
Structural steel	-	-	3 120	1 560 000
Instrum. and c. valves	-	-	-[a]	2 800 000
Steam generators	-	-	3 600	2 720 000
Turbogenerators	-	-	-	-
Electric distribution	-	-	-[a]	2 680 000
Miscellaneous	-	-	1 380	800 000
Total	-	-	54 720	47 210 000

a/ Not expressed in tons because weights of these items are difficult to estimate with accuracy.

(f) Petrochemicals

The total equipment required for the petrochemical projects listed in item 4 (f), with the exception of DUPERIAL,[5/] all of which are to be completed by 1965, leads to approximately 41 500 tons. The cost of the bare materials is estimated to be 51 250 000 dollars.

Table 29

PETROCHEMICALS

	(1962-65)		(1966-70)	
	Weight in tons	Approx. cost material (dollars)	Weight in tons	Approx. cost material (dollars)
Storage tanks	11 700	4 642 000	11 700	4 642 000
Pressure vessels	6 342	6 344 000	6 342	6 344 000
Heat exchangers	2 100	3 775 000	2 100	3 775 000
Furnaces	1 964	1 920 000	1 964	1 920 000
Pumps and drivers	-a/	2 313 000	-a/	2 313 000
Compressors and drivers	-a/	4 880 000	-a/	4 880 000
Valves	3 300	5 112 000	3 300	5 112 000
Piping	9 960	7 668 000	9 960	7 668 000
Structural steel	3 315	1 599 000	3 315	1 599 000
Instrum. and c. valves	-a/	1 590 000	-a/	1 590 000
Steam generators	1 950	1 544 000	1 950	1 544 000
Turbogenerators	-a/	2 888 000	-a/	2 888 000
Electric distribution	-a/	4 242 000	-a/	4 242 000
Miscellaneous	869	2 733 000	869	2 733 000
Total	41 500	51 250 000	41 500	51 250 000

a/ Not expressed in tons because weights of these items are difficult to estimate with accuracy.

In the absence of a definite programme it has been assumed for the purpose of assessing the demand for basic equipment in 1966-70 that the requirements for the petrochemical industry in the period will be the same as during 1962-65, namely 41 500 tons of equipment and a bare material cost of 51 250 000 dollars.

5/ The cost of the bare materials for the DUPERIAL plant is of the order of 10 000 000 dollars and the steel required is estimated to weigh about 5 000 tons. Information with regard to this project was not available in sufficient detail to permit of a breakdown into basic equipment, and therefore it is not included in the estimate of equipment for the petrochemical industry.

/6. Overall breakdown

6. Overall breakdown of the equipment requirements for the 1962-70 period

The minimum quantities of equipment anticipated for the periods 1962-65 and 1966-70 may be summarized as follows:

Table 30

	Tons	Approximate cost of material (dollars)
1962-65		
Crude oil programme	487 567	112 668 000
Natural gas production	9 085	1 743 000
Natural gas processing	16 000	15 250 000
Natural gas transportation	290 535	90 727 000
Crude oil and products storage	6 750	1 980 000
Refinery equipment	46 580	42 275 000
Petrochemicals	41 500	51 250 000
Total	898 017	315 893 000
1966-70		
Crude oil programme	736 784	168 500 000
Natural gas production	4 035	794 000
Natural gas processing	-	-
Natural gas transportation	620 075	156 635 000
Crude oil and products storage	65 350	18 985 000
Refinery equipment	82 080	70 815 000
Petrochemicals	41 500	51 250 000
Total	1 549 824	466 979 000

The weight of the requirements for pipes represents 90 per cent of the total minimum demand for equipment anticipated over the period 1962-65 and 1966-70, respectively. Pricewise, pipes represent about 61 and 72 per cent over the two said periods, being the most important item. Other percentages are as shown in the following table.

/Table 31

Table 31

APPROXIMATE REQUIREMENTS FOR BASIC EQUIPMENT

(Percentage of the total cost of material)

	(1962-65)	(1966-70)
Storage tanks	4.2	6.8
Pressure vessels	3.6	2.6
Heat exchangers	2.6	2.1
Furnaces	1.7	1.6
Pumps and drivers	1.8	1.4
Compressors and drivers	11.8	3.2
Valves	4.2	3.4
Piping	61.0	72.0
Structural steel	1.0	0.8
Instruments and c. valves	1.6	1.2
Steam generators	1.6	1.2
Turbogenerators	0.9	0.6
Electric distribution	2.4	1.8
Miscellaneous	1.2	0.8
Total	100.0	100.0

Tables 32 and 33 show the approximate weights of the various types of equipment required for the crude oil programme, the natural gas industry, the new refineries, the petrochemical plants and the tankage necessary for increasing the storage facilities for crude and petroleum products.

Tables 34 and 35 show the respective cost breakdowns.

/Table 32

Table 32

APPROXIMATE WEIGHT OF THE EQUIPMENT REQUIRED
DURING THE 1962-65 PERIOD
(Weight in tons)

	Crude oil pro-gramme	Nat. gas produc-tion	Nat. gas process-ing	Nat. gas trans-port.	Crude oil and prods. storage	Refine-ries	Petro-chem.	Total
Storage Tanks	-	-	6 000	-	6 750	15 310	11 700	39 760
Pressure Vessels	-	-	1 360	-	-	4 875	6 342	12 577
Heat Exchangers	-	-	590	-	-	2 385	2 100	5 075
Furnaces	-	-	560	-	-	3 900	1 964	6 424
Pumps and Drivers	-	-	-	-	-	-	-	-
Compressors and Drivers	-	-	-	-	-	-	-	-
Valves	1 287	85	1 050	535	-	3 195	3 300	9 452
Piping	486 280	9 000	3 140	290 000	-	9 625	9 960	808 005
Structural Steel	-	-	600	-	-	2 460	3 315	6 375
Instruments and C. Valves	-	-	-	-	-	-	-	-
Steam Generators	-	-	1 190	-	-	1 380	1 950	4 520
Turbogenerators	-	-	-	-	-	-	-	-
Electric Distributors	-	-	-	-	-	-	-	-
Miscellaneous	-	-	1 510	-	-	3 450	869	5 829
Total	487 567	9 085	16 000	290 535	6 750	46 580	41 500	898 017

