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NEW PRIMARY FEED-STOCK SUPPLIER ACCELERATES DEVELOPMENT OF LARGE SCALE PETROCHEMICAL INDUSTRY IN BRAZIL[1/]

by

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SUMMARY

NEW PRIMARY FEED-STOCK SUPPLIER ACCELERATES DEVELOPMENT OF LARGE SCALE PETROCHEMICAL INDUSTRY IN BRAZIL

by

B.S. Duff

Sao Paolo, Brazil

Although the most populous country in Latin America, Brazil is one of the lowest in per capita consumption of petrochemical products. The existing petrochemical industry, based largely on petroleum refinery gases, supplies only a fraction of the country s requirements for fertilizers and polymers.

A group of private Brazilian entrepreneurs founded the company "Petroquímica União S..." with the objective of building a large-scale naphtha based olefins-aromatics complex to supply primary feed-stock at quantities and prices that would permit the development of a conversion industry capable of operating on an economic scale comparable to the more industrialized countries. The Brazilian government has given its enthusiastic support to the project including the commitment to supply the required naphtha and the participation

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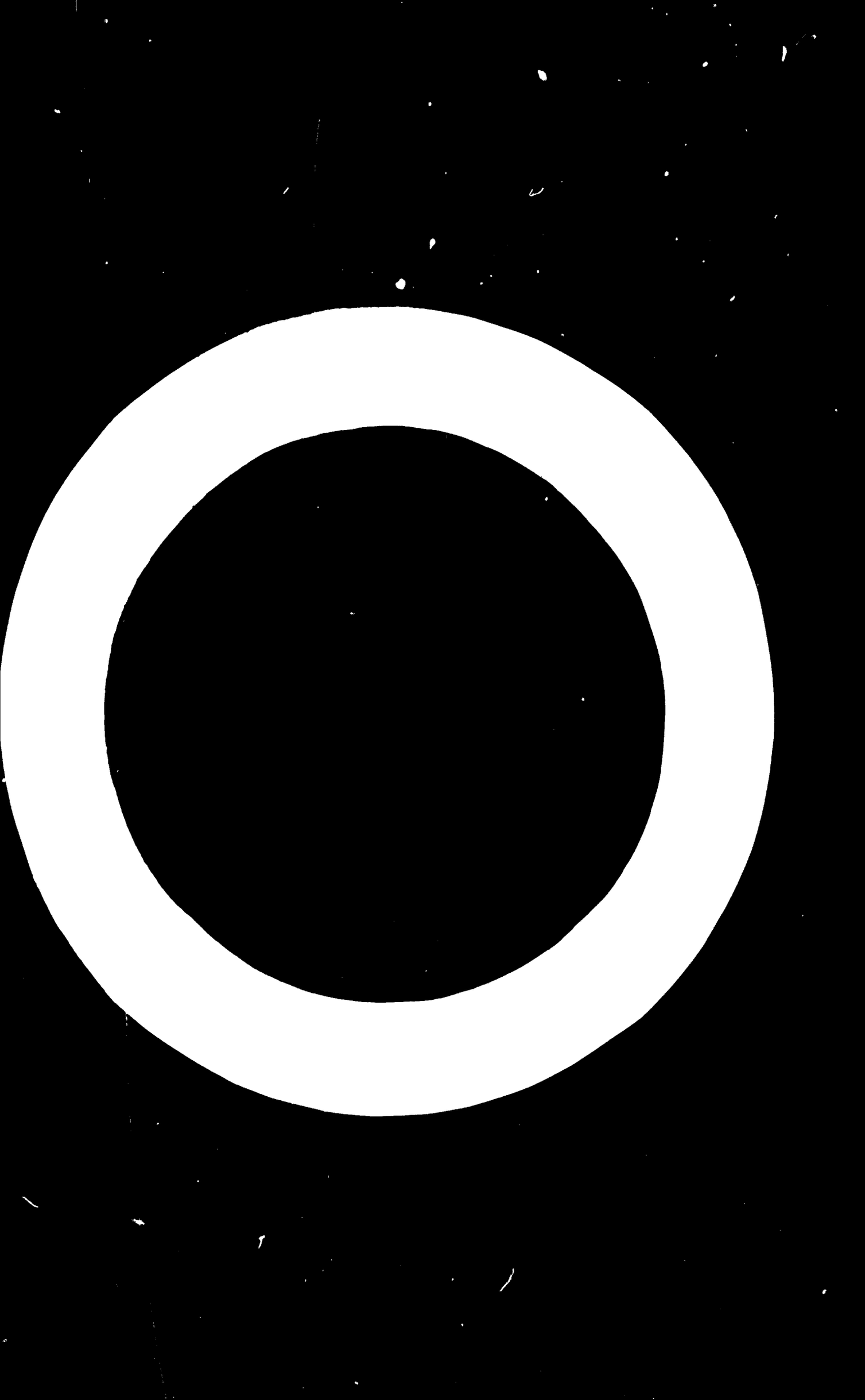


