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PETROLEUM

C/F MEXICO

p.420

EFFECT OF ENGINEERING ORIGIN IN THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY IN MEXICO

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FINAL REPORT

INSTITUTO MEXICANO DEL PETROLEO
August 1978

ENGINEERING ORIGIN EFFECT IN THE DEVELOPMENT OF THE CAPITAL GOODS IN MEXICO

UNITED NATIONS ORGANIZATION FOR
INDUSTRIAL DEVELOPMENT

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CHAPTER I

INTRODUCTION

In general, it has been considered that project engineering is a determining factor as to the rights of the capital goods of a project, therefore the projects which are undertaken with the utilization of foreign engineering technology run the risk that their capital goods could also be of foreign origin with damaging effects to the growing Mexican industry of capital goods.

On the other hand, it has been estimated that the usage of the national engineering technology would mean a greater participation in projects of local capital goods which in turn would widen and strengthen their market.

In order to verify the soundness of this theory and considering that its confirmation would imply a greater participation of the national engineering service in the integration and development of the Mexican Industry of capital goods, the United Nations Development Organization appointed the Mexican Petroleum Institute to conduct a research on how project or detailed engineering would affect the capital goods of an industrial installation, taking into account the experience the Mexican Petroleum Institute has had as a supplier of engineering services to PEMEX. The research is also to provide the national - engineering out look for the period 1978 to 1986, the expected demand of capital goods derived from Pemex's investment programs for the same period and the influence the national engineering services have had on the selection of capital goods locally produced.

Such information will be very useful in order to set up a developing program for the industry of capital goods of Mexico. This report consists of eight chapters, three of which are basic in order to - attain the proposed aims. In chapter five a diagnosis is made of the experience the Mexican Petroleum Institute has had as an - enterprise specialized on petro-chemical and petroleum engineering projects, and an account is given of the progress, the Institute has - had in Design and Project Engineering; an appraisal of the benefits of using local engineering is made from a group of selected projects, the demand of capital goods are analyzed and conclusions are issued as to the influence which engineering has on determining the origin of such capital goods.

Another chapter describes the general development plan for the basic petrochemical and petroleum industry for the period 1977-1982 with an insight to 1986. The main aim of this chapter is to forecast the - expected demand of project engineering and its capital goods, which - was attained by breaking down the principal investment projects into the main branches of capital goods of which they are composed.

Several elements were identified within the conclusions of this chapter, such as: the feasibility to produce goods locally which at present are being imported, the probable development of aiding industries to the petroleum and petro-chemical industries, for seeing the utilization of national engineering instead of foreign, and the progress in engineering pursuits at the Mexican Petroleum Institute. These elements will certainly reinforce the national engineering as well as the industry of capital goods.

At third chapter refeared a series of measures to promote the usage of equipment design engineering and national project engineering is set up. These measures which are of: fiscal type, financial foreign trade and personnel training will increase the national engineering capacity and accelerate the development of the national industry of capital goods.

CHAPTER II

PRELIMINARY DATA

The concepts, data and conclusions from the report which was made up by the ONUDI-NAFINSA group, entitled "Mexico, a strategy for the Development of Capital Goods" will be used in this research, in order to round up its aims.

Within the structure of demands of capital goods in Mexico, the Report NAFINSA-ONUDI points out the fact that during the period 1970-1974, the internal demand of the metal-mechanic sector increased at a rate of 12% annually as a result of the combined enlargement of the different sub-sectors which compose it. These are: metallic products 9.8%, non-electric machinery 11.0%, electric machinery 11.0%, transportation equipment and material 15.6%.

Within the group of metallic products, the main investment goods demanded were: copper, brass and iron products, boilers and burners, just as well as heat exchangers. These investments goods stood for the 16.7% of the global internal demand of the group, the remainder is regarded to simpler products from a technological point of view and they are considered as intermediate or consumption products.

In the group of non-electric machinery construction, the demand is - made up mainly by investment goods (71%) and by intermediate goods (27%) such as filters, pumps, valves, with a remaining 2% made up by consumption goods. Within this branch, the investment goods - which showed a more dynamic annual growth (18.1%) were equipment and machinery demanded by the petroleum sector, and by the mining and construction sector although the branch corresponding to the 11% showed a sight inferiority.