/Table 33

Table 33

APPROXIMATE WEIGHT OF THE EQUIPMENT REQUIRED DURING THE 1966-70 PERIOD

(Weight in tons)

	Crude oil pro-gramme	Nat. gas produc-tion	Nat. gas process-ing	Nat. gas trans-port.	Crude oil and prods. storage	Refine-ries	Petro-chem.	Total
Storage Tanks	-	-	-	-	65 350	26 250	11 700	103 300
Pressure Vessels	-	-	-	-	-	7 125	6 342	13 467
Heat Exchangers	-	-	-	-	-	4 155	2 100	6 255
Furnaces	-	-	-	-	-	7 500	1 964	9 464
Pumps and Drivers	-	-	-	-	-	-	-	-
Compressors and Drivers	-	-	-	-	-	-	-	-
Valves	1 839	35	-	75	-	6 225	3 300	11 474
Piping	734 945	4 000	-	620 000	-	18 675	9 960	1 387 580
Structural Steel	-	-	-	-	-	4 680	3 315	7 995
Instruments and C. Valves	-	-	-	-	-	-	-	-
Steam Generators	-	-	-	-	-	5 400	1 950	7 350
Turbogenerators	-	-	-	-	-	-	-	-
Electric Distribu-tors	-	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	2 070	869	2 939
Total	736 784	4 035	-	620 075	65 350	82 080	41 500	1 549 824

/Table 34

Table 34

TENTATIVE COST BREAKDOWN FOR THE EQUIPMENT REQUIRED DURING THE 1962-65 PERIOD

(Cost in thousands of dollars)

	Crude oil pro-gramme	Natural gas produc-tion	Natural gas process-ing	Natural gas trans-port.	Crude oil and products storage	Refine-ries	Petro-chemical	Total
Storage Tanks	-	-	1 800	-	1 980	4 945	4 692	13 367
Pressure Vessels	-	-	1 092	-	-	3 900	6 344	11 336
Heat Exchangers	-	-	880	-	-	3 620	3 775	8 275
Furnaces	-	-	434	-	-	3 045	1 920	5 399
Pumps and Drivers	-	-	828	-	-	2 500	2 313	5 641
Compressors and Drivers	-	-	4 016	25 600	-	2 200	4 880	36 696
Valves	1 480	123	1 410	1 627	-	4 445	5 112	14 197
Piping	111 188	1 620	2 362	63 500	-	6 970	7 668	193 308
Structural Steel	-	-	286	-	-	1 255	1 599	3 140
Instruments and C. Valves	-	-	702	-	-	2 900	1 590	5 192
Steam Generators	-	-	892	-	-	2 560	1 544	4 996
Turbogenerators	-	-	-	-	-	-	2 888	2 888
Electric Distribution	-	-	548	-	-	2 835	4 242	7 625
Miscellaneous	-	-	-	-	-	1 100	2 733	3 833
Total	112 668	1 743	15 250	90 727	1 980	42 275	51 250	315 893

/Table 35

Table 35

TENTATIVE COST BREAKDOWN FOR THE EQUIPMENT REQUIRED DURING THE 1966-70 PERIOD

(Cost in thousands of dollars)

	Crude oil programme	Natural gas production	Natural gas processing	Natural gas transport.	Crude oil and products storage	Refineries	Petrochemical	Total
Storage Tanks	-	-	-	-	18 985	8 235	4 642	31 862
Pressure Vessels	-	-	-	-	-	5 700	6 344	12 044
Heat Exchangers	-	-	-	-	-	6 240	3 775	10 015
Furnaces	-	-	-	-	-	5 700	1 920	7 620
Pumps and Drivers	-	-	-	-	-	4 200	2 313	6 513
Compressors and Drivers	-	-	-	7 200	-	3 000	4 880	15 080
Valves	2 120	54	-	235	-	8 400	5 112	15 921
Piping	166 380	740	-	149 200	-	13 500	7 668	337 488
Structural Steel	-	-	-	-	-	2 340	1 599	3 939
Instruments and C. Valves	-	-	-	-	-	4 200	1 590	5 790
Steam Generators	-	-	-	-	-	4 080	1 544	5 624
Turbogenerators	-	-	-	-	-	-	2 888	2 888
Electric Distribution	-	-	-	-	-	4 020	4 242	8 262
Miscellaneous	-	-	-	-	-	1 200	2 733	3 933
Total	168 500	794	-	156 635	18 985	70 815	51 250	466 979

/7. Total anticipated

7. Total anticipated demand in terms of specification steels

The equipment pertaining to each of the categories considered in this study are fabricated from steels and materials having different physical and chemical properties, suitable for the specific purposes for which they are to serve.

Specifications for steel pipe to be used in oil fields for drilling and for the transport of petroleum and gas have been standardized by the American Petroleum Institute, and these API specifications are those used generally by the petroleum and natural gas industry for these purposes. The materials used for petroleum refineries and petrochemical plants are normally specified in terms of standards drawn up by the American Society for Testing Materials (ASTM).