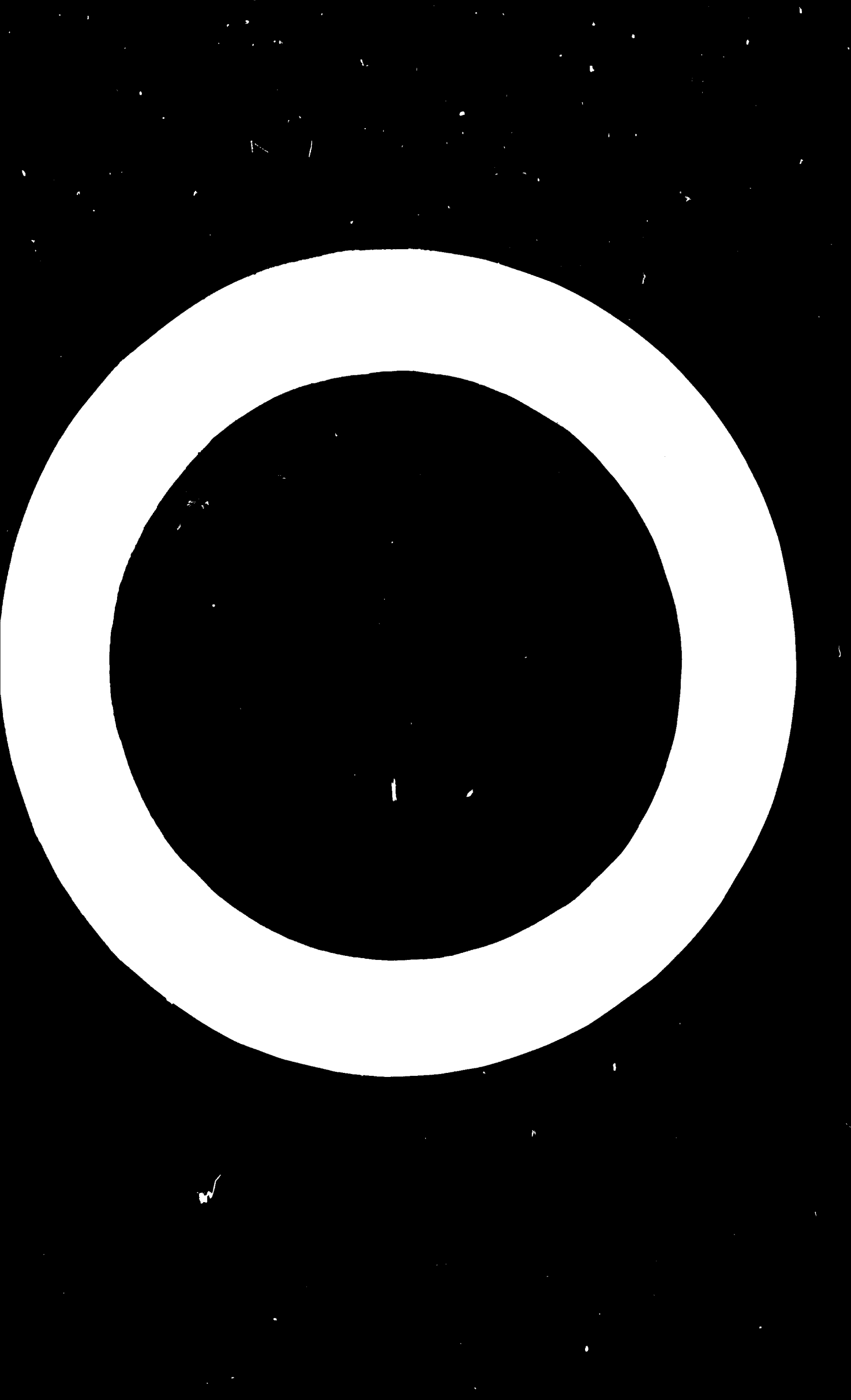
of "Petroquisa", the newly formed petrochemical subsidiary of Petrobras.