The group of electric-machinery has a low proportion of investment - goods which are mainly constituted by motors, motor-generators, - transformers, and other electrical equipment.

Although the branch of transportation equipment and material represents 40.6% compared to a 21.6% of the metal mechanic branch, it is not widely mentioned as it is not one of the main aims of this research.

In the branches of metallic products, non-electric machinery and electric machinery which are of great importance to this research their - importation rates were found to be 5.36%, 50.3% and 16.9% - respectively within the totality and of 27.7%, 60.2% and 36.7% within the branch of imported investment goods.

What is to be noted is that the importation component of the internal demand is higher in the investment goods than in the totality.

After analyzing the structure of importations in function of the demanding sectors, it was found that the petroleum sector imports a great deal of investment goods, and is second only to transportation equipment repair and construction sectors. Pemex's importations represented 10% of - Mexico's importation of investment goods during the 1970-1974 period. - And within the structure of importations the most outstandings were: - shipping 41%, land-removing machinery 7.2%, compressors and - ventilators 5.8%, pumps 5.1%, boilers and heat exchangers 5.1%, gas and steam turbines 4.6%.

After analyzing the cost of the importations of the investment goods, - according to the type of products the most important rubrics were:

RUBRIC		% of Totality
1)	Automotive Equipment	15.1
2)	Machinery for the Petroleum Construction and Mining Industry.	5.6
3)	Textile Machinery	5.0
4)	Shipping	5.3
5)	Tool-Machines	5.0
6)	Electric Equipment	44.0
7)	Railway Equipment	3.5

		% of Totality
8)	Pumps and Compressors	10.9
9)	Office Machines·	3.0
10)	Agricultural Machines	2.6

The petroleum sector imported: 24% of the machines for the petroleum, construction and mining industries; 52% of the shipping; 13.8% of the electric equipment; 8% of the railway equipment; 31.5% of the pumps and 30.9 of the compressors, all which show that Pemex is an important importor. Taken to figures, the petroleum sector imports 9.8% - of the 37.2% of the importations of capital goods made by the public - enterprises.

Another interesting aspect which the NAFINSA-ONUDI group analyze is referred to the design technology and project engineering from which - the following concepts were taken.

Design technology and national project engineering were promoted as - important factors for the growth, development and reinforcement of the industry of capital goods.

It is also to be pointed out that the enormous technological dependency - of the Mexican Industry of capital goods, limits its future development and compels the local manufacturer of capital goods to look for solutions of many problems abroad and such solutions are often inadequate.

The lacking of proper technology has increased the importation of - designs which quite often do not take into account the capacity and - materials available on the national market, therefore standardization - becomes more difficult, which in turn heightens the demand for spare parts and at the same time slows down the national integration process.

Another important conclusion is the need to increase the utilization of - process and product local engineering since the industry of capital goods is a channel for technological processes, therefore if there is a hike - in the quantity and guality of the local engineering, the competitive - possibilities of the industry will augment whereas importations will - decrease with a higher participation in the exportation market.

As to project engineèring, it is at this stage when the technical characteristics of the equipment and supplies are chosen based on the norms and specifications of the orders. Therefore project engineering plays an - important role in determining the origin of the capital goods.

Although the NAFINSA-ONUDI report does not provide solid data on this matter, it points out the fact that the utilization of the national engineering services which aids the natural process of adaptation and technology production will stimulate the growth of the local capital goods industry - and indirectly widen and strengthen the national market.

CHAPTER III

METHODOLOGY

In this chapter a description is made of the procedures followed in this research, in order to attain the set forth aim, which was to determine the degree to which the engineering projects of refining and petrochemical plants influence the origin of capital goods of these same plants. To achieve this aim, a study was made of the purchases of fourteen industrial projects, six of petrochemical projects and eight of refining projects, all of them carried out by the Mexican Petroleum Institute.

For each equipment composing each one of the chosen projects, technical and commercial information was gathered, with which a computer's file was made which served as a base for making arrangements that provided different types of data(1), whose analysis aided to evaluate the degree of influence which engineering had on the origin of capital goods. The results of the analysis and description of the data rendered by the computer are included in the section of capital goods of this research.