There are a number of other organizations which have contributed to the standardization of quality and steel products but the API and ASTM specifications are the most widely used in the petroleum and natural gas industries. For this reason, the requirements indicated hereinafter have been calculated in terms of these two specifications.

Pumps, compressors, drivers, instruments, control valves, electric generators and electric distribution equipment have not been considered due to the enormous variety and complexity of the raw materials consumed.

The tonnages shown in tables 36 and 37 should be understood as being only a rough approximation of the minimum quantities of different grades of raw steel to be consumed in each of the categories of equipment considered over the 1962-65 and 1966-70 periods.

/Table 36

Table 36

DEMAND IN TERMS OF SPECIFICATION STEELS AS ANTICIPATED FOR THE 1962-65 PERIOD

(Weights in tons)

	Steel pipes and tubes							Steel plates				Structural steel ASTM A 7	Steel castings ASTM A216	Steel forgings ASTM A181	Miscellaneous materials	Total
	API 5A	API 5L	API 5LX	ASTM A53	ASTM A214 or A 179	ASTM A 106 or A 161	Miscellaneous pipes and tubes	ASTM A 283	ASTM A 285	ASTM A 201	Miscellaneous plates					
Storage tanks	-	-	-	-	-	-	-	35 700	-	-	-	2 800	-	-	1 260	39 760
Pressure vessels	-	-	-	-	-	-	-	628	8 800	-	1 200	378	-	-	1 571	12 577
Heat exchangers	-	-	-	-	1 800	-	-	100	1 250	300	150	-	-	-	1 475	5 075
Furnaces	-	-	-	-	-	2 800	100	-	1 000	-	600	1 000	-	-	924	6 424
Pumps and drivers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compressors and drivers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valves	-	-	-	-	-	-	-	-	-	-	-	-	4 270	3 800	1 382	9 452
Piping	432 200	47 080	306 000	10 200	-	9 100	3 425	-	-	-	-	-	-	-	-	808 005
Structural steel	-	-	-	-	-	-	-	-	-	-	-	6 375	-	-	-	6 375
Instruments and C. valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steam generators	-	-	-	-	-	1 050	500	-	1 200	-	250	600	-	-	920	4 520
Turbogenerators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electric distribution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5 829	5 829
Total	432 200	47 080	306 000	10 200	1 800	12 950	4 025	36 428	12 250	300	2 200	11 153	4 270	3 800	13 361	898 017

/Table 37

Table 37

DEMAND IN TERMS OF SPECIFICATION STEELS AS ANTICIPATED FOR THE 1966-70 PERIOD

(Weights in tons)

	Steel pipes and tubes							Steel plates				Structural steel ASTM A 7	Steel castings ASTM A 216	Steel forgings ASTM A 181	Miscellaneous materials	Total
	API 5A	API 5L	API 5LX	ASTM A 53	ASTM A 214 or A 179	ASTM A 106 or A 161	Miscellaneous pipes and tubes	ASTM A 283	ASTM A 285	ASTM A 201	Miscellaneous plates					
Storage tanks	-	-	-	-	-	-	-	93 000	-	-	-	7 200	-	-	3 100	103 300
Pressure vessels	-	-	-	-	-	-	-	675	9 500	-	1 300	405	-	-	1 587	13 467
Heat exchangers	-	-	-	-	2 200	-	-	125	1 560	375	190	-	-	-	1 805	6 255
Furnaces	-	-	-	-	-	4 250	190	-	1 400	-	900	1 400	-	-	1 324	9 464
Pumps and drivers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Compressors and drivers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Valves	-	-	-	-	-	-	-	-	-	-	-	-	5 200	4 600	1 674	11 474
Piping	613 400	50 545	695 000	12 900	-	11 500	4 235	-	-	-	-	-	-	-	-	1 387 580
Structural steel	-	-	-	-	-	-	-	-	-	-	-	7 995	-	-	-	7 995
Instruments and C. Valves	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Steam generators	-	-	-	-	-	1 840	750	-	2 000	-	400	1 100	-	-	1 260	7 350
Turbogenerators	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Electric distribution	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Miscellaneous	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2 939	2 939
Total	613 400	50 545	695 000	12 900	2 200	17 590	5 175	93 800	14 460	375	2 790	18 100	5 200	4 600	13 689	1 549 824

/1t can

It can be observed that some 90 per cent of the total equipment required during both periods is to be supplied in the form of pipes and tubes. This is the item for which the demand is by far the largest one.

Table 38

	(1962-65)		(1966-70)	
	(tons)	(%)	(tons)	(%)
Steel pipes and tubes	814 255	90.8	1 396 810	89.9
Steel plates	51 178	5.7	111 425	6.9
Structural steel	11 153	1.2	18 100	1.1
Steel castings	4 270	0.5	5 200	0.3
Steel forgings	3 800	0.4	4 600	0.3
Miscellaneous materials	13 361	1.5	13 689	0.8
Total	898 017	100.0	1 549 824	100.0

The following are the figures estimated for 1962-65:

/Table 39

Table 39

(Weights in tons)

		Total	Welded	Seamless
API 5A	Casing	351 800	70 400	281 400
	Tubing	80 400	-	80 400
API 5L	Crude gathering system	8 080	6 500	1 580
	Natural gas collecting system	9 000	9 000	-
	Maintenance of existing pipelines	30 000	24 000	6 000
API 5LX	Gasoducto del Sud, mainline	290 000	290 000	-
	Pipeline Colonia Catriel-V.Regina	6 000	6 000	-
	Maintenance of existing pipelines	10 000	8 000	2 000
ASTM A53	Piping (natural gas plants, refineries and petrochemicals)	10 200	-	10 200
ASTM A214 or A179	Heat exchangers (natural gas plants, refineries and petrochemicals)	1 800	900	900
ASTM A106 or A161	Furnaces, piping and steam generators (natural gas plants, refineries and petrochemicals)	12 950	-	12 950
Miscellaneous pipes and tubes		4 025	2 015	2 010
Total		814 255	416 815	397 440
		100%	51%	44%