The investment in the basic facility is approximately US$ 75 million, of which the Brazilian sponsors are providing US$ 26 million as equity capital, the International Finance Corporation (World Bank) is providing US$ 8 million as equity and loans, a group of French banks is lending US$ 36 million and a group of Brazilian banks is lending US$ 3 million for working capital.

The project includes a naphtha cracking unit to produce ethylene, propylene, butadiene, pyrolysis gasoline, and carbonblack feed-stock; a naphtha reformer for benzene and xylene reformate; an aromatics extraction unit to recover the benzene, toluene and xylenes from the pyrolysis gasoline and reformate; a toluene hydrodealkylation unit to convert toluene to benzene; a xylene isomerization unit; and an aromatics fractionation and finishing unit. Provision is also being made for future installation of a para-xylene recovery unit.

At full operation the plant will produce: 300,000 metric tons per year of ethylene, 165,000 tons of propylene, 110,000 tons of benzene, 68,000 tons of xylenes and over 200,000 tons of other feed-stocks.

The project has already stimulated an investment of US$ 200 million in downstream projects, including high density polyethylene, low density polyethylene, vinyl chloride monomer, vinyl chloride polymer, propylene tetramer and cumene. Several other projects in an advanced planning stage will require over US$ 200 million in additional investment.



With a population of some 90.000.000, Brazil is by far the most populous country in Latin America. Its production and consumption of petrochemical products, however, is low compared to other countries. As an example, Table I shows the per capita consumption of thermoplastics for the year 1964.

Table I

Per capita consumption of thermoplastics

1964

(Kilograms)

Country	Polyethylene	PVC	Polystyrene	Total
U,S.A.	5.34	3.54	4.60	13.48
Germany	2.92	4.30	2.55	9.77
U.K.	2.81	3.54	1.59	7.94
Benelux	2.71	2.38	1.50	6.59
Holland	2.66	4.23	1.33	8.22
Japan	2.66	3.80	1.05	7.51
France	2.30	3.35	1.72	7.37
Italy	1.51	2.70	1.79	6.00
Venezuela	0.84	0.83	0.12	1.79
Spain	0.64	0.80	0.50	1.94
Argentina	0.52	0.46	0.28	1.26
Mexico	0.46	0.32	0.23	1.01
Chile	0.44	0.41	0.45	1.30
Colombia	0.26	0.17	0.07	0.50
Brazil	0.21	0.36	0.17	0.74

A basic reason for Brazil's low consumption has been its lack of natural gas and its dependance on imported petroleum. As a result, the petrochemical industry has developed slowly, on a small scale with consequent high priced products.

The existing industry started in 1954 with the production of ammonia from off-gas from the Cubatão refinery of Petrobrás. Then came the recovery of ethylene (20 tons per day) from the same refinery followed by styrene (Koppers Co), methanol (Bordon), polyethylene (Union Carbide) and carbon black (Copebrás). Thus the initial phase of the Brazilian petrochemical industry was based on by-products of the Cubatão refinery.