The recovery of the technical and economical information of the capital goods of the projects was obtained in accordance with the representers -

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(1) Included in the appendix.

of the UNIDO and the National Financing Company in order to make a file which was divided. into two parts, one on refining and the other - on petrochemical.

In both parts, the following information is included for each equipment:

- Number of the project to which each equipment belongs.
- Number of the buying order, code of the capital good, with an interpretation located on Table T.V.11.
- Code of the country where the capital good is from, with an interpretation of the code on Table T.V.8.
- Code of the supplier of the equipment with its interpretation on - Table T.V.13.
- Cost of the equipment given in the currency of the country of origin and the date of the purchasing order.
- Code of the given currency according to Table T.V.9.
- Code of the design supplier with an interpretation of the code on - Table T.V.13.
- Number of units comprised.
- Weight of the capital good in kilograms.
- Measuring units which were used to measure the capacity of the - capital good whose code can be seen on Table T.V.10.
- Weight percentage of steel alloy contained in capital good.

- Classification of the type of capital good dealt with, which was done according to the classification requested by the representers of UNIDO and NAFINSA.

- The interpretation of the codes are found on Table T.V.12.

With the intention of comparing the cost data, the prices were set to december of 1977 using the following procedure.

From the date of purchase to December of 1977 the prices were risen in proper proportion for each capital good in its currency of purchase.

The prices which were augmented proportionally to December 1977 were then converted into dollars at the rate exchange for each currency considered to the last day of the month in question.

The augmentation index used in each case was as follows:

	Foreign Index	National Index
Ovens	BLS-106	111
Water treatment	BLS-1072	111
De-over heaters	BLS-106	111
Boilers	BLS-106	111
Towers	BLS-107	111

	Foreign Index	National Index
Tower internals	BLS-107	111
Reactors.	BLS-1072	111
Exchangers	148	111
Air ducts	148	111
Ejectors	BLS-107	111
Recipients	BLS-1072	111
Recipients internals	BLS-107	111
Pumps	BLS-1142-02	164
Compressors	BLS-1141-04	164
Turbo-expanders	BLS-1141-04	164
Motors	BLS-1173-01	163
Turbines	BLS-1141-04	164
Piping	BLS-1074-0195	111
Valves	BLS-1074-0195	111
Connections	BLS-1074-0195	111
Instruments	147	164
Equipment and Electric-Material	BLS-117	163

The names of the indexes used are on Table T.V. 19.

The contents of each one of the computer's out put is described as follows:

Report # 1.- For each project, there is a list of the capital goods with an indication of the cost in dollars for each one of them up until December 1977, given for Mexico - and abroad just as well as the percentages of each - one. Just the same, within the totality there are the figures for the national and foreign suppliers and their percentages too.

Report # 1.a.- For each group of equipment the percentage of national and foreign data participation on each project.

CHAPTER IV

DIAGNOSIS OF PROJECT ENGINEERING ACTIVITIES AT THE MEXICAN PETROLEUM INSTITUTE AND ITS INFLUENCE ON THE ORIGIN OF CAPITAL GOODS.

IV.1 INTRODUCTION

In order to give a diagnosis of the project engineering executed by the Mexican Petroleum Institute for the Mexican Petroleum Company since its beginning as an interprise to the date of this research and in conformity with the data provided by the chapter on methodology, an analysis was made of fourteen industrial projects, which included seven on refining plants, six on petro-chemical plants and an area of common services to refining plants.

In carrying out this assignment, the data required per project such as: suppliers of basic and detailed engineering, hours of man power used to develop the engineering work, cost of the labor per man per hour, payment of rights, list of capital goods of the project, origin, supplier and all the other data necessary were taken from files.

With the aim of giving the diagnosis a frame of reference a study is made of the progress attained by the Mexican Petroleum Institute in project engineering compared against the first stages of the Institute making emphasis on the degree of technological independence achieved - and how the origin of engineering influenced the origin of capital goods.

IV.2 PROGRESS IN PROJECT ENGINEERING AT THE MEXICAN - PETROLEUM INSTITUTE AND THE TECHNOLOGICAL INDEPENDENCE ACHIEVED.

I.- PROGRESS IN PROJECT ENGINEERING.