/The situation

The situation corresponding to the 1966-70 period is anticipated as follows:

Table 40

(Weights in tons)

		Total	Welded	Seamless
API 5A	Casing	499 300	99 300	400 000
	Tubing	114 100	-	114 100
API 5L	Crude gathering system	11 545	9 200	2 345
	Natural gas collecting system	4 000	4 000	-
	Maintenance of existing pipelines	35 000	28 000	7 000
API 5LX	Gasoducto B. Ville to Pacheco	60 000	60 000	-
	Gasoducto del Sud and Gasoducto del Este, branch lines	620 000	620 000	-
	Maintenance of existing pipelines	15 000	12 000	3 000
ASTM A53	Piping (refineries and petrochemicals)	12 900	-	12 900
ASTM A214 or A179	Heat exchangers (refineries and petrochemicals)	2 200	1 100	1 100
ASTM A106 or A161	Furnaces, piping and steam generators (refineries and petrochemicals)	17 590	-	17 590
Miscellaneous pipes and tubes		5 175	2 587	2 588
Total		1 396 810	836 187	560 623
		100%	60%	40%

/The overall

The overall quantities of plates and billets deemed necessary over the periods 1962-65 and 1966-70 are shown in the table below. These figures give a rough idea of the minimum potential load to be expected on the manufacturing sector of the steel industry.

Table 41

	(1962-65)		(1966-70)	
	(tons)	(%)	(tons)	(%)
Steel plates	467 993	52.0	1 007 612	62.5
Steel billets	397 440	44.3	560 623	34.9
Structural steel	11 153	1.2	18 100	1.1
Steel castings	4 270	0.5	5 200	0.3
Steel forgings	3 800	0.4	4 600	0.3
Miscellaneous materials	13 361	1.5	13 689	0.8
Total	898 017	100.0	1 609 824	100.0

/8. Market for

8. Market for the heavy equipment industry

The demand for basic equipment has been estimated in terms of the total minimum quantities which are expected to be consumed during the 1962-65 and 1966-70 periods. The following are the known figures:

Table 42

	(Approximate cost of material) (US$)	
	(1962 - 65)	(1966 - 70)
Crude Oil Programme	112 668 000	168 500 000
Natural Gas Production	1 743 000	794 000
Natural Gas Processing	15 250 000	-
Natural Gas Transportation	90 727 000	156 635 000
Crude Oil and Products Storage	1 980 000	18 985 000
Refinery Equipment	42 275 000	70 815 000
Petrochemicals	51 250 000	51 250 000
Total	315 893 000	466 979 000[a/]

a/ The same figures shown in item 5.

Such values give a reasonable feeling of the ample market for heavy equipment existing in Argentina over the coming years.

However, during 1962-65 all the petrochemical projects, the 20 000 BPD lubricating oil refinery for YPF and the Gasoducto del Sud are being financed by foreign capital and with the exception of minor elements, the whole of the basic equipment to be installed in these projects is being manufactured abroad and will be imported. The 50 000 BPD refinery to be erected by 1965 and much of the drillings contracted by YPF for the next years will also be financed by foreign capital. It is possible that the whole of the equipment for these projects will be imported. Similarly, the Gasoducto del Sud project is being financed by foreign capital and it is also possible that much of the basic equipment, including the gas plants, will be manufactured abroad.

/The situation

The situation anticipated for these sectors during the 1962-65 period is tentatively shown in the following tables:

Table 43

CRUDE OIL PROGRAMME

(1962 - 65)

	Imported (US$)	Domestic (US$)	Total (US$)
Valves	740 000	740 000	1 480 000
Piping	40 250 000	40 250 000	80 500 000
	10 500 000	10 500 000	21 000 000
	-	1 500 000	1 500 000
Total	51 490 000	52 990 000	104 480 000

Table 44

NATURAL GAS TREATMENT PLANTS

(1962 - 65)

	Imported (US$)	Domestic (US$)	Total (US$)
Storage Tanks	1 800 000	-	1 800 000
Pressure Vessels	1 092 000	-	1 092 000
Heat Exchangers	880 000	-	880 000
Furnaces	434 000	-	434 000
Pumps and Drivers	828 000	-	828 000
Compressors and Drivers	4 016 000	-	4 016 000
Valves	1 410 000	-	1 410 000
Piping	2 362 000	-	2 362 000
Structural Steel	286 000	-	286 000
Instruments and C. Valves	702 000	-	702 000
Steam Generators	892 000	-	892 000
Turbogenerators	-	-	-
Electric Distribution	548 000	-	548 000
Miscellaneous	-	-	-
Total	15 250 000	-	15 250 000

/Table 45

Table 45

REFINERY EQUIPMENT

(20 000 and 50 000 BPD Refineries)

(1962 - 65)

	Imported (US$)	Domestic (US$)	Total (US$)
Storage Tanks	4 945 000	-	4 945 000
Pressure Vessels	3 900 000	-	3 900 000
Heat Exchangers	3 620 000	-	3 620 000
Furnaces	3 045 000	-	3 045 000
Pumps and Drivers	2 500 000	-	2 500 000
Compressors and Drivers	2 200 000	-	2 200 000
Valves	4 445 000	-	4 445 000
Piping	6 970 000	-	6 970 000
Structural Steel	1 255 000	-	1 255 000
Instruments and C. Valves	2 900 000	-	2 900 000
Steam Generators	2 560 000	-	2 560 000
Turbogenerators	-	-	-
Electric Distribution	2 835 000	-	2 835 000
Miscellaneous	1 100 000	-	1 100 000
Total	42 275 000	-	42 275 000