The demand for consumer products derived from petrochemicals is high in Brazil. In spite of existent adverse economic factors, the consumption of basic petrochemical derived products including thermoplastics, synthetic fibres and synthetic rubber has grown rapidly, as can be seen in Table II (which includes imports).

Table II

Apparent consumption of some petrochemical derived products in Brazil

	Thermoplastics		Synthetic Fibres		Synthetic Rubber	
Year	Tons	% increase	Tons	% increase	Tons	% increase
1965	51.930	-	14.700	-	37.800	-
1966	70.980	37	19.350	31	51.500	36
1967	94.300	33	25.480	31	57.000	11
1968	132.220	40	33.710	33	70.500	24

Under the pressure of the high demand for petrochemicals intermediates to support this growth rate, the existing conversion industry has resorted to every means to maximize its output, including for example the cracking of natural alcohol to supplement the limited availability of ethylene. However, for the most part the industry has depended on increasing imports of intermediates with its consequent adverse effect on the country's balance of payments.

Advent of Petroquimica União

In 1965, encouraged by favourable legislative actions of the Castello Branco Government, the entrepreneurs of the private Refinaria União undertook the promotion of a large scale petrochemical complex. The objective was to utilize the cheapest available raw material in a large scale plant, employing the latest technology, so that basic olefins and aromatics could be produ

at a price that would stimulate the development of a conversion industry capable of satisfying the domestic demand at prices competitive with those in the more industrialized countries.

The first idea was to form a joint venture between the Brazilian sponsor and a major foreign company with know-how in the field. Two attempts to form such a joint-venture were carried through detailed financial and technical studies to the point where construction work was almost ready to start but in each case the foreign partner backed out at the last minute. Frustrated by these failures the sponsors decided to promote the project without foreign participation.

In December 1967, Petrobrás Química S.A. (Petroquisa) was created by governmental Decree No. 61.981, with the majority of its shares owned by Petrobrás, the government oil company. The decree clearly defined the separation of the petrochemical industry from the state monopoly and empowered Petroquisa to participate, even as a minority partner, in the promotion of private projects. At the same time it provided that Petrobrás would supply the naphtha or other raw materials to the petrochemical industry at competitive world prices.

As a result of these favourable developments, the original sponsors were able to organize Petroquímica União as a joint venture of four Brazilian groups: Refinaria União, Petroquisa, Walter Moreira Salles group and the Ultra group.

During the first half of 1968, new studies were made to reconfirm the size of the markets, to identify possible outside financing and to prepare economical feasibility studies to optimize the project. These studies included one made by the International Finance Corporation, division of the World Bank, which reported favourably on the project and led to the participation of IFC in the project, as an equity partner and lender.

The Financial Plan

During July, August and September of 1968, intensive negotiations were carried out with financial groups in the United States, England and France to determine the best financial plan for the project. The objective of the negotiations was to obtain sixty per cent of the capital requirements in the form of long term loans with the remaining forty per cent to be provided as equity capital by the four Brazilian groups, plus IFC.

The financing plan selected by Petroquimica União, S.A. is based on an offer by the French Company - CIAVE S.A. and includes two types of loans. Twenty per cent of the total amount is in the form of a Euro-Dollar loan for the purchase of equipment in Brazil and eighty per cent of the total is in the form of a buyer's credit in French francs. Up to fifteen per cent of the total can be utilized for the purchase of equipment in the Common Market, plus England. The Franc loan made by a syndicate of French banks, headed by Banque Worms, is to be repaid over a ten year period, starting one year after completion of the plant.

After subsequent studies led to an increase in the size of the project and after some changes in the equity participation, the final project budget was established at 75 million dollars, with the loan and equity capital being distributed as shown in Table III.