In contrast to other interprises dedicated to project engineering, the - mexican petroleum institute started off its activities in this field undertaking very large projects such as: an ethylene plant with a capacity - of 183,000 tons/year, located at Pajaritos, Veracruz; two recovery - plants of liquefiable hydrocarbons with a capacity to process 175 and - 200 million standard cubic feet per day, one of them located at the - petrochemical complex in Pajaritos, Veracruz, and the other in La Venta, Tab. Two warehouses for storing 4,000 tons. of ethylene each one, - located in Pajaritos, Ver., and Tuxpan, Ver. These projects were - undertaken by the Institute during its first two years of operation.

Of the projects above mentioned, the warehouses were the only ones that had a participation of basic and detailed engineering from the Mexican - Petroleum Institute, the others only implied detailed engineering.

To develop these activities, it was necessary to hire the best qualified personnel available. In Mexico at that time, there was not enough - personnel for this kind of labor, as a matter of fact there was one big company and several small ones which were dedicated to detailed engineering in diverse fields but none of them in the area of processing plants in the petroleum industry.

Therefore a group was formed which would work on these projects. - These people came from different enterprises mainly to work in the - areas of piping, detailed and electrical engineering. And in order to form a coordination group for the projects, some persons were - contracted from Petroleos Mexicanos along with a group of technicians to cover other areas of detailed engineering such as vessels, mechanical, civil and architectural engineering, since from 1957 this enterprise had done jobs in detailed engineering such as warehouse and distribution - terminals, pumping and compression stations and other simple modifications to processing and operating plants. In all the cases above - mentioned not more than one person was hired for each specialty. - The rest of the personnel were people hired to cover other needs - although they were lacking experience which made it necessary to train them while at work.

The ethylene plant and the two liquifiable hydrocarbons recovery plants were among the first projects undertaken and they were licensed by - "The Lummus Company" and "The Fluor Engineering Company" respectively and an agreement was reached with these enterprises in order to - receive counseling in detailed engineering.

For the realization of the detailed engineering of the ethylene plant, the Lummus Co. was asked for counseling in some areas, the number of - specialties which required counseling could increase just as well as - their intensity depending on the development of the project.

With most of the detail engineering, we got advise from this company, with experts in the following branches: one for the general management of the project, other for the technical coordination, two project - engineers (one of them expert in auxiliary services), one for the - acquisitions area, three in pipe engineering, one in materials, one in - instrumentation, one in vessels, one in electrical engineering and one - in mechanical engineering. It was not necessary to seek advise in - the areas of civil engineering and architecture.

For the stress analysis subject, a group of professionals was sent to - the United States to take a course, because this speciality is not taught in Mexico, and participate, some of the time, in activities related with stress analysis at Lummus Company.

From Fluor Company, came a project manager that at the same time - was the representative of this company, and helpped the project engineers. Furthermore there were two experts in the pipe engineering - area, in charge of the design of the cryogenic plants.

The benefits obtained from this teachings are quite clear, since most - of the people engaged in this activities, work now in coordinative or - directive jobs at different levels.

Work sheets were fournished, equipment specifications, norms and - standards for detail engineering, calculating methods, as well as a - fast and coordinated qualification for the personnel involved.

The results of foreign consultation was positive, since the cost for - qualifying was very low, considering the number of people, who received it, either by direct contact with the foreign experts or during the - accomplishment of the job.

II. TECHNOLOGICAL ADVANCEMENT IN PROJECT ENGINEERING.

At 12 years distance from the beginning of MPI's (Mexican Petroleum - Institute) first project, with over 25 projects already completed and with more than 40 detail engineering projects now on the drawing boards, - there can be no doubt that real technological advance has been achieved.

In the area of basic engineering a processing simulator has been - - adapted for fast balancing of matter and energy in all operations which involve the following processes: separation, distillation, absorption, - flash calculations, energy balances and effective use of heat exchange equipment, calculation of the thermophysical properties of the compounds most commonly handled in the petroleum industry; the apparatus is - also being put to work in order to simulate the performance of various reactors, such as reformation and hydrodesulphurization reactors. - This simulator represents an advancement in the development of basic - engineering, and at present no Mexican engineering firm is in possession of a tool with such features.