/Table 46

Table 46

PETROCHEMICALS

(1962 - 65)

	Imported (US$)	Domestic (US$)	Total (US$)
Storage Tanks	4 642 000	-	4 642 000
Pressure Vessels	6 344 000	-	6 344 000
Heat Exchangers	3 775 000	-	3 775 000
Furnaces	1 920 000	-	1 920 000
Pumps and Drivers	2 313 000	-	2 313 000
Compressors and Drivers	4 880 000	-	4 880 000
Valves	5 112 000	-	5 112 000
Piping	7 668 000	-	7 668 000
Structural Steel	1 599 000	-	1 599 000
Instruments and C. Valves	1 590 000	-	1 590 000
Steam Generators	1 544 000	-	1 544 000
Turbogenerators	2 888 000	-	2 888 000
Electric Distribution	4 242 000	-	4 242 000
Miscellaneous	2 733 000	-	2 733 000
Total	51 250 000	-	51 250 000

/Only the

Only the additional products storage which will be necessary over the years 1962-65 and the piping and valves for the YPF crude drilling programme, oil and gas collecting system, and the pipe for the short crude line from Colonia Catriel to Villa Regina, are expected to be purchased in Argentina during this period. These items refer to basic equipment being normally supplied by the domestic manufacturers to the crude oil and gas collecting sector of the petroleum industry; the trend for the future is not to discontinue the local procurement of such items. The piping and the valves required for the gas distributing system are of normal dimensions and it has been assumed that these items will also be of local manufacture.

The following tables show a brief summary of the picture possible to anticipate for the 1962-65 period:

Table 47

NATURAL GAS COLLECTING SYSTEM

(1962-65)

	Imported (US$)	Domestic (US$)	Total (US$)
Valves	-	123 000	123 000
Piping	-	1 620 000	1 620 000
Total	-	1 743 000	1 743 000

Table 48

NATURAL GAS TRANSPORTATION

(1962-65)

	Imported (US$)	Domestic (US$)	Total (US$)
Compressors and drivers	25 600 000	-	25 600 000
Valves	1 274 000	-	1 274 000
	-	353 000	353 000
Piping	54 000 000	9 500 000[a/]	63 500 000
Total	80 874 000	9 853 000	90 727 000

a/ About 15 per cent of the piping required for Gasoducto del Sud is being purchased locally.

/Table 49

Table 49

TRANSPORT OF CRUDE OIL AND PRODUCTS

(1962-65)

	Imported (US$)	Domestic (US$)	Total (US$)
Piping	-	1 068 000	1 068 000
	-	-	-
	-	7 120 000	7 120 000
Total	-	8 188 000	8 188 000

Table 50

CRUDE OIL AND PRODUCTS STORAGE

(1962-65)

	Imported (US$)	Domestic (US$)	Total (US$)
Storage tanks	-	-	-
	-	1 980 000	1 980 000
Total	-	1 980 000	1 980 000

Under such conditions, the equipment marked actually available to the domestic industry is much smaller than the overall demand. It is estimated that such limited demand is of the order of 75 million dollars, i.e. about 24 per cent only of the total expenditures in equipment anticipated during the 1962-65 period (316 million dollars). The following table shows broken-down figures as classified by sectors:

/Table 51

Table 51

(1962-65)

	Imported (US$)	Domestic (US$)	Total (US$)
Crude oil programme	51 490 000	61 178 000	104 480 000
Natural gas production	-	1 743 000	1 743 000
Natural gas processing	15 250 000	-	15 250 000
Natural gas transportation	80 874 000	9 853 000	90 727 000
Crude oil and products storage	-	1 980 000	1 980 000
Refinery equipment	42 275 000	-	42 275 000
Petrochemicals	51 250 000	-	51 250 000
Total	241 139 000	74 754 000	315 893 000
	76%	24%	100%

It is highly desirable and recommended that as much as possible of the basic equipment for the gas plants and the 50 000 BPD refinery (these two projects are still in preliminary stages and include equipment well within the manufacturing capacity of the domestic industry) be purchased in Argentina. If this objective can be achieved and assuming that some 50 per cent of the respective equipment will be fabricated in the country, the size of the prospective market available to the national equipment industry would be increased by some 19 million dollars. The anticipated situation would then be:

/Table 52

Table 52

	Imported (US$)	Domestic (US$)	Total (US$)
Crude oil programme	51 490 000	61 178 000	104 480 000
Natural gas production	-	1 743 000	1 743 000
Natural gas processing	7 625 000	7 625 000	15 250 000
Natural gas transportation	80 874 000	9 853 000	90 727 000
Crude oil and Products storage	-	1 980 000	1 980 000
Refinery equipment	30 475 000	11 800 000	42 275 000
Petrochemicals	51 250 000	-	51 250 000
Total	221 714 000	94 179 000	315 893 000
	70%	30%	100%

For the 1966-70 period, it is expected that most of the financial problems associated with purchasing domestic equipment will be solved with the result that the market for heavy industrial equipment effectively available to the Argentine industry would be of an order of magnitude of some 80 per cent of the overall anticipated demand. (It is expected that imports deemed absolutely necessary during this period will consist only of special alloy steels, a few compressor items, special compressor drivers, sophisticated types of instruments and control valves and electricity generating plant, the demand for which seems to be too small to be likely to expect the development of manufacturing facilities in the coming years.)