Table III

Financial Plan

Project Budget		US$ 75 million
Equity		US$ 29 million
Refinaria e Exploração de Petróleo União S.A.	25 %	
Petrobrás Química S.A.	25 %	
Companhia São Fernando de Administração e Participações	25 %	
Administração e Participações Cotil II Limitada	15 %	
International Finance Corporation	10 %	

Loans — US$ 46 million

CIAVE Group	38 million
International Finance Corporation	5 million
Brazilian Banks (Working Capital)	3 million

Description of the plant

This project of Petroquímica União includes a naphtha cracking unit to produce ethylene, propylene, butadiene, pyrolysis gasoline and carbon black feed-stock; a naphtha reformer for benzene and xylene reformate, an aromatics extraction unit to recover benzene, toluene and xylenes from the pyrolysis gasoline and reformate; a toluene hydrodealkylation unit to convert toluene to benzene; a xylene isomerization unit and an aromatics fractionation and finishing unit.

Figure -1- presents a block flow diagram showing the integration of the several process units and the scheduled production from the complex at full capacity.

The prime contractor for the project is Société Française des Techniques Lummus. The naphtha cracking technology is being supplied by the Lummus Company and incorporates the Lummus proprietary short residence time (SRT) pyrolysis heaters. Pyrolysis gasoline from the naphtha cracking unit is stabilized in a Lummus licensed two stage hydrotreating unit. The naphtha cracking unit will be fed with light and heavy cuts from a full range Bahia naphtha supplied by Petrobrás from its Presidente Bernardes Refinery at Cubatão.

A heart cut from the full range naphtha is reformed to maximize the yield of aromatics in a catalytic reforming unit licensed by Engelhard Minerals and Chemicals Corporation. The aromatic reformate from this unit and the stabilized pyrolysis gasoline from the naphtha cracker are processed in an aromatic extraction unit licensed by Lurgi Gesellschaft fuer Mineralöltechnik mbH. for the recovery of benzene and heavier aromatics. This extraction process, known as the Arosolvan process, incorporates a N-Methyl-pyrrolidone solvent. The non-aromatic raffinate from the extraction unit is returned to the naphtha cracking unit.