Another instance of outstanding technological advancement is the MPI's participation in basic engineering efforts. A major breakthrough has now been made with MPI's new liquid recovery process (by cryogenic - processing), the MPT-licensed DEMEX process, basic engineering for vacuum and combination distilling processes, and the naphta and - -

intermediate distillates hydrodesulphurization processes, where MPI - developed catalysts are used.

A striking advance in yet another area of detail engineering is the MPI's complete thermodynamic, mechanical designing of heat transfer - - equipment (quiver and tube heat exchangers and direct fire heating - furnaces). In this respect, it is to be pointed out that there is no - other organization in Mexico with a staff of designers who have calculation tools comparable to those of the MPI, nor does another group have calculation methods fully geared to the development of project engineering. The MPI group gets projects completed sooner because it produces its own mechanical design plans for the heat exchange equipment required, thus eliminating the need to wait for an outside designer to calculate and design the equipment which must later be evaluated and - approved by the MPI. Under this arrangement it is only necessary - to call for bidding on the manufacturing of the equipment.

Another important point of development is stress analysis of casings, - equipment and structures which are subjected to extreme, non-standard pressures and temperatures, either high or low, and analysis of - - casing or accesory weight. This is an expertise made necessary by - the ever more drastic processing conditions in pressure and temperature required for obtaining a product with the specifications requested. This is therefore a specialty which is now more scientific than - -

empirical, even though rather new in proyect engineering; consequently, in many firms devoted to this activity it is not known, perhaps because of the types of projects they handle are under relatively standard operational conditions free of extreme factors, how a recovery of hydrocarbons at low temperatures or a reformation heater outlet might be.

In the area of piping, casing design has for some time been spurred by the use of scale modules rather than the traditional floor and elevation piping plans, with the advantage that it consumes less man-hours, facilitates interpretation in both the engineering and the construction stages, and later helps the customers in the training of plant workers.

The large number of refining and petrochemical plant proyects carried out by MPI and the problems posed by the increased expansion of personnel brought about a search for methods and tools able to raise productivity, particularly in areas of high-level man-hours consumption such as piping engineering, where consumption averages 40% of project man-hours. A system of calculation, processing, drawing and information recovery is now being employed for solving different problems of piping design. This system generates:

- Isometric drawings and certain lists of materials by means of a computer and a diagramer used in conjunction with a simple open format Fortran Codifier fed with data obtained directly from a scale mock-up.

- Preliminary requisitions by means of summaries of the lists of materials.
- Floor and elevation piping plans in zones of dimensions controlled by the user.
- Creation of reference files on dimensions of accesories, piping, packing, etc.
- Development of computer programs to achieve compatibility among programs for analysis of piping flexibility and for checking hydraulic performance against isometric perfomance.
- Development of interacting programs for the designing of piping, using computer, cathode ray screen and copying machine.

The last three points are at present in their development stage.

Aware of the need to have adequate technology for the solution of problems related to high-speed rotary, emphasis has been given to dynamic analysis of rotors aimed at evaluation of dynamic performance of rotary in the following aspects: critical side velocity, adimentional bearing coefficients, response to imbalance, eliptical robits, hydrodynamic stability analysis, bearing overload, temperature balance, and distribution of reactions in rotors resting on 3 and 4 points.

The above has served as a basis for adequate specification of vibration monitor systems in large rotaries, adequate analysis of the performance of equipment to be purchased for the project, and evaluation of equipment performance during adaptability tests in the producer's shops.

Comparison between the initial situation and the present situation.

In comparing the initial situation with the present one in the MPI's proyect engineering, the basic reference will be to the Institute's efforts in the detail engineering with which it began, because since then many significant changes have taken place. The number of persons working on the projects has increased from 140 employees in the second year to over 950 after 11 years of work. The number of projects rose from three in the second year to over 25 in 1978, besides another 15 which are getting under way or nearing completion.

The number of specialties which participate in the project engineering has grown. Previously, there was no process engineering in the strict sense, but the basis was laid for process designing.

For the development of basic engineering there is a basic engineering development department, where the work is devoted to balances of processing matter and energy, calculation of major equipment, and providing basic information for those who will put together the processing in a flow diagram, namely, the Process