9. Possibilities of supply of basic equipment for the petroleum, natural gas and petrochemical industries during the 1962-65 and 1966-70 periods

The equipment fabricating industry has made considerable progress during the last years and there is little doubt that under proper conditions it could produce more than 80 and 90 per cent of the total demand anticipated for the 1962-65 and 1966-70 periods, respectively.[6/]

Such percentages are well indicative of the high stage of development already reached and further expected from the domestic industry over the coming years.

It should be noted that the percentages shown in tables 53 and 54 refer to the total volume of the orders that could be placed in Argentina in the near future after having properly taken into account the manufacturing capacity of the various sectors of the local industry plus the prospective technical problems and limitations resulting from the very strict specifications imposes on some of the equipment deemed to be required.

6/ Assuming that financial problems in connexion with domestic suppliers' credit may be eliminated.

Table 53

APROXIMATE VALUE OF THE EQUIPMENT THAT COULD BE MADE IN THE COUNTRY IN THE 1962-65 PERIOD

	Total anticipated demand (US$)	Estimated manufacturing capacity of the domestic industry (%)	Approximate value of the equipment that could be made in the country (US$)
Storage tanks	13 367 000	100	13 367 000
Pressure vessels	11 336 000	80	9 100 000
Heat exchangers	8 275 000	80	6 600 000
Furnaces	5 399 000	60	3 240 000
Pumps and drivers	5 641 000	60	3 380 000
Compressors and drivers	36 696 000	35	12 800 000
Valves	14 197 000	75	10 600 000
Piping	193 308 000	95	183 500 000
Structural steel	3 140 000	100	3 140 000
Instruments and C. Valves	5 192 000	25	1 300 000
Steam generators	3 996 000	70	3 500 000
Turbogenerators	2 888 000	-	-
Electric distribution	7 625 000	80	6 100 000
Miscellaneous	3 833 000	50	1 920 000
Total	315 893 000	82	258 547 000

/Table 54

Table 54

APPROXIMATE VALUE OF THE EQUIPMENT THAT COULD BE MADE IN THE COUNTRY IN THE 1966-70 PERIOD

	Total anticipated demand (US$)	Estimated manufacturing capacity of the domestic industry (Percentage)	Approximate value of the equipment that could be made in the country (US$)
Storage Tanks	31 862 000	100	31 862 000
Pressure Vessels	12 044 000	90	10 800 000
Heat Exchangers	10 015 000	90	9 000 000
Furnaces	7 620 000	70	5 330 000
Pumps and Drivers	6 513 000	75	4 900 000
Compressors and Drivers	15 080 000	55	8 300 000
Valves	15 921 000	90	14 300 000
Piping	337 488 000	98	330 000 000
Structural Steel	3 939 000	100	3 939 000
Instruments and C. Valves	5 790 000	50	2 900 000
Steam Generators	5 624 000	80	4 500 000
Turbogenerators	2 888 000	-	-
Electric Distribution	8 262 000	100	8 262 000
Miscellaneous	3 933 000	70	2 750 000
Total	466 979 000	94	436 843 000

/No consideration

No consideration is given in the above percentages to the fact that before 1955 the domestic production of steel plates and/or ingots is not expected to be large enough to meet the requirements of the heavy equipment industry. Under such limitations, almost all raw material is probable to come from foreign suppliers during the 1962-65 period. It is further to be noted that these values shown in table 5 should be taken as only a preliminary measure of the manufacturing capacity of the Argentine industry.

The figures referring to the possibilities of the domestic industry were estimated with basis on information submitted by leading representatives of various sectors of the industry, engineering companies, foreign suppliers and most important consumers concerned.

1. Storage tanks

The manufacturing potential throughout the 1962-65 and 1966-70 periods is expected to cover 100 per cent of the total demand.

Large tanks up to 93 750 lbs or 15 000 m^3 spheres up to 10 000 lbs are already being fabricated in Argentina from imported steel plate.

Asociación de Industriales Metalúrgicos estimate the annual capacity of the industry in the neighbourhood of 60 000 tons. The types fabricated include bullets, spheres, cylindrical tanks, of either conical or floating roofs (welded construction), i.e. all current types normally called for in refinery service.

2. Pressure vessels

The manufacturing potential is expected to cover 80 and 90 per cent of the demand during the 1962-65 and 1966-70 periods, respectively.

Pressure vessels and fractionating columns up to 3.8 m in diameter and 40 m in height are possible to obtain in the country. (The raw material, of course, is being 100 per cent imported at the present time. Special fittings and accessories are also being imported.)

Protection against corrosion at high temperature requires the use of alloy clad steel. These units are being imported from abroad and will probably continue coming from foreign suppliers in the near future.

/3. Heat exchangers

3. Heat exchangers

Non-ferrous or alloy steel heat exchangers are the only type not fabricated in the country at the present time. However, there are manufacturers already considering the possibilities in this respect and planning to start soon fabrication of exchangers other than carbon steel units.

The manufacturing potential of the industry can be assumed to cover 80 and 90 per cent of the demand anticipated for the 1962-65 and 1966-70 periods.

4. Furnaces

The manufacturing capacity is estimated approximately 60 to 70 per cent of the demand for 1962-65 and 1966-70, respectively.

The steel content of this equipment consists essentially of tubes and headers set in a framework of structural steel. Alloy tubes and headers are required for protection against corrosion and allowance for the importation of these items is included in the above percentages.

5. Pumps and drivers

Leading American manufacturers of centrifugal process pumps have already licensed Argentine fabricators or established their own facilities in the country for the manufacture of equipment. Parts and/or accessories accounting to some 10 to 15 per cent of the total weight of such pumps are and probably will continue being imported throughout the coming years.