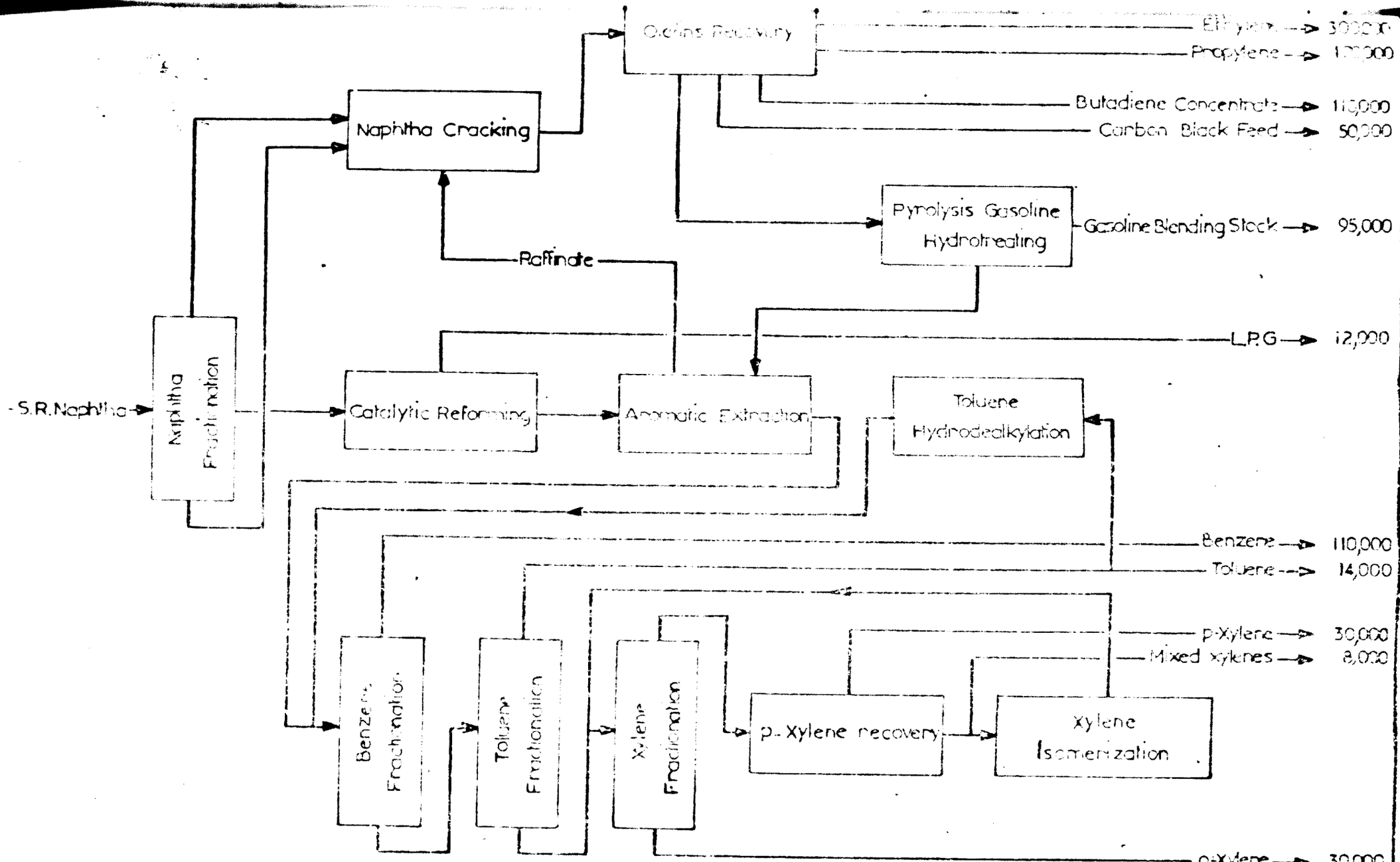


FIGURE 1

PETROQUÍMICA UNIÃO S.A

BLOCK FLOW DIAGRAM AND PRODUCTION SCHEDULE

The aromatic extract from the Arosolvan unit is fractionated into benzene, toluene, ortho-xylene and mixed xylenes. A portion of the mixed xylenes are further processed in a xylene isomerization unit (licensed by Engelhard) to maximize the yield of ortho and eventually para-xylene. Although not included in the initial phase of the project, it is anticipated that a paraxylene recovery unit will be added in the early years of the plant operation.

A toluene hydrodealkylation unit using the non-catalytic process licensed by Hydrocarbon Research Institute is used to convert the surplus toluene to benzene.

Construction of the complex is underway on a site of approximately 500.000 square meters, adjacent to the Refinaria União at Capuava, state of São Paulo. Completion of the entire facility is scheduled for the first half of 1971.

Market already established by long term contracts

The Petroquímica União project has already stimulated some 200 million dollars in investments in new projects. A large percentage of Petroquímica's total production has been committed to these down-stream projects by long term sales contracts.

Ethylene will be furnished to at least three consumers, including: Polioleofinas Ltda., Eletroteno Indústrias Plásticas S.A. and Companhia Paulista de Petróquimico Ltda. (Copamo). Polioleofinas is building a plant across the fence from Petroquímica with a capacity of 80.000 tons per year of low density polyethylene. Eletroteno and Copamo are located some 15 km away from Petroquímica and will be supplied by means of a connecting ethylene pipeline. Eletroteno will produce up to 50.000 tons per year of high density polyethylene. Copamo will produce 100.000 tons per year of vinyl chloride monomer, which will be polymerized in two additional plants.

Propylene will be delivered by pipeline to neighbouring Tetramer, where it will be processed to propylene tetramer which in turn will be sold to an existing dodecyl benzene plant. Additional propylene will be supplied by truck along with benzene to Rhodia Industrias Quimicas e Texteis S.A. for the production of cumene which in turn will be further processed by Rhodia in existing plants to nylon.

Several additional projects are in an advanced planning stage and will provide the market for the remainder of Petroquimica's ethylene, propylene, butadiene concentrate and carbon-black feed-stock.

Ortho-xylene, mixed xylenes and toluene will be sold to existing companies presently importing these materials. Any surplus products will be returned to Petrobras as LPG or gasoline blending stocks.

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