Asociación de Industriales Metalúrgicos has informed that units specified for service conditions up to 450 m^3/hour, pressures of 15 kg/m^2 and temperatures of 300°C have already been fabricated in the country. Electric drivers (inclusive of explosion-proof types) up to 150 HP have also been manufactured in Argentina. Nevertheless, larger pumps operating at higher temperatures and explosion-proof motors of greater power are to be required. For this reason, the overall manufacturing capacity is expected to be of the order of only 60 and 75 per cent of the demand during the 1962-65 and 1966-70 periods.

/6. Compressors and

6. Compressors and drivers

At the present time there is no fabrication of compressors in Argentina. However, two leading American manufacturers have already entered into license agreements with domestic firms for the purpose of fabricating compressors in the country. The idea under way is to start with the fabrication of parts and accessories needed for maintenance and replacement of the units in operation. As this maintenance and replacement market expands, the fabrication of integral units will gradually follow.

According to representatives of such two American firms, it is expected that the manufacturing capacity by 1965 will be of the order of 50 per cent of the demand, to be increased to some 70 per cent by 1970.

Average figures throughout the 1962-65 and 1966-70 periods are smaller, in the neighbourhoods of 35 and 55 per cent of the demand.

7. Valves

Asociación de Industriales Metalúrgicos estimates that the domestic industry is already capable of producing some 90 per cent of all valves currently called for by the petroleum, natural gas and petrochemical industries.

The manufacturing capacities assumed for the 1962-65 and 1966-70 periods are of the order of 75 and 90 per cent, respectively. The balances of 25 and 10 per cent make allowance for the very special type which are not yet produced in the country and should be imported.

8. Piping

The pipe required for the crude oil and gas programmes, petroleum refining and the petrochemical industry is mainly of the ordinary seamless or welded carbon steel types, made according to specifications API 5A, 5L, 5LX and ASTM.

A considerable quantity of such piping is already being made in the country. Asociación de Industriales Metalúrgicos and Cámara Gremial de Fabricantes de Caños y Tubos de Acero have undertaken a preliminary survey of the manufacturing resources in this sector and arrived to the following non-cumulative figures:

Specification	Diameters	Manufacturing capacity	
		1962-65	1966-70
API 5A	2 1/2" to 7"	above 900 000 tons	above 1 200 000 tons
API 5L	up to 10 3/4"	above 1 200 000 tons	above 1 500 000 tons
API 5LX	above 10"	above 500 000 tons	above 700 000 tons
ASTM	all sizes	above 1 200 000 tons	above 1 600 000 tons

The totals were calculated with basis on the capacity of the leading manufacturers presently in operation in Argentina. The figures shown are not to be understood as representative of the total possibilities of the country which are certainly in excess of these tonnages.

To make allowance for special alloy types which are not yet produced or deemed to be fabricated in Argentina in the near future, the manufacturing potential for the 1962-65 and 1966-70 periods is to be taken in the neighbourhood of 95 and 98 per cent of the demand.

9. Structural steel

About 36 000 tons/annum of steel structures are being produced in the country. The manufacturing potential throughout the 1962-65 and 1966-70 periods is 100 per cent.

10. Instruments and control valves

Fabrication of instruments and control valves for process industries has recently started in Argentina. At least one leading American manufacturer of instruments has licensed the domestic fabrication of indicators, pneumatic controllers and recorders. A complete line of instruments for temperature, pressure, flow and level measurement and control appears to be available in the country.

Domestic fabrication of control valves has also recently started.

Although it is rather difficult to anticipate accurate estimates for the manufacturing potential in this sector, it is expected that a minimum of 25 and 50 per cent of the demand for the 1962-65 and 1966-70 periods will be possible to satisfy through domestic suppliers.

/11. Steam generators

11. Steam generators

A sizeable volume of steam generators is being already produced in the country.

According to information submitted to CEPAL, the manufacturing capacity is considered adequate to supply in excess of 60 per cent of the demand envisaged for the 1962-65 and 1966-70 periods.

Average figures of 70 and 80 per cent are reasonable to consider for the two periods in question.

12. Turbogenerators

Steam turbogenerators are not being manufactured in Argentina at the present time and projects for developing fabricating facilities are not yet known to date. For this reason, 100 per cent of the demand for both future periods is to depend on importation.

13. Electric distribution equipment

Domestic resources cover a wide range of products. Asociación de Industriales Metalúrgicos estimate that about 80 per cent of the demand can be already supplied by the national industry, inclusive of explosion-proof equipment. In a reasonably short time it is expected that this figure will attain the neighbourhood of 100 per cent.

10. Prospective trends for the equipment fabricating industry

The basic equipment which will be called for by the petroleum, natural gas and petrochemical industries over the period 1962-70 has a total minimum value of the order of 783 million dollars.

If substantially the major part of the equipment is to be imported (as indicated in section 8), the Argentine equipment fabricating industry will miss many valuable opportunities during the next years to expand its resources in this field of activities.

It is clear that one of the most severe limitations in this sector is the lack of capital to finance the purchasing of equipment to be paid for in pesos, with the consequence that the domestic industry is prevented from producing a reasonable proportion of the items consumed.

The present position in which, for instance, practically the whole of the basic equipment for the refineries and the petrochemical developments scheduled for 1962-65 will be imported may create an adverse situation for the expansion of the equipment fabricating industry. For this reason, consideration should be given as soon as possible to the problem of ensuring that a proportion as large as possible of the heavy industrial equipment required for the 1966-70 period can and will be manufactured in the country.

In the near future, in the 1962-65 period, it would be highly desirable, if possible, that arrangements were made whereby the projected 50 000 BPD refinery and the gas plants could be manufactured in Argentina to the largest possible extent. This point had been already mentioned in section 9.

As already indicated, the present situation is largely dictated by shortage of capital and means must be found to alleviate this position if the fabricating industry is to take its full share of the demand for basic equipment.

The petroleum, natural gas and petrochemical industries are essential primary industries. As such they require very large capital investments in plant and equipment and for many years will probably be partly financed by foreign concerns. It is therefore important to consider what steps should be taken to ensure the expansion of the equipment industry so that, under these conditions, it can supply a major proportion of the basic equipment requirements.

/Among the

Among the various possible ways to assist the domestic industry, it will certainly require financial support at reasonable rates, in the form of working capital, either to enable it to finance the manufacture of its products or to finance competitively the sale of the finished goods.

Also, in order to make sure that the industry has the opportunity to quote for a major portion of the basic equipment required, it is suggested that a condition should be made to induce investors to employ preferably those contractors who have established a purchasing department in Argentina and who also propose to carry out the greater portion of the mechanical design in the country.

It is clear that the basic design of all refinery and petrochemical plants to be erected in Argentina over the next decade shall almost certainly have its origin abroad. At the present time the natural tendency is for designers in these countries to specify unit items of basic equipment in terms of the qualities of material and the equipment designs available to them in their very highly developed supply industries, and insistence on such standards by the design departments of contractors makes it very difficult for their purchasing departments to place orders in those countries where the fabricationg industries are still in the development stage with regard to the supply of the specialized equipment required.

To overcome this difficulty, it is essential that foreign contractors for the petroleum and petrochemical industries employed by foreign or national investors should establish purchasing organizations in Argentina fully cognizant with what is available in the country and prepared to co-operate with local manufacturers. It is also essential that contractors should take steps to see that the detailed mechanical design of the equipment they specify is based on a thorough knowledge of whatever can be obtained in the country at the time, and if possible do a large part of the mechanical design in Argentina. In the event that Argentine construction companies should become allied with foreign contractors in order to obtain the necessary technical knowledge, and set up their own purchasing and mechanical design departments to work with their foreign associates, the same beneficial result would be achieved.

/At this

At this point some explanation of "know-how" and its transfer is necessary. "Know-how" is simply specialized knowledge and experience. In the design and manufacture of refinery and petrochemical plant there are three main areas of activity:(i) process design in which the exact manner in which the process is to be carried out is laid down in detail; (ii) mechanical design, in which the process design is converted into a combination of unit pieces of equipment to meet all the conditions laid down in the process design. Here the projected units are designed in mechanical detail and complete specifications are laid down so that purchasing orders may be placed for each item of equipment; iii) fabrication. When the order is placed the manufacturer is completely informed of what he has to make and is subject to a rigid inspection before delivery is accepted. The "know-how" in each of these areas is quite different. Process design is the work of teams of research chemists, physicists, and chemical engineers, and the knowledge and experience exercised in this field determines whether the processes will be competitive and ultimately whether the contractor's business will be successful. Activity in this area is mainly directed towards progress, and technically it is only concerned with the past in so far as it is a stepping stone to the future. It is much concerned with patent rights and royalties and a great deal of the knowledge accumulated in process design departments is of a secret nature - especially in the field of chemicals from petroleum. It is obvious that up to date "know-how" in this area cannot be fully transferred. It can only be acquired in Argentina along the same way, followed in highly developed countries, which is a long, laborious and costly development.

In the area of mechanical design the matter is quite different, and specialized knowledge can be readily transferred to properly trained mechanical engineers who have gained appropriate experience in refineries and chemical plants. Similarly, the manufacturing industry learns by doing, and the first stage in the transfer of "know-how" in this field takes place when the contractor sets up a purchasing department in the country where the equipment is to be purchased.

/Much progress

Much progress in this direction has been made in Argentina as a result of the initiative of foreign consulting engineering firms, and of the co-operation of the private petroleum companies. As a result the equipment fabricating industry has already developed to the point where it is competent to produce much of the code equipment required.

In other words the first stage in the transfer of "know-how" has already started and will continue as the demand from the petroleum, natural gas and petrochemical industries increases in volume and complexity.

If arrangements can be made whereby a gradually increasing part of the mechanical design is to be carried out in Argentina either by foreign or Argentine contractors the next stage in the transfer of "know-how" that is knowledge and experience of mechanical design, will take place and will form a valuable base for the time in the future when Argentine companies can themselves develop their own process design departments. In continuation to the means suggested to assist the local industry it could further be indicated that incentives might be given to investors submitting schemes which make the fullest use of Argentine manufacturing resources.

Adequate supplies of raw steel in the forms and to the specifications required should also be more easily available to the industry in order to eliminate the present situation where practically all the steel plate consumed in the country is to be imported at a price well above the international levels.

In addition to all suggested measures on its support, the domestic industry must make efforts to provide itself with adequate mechanical equipment and trained people so that it can fabricate basic equipment in the sizes and according to the high standards of quality, finish and workmanship normally called for by the process industries. (The trend in petroleum refineries, for instance, is for building larger process units which may take advantage of the economies of scale in investments and operating costs resulting from utilization of such greater units. These units call in turn for larger furnaces, larger fractionating columns, larger heat exchangers, larger pumps and more powerful motors, all of which will call for adequate equipment and highly skilled and trained people in the fabricating industries.) In this connexion it should be noted that specialized

fabricating facilities need not be built up by every manufacturer but may well be concentrated with a few enterprises in order to minimize the investments. Access to these specialized facilities could be made available to all manufacturers in the form of contracts inter-industries.

Finally, the whole of the heavy equipment industry should dedicate to establish the best possible standards of organization in order to avoid wastes of time and labour and be able to deliver all orders to time and at the lowest possible costs, thus trying to make itself fully competitive with foreign suppliers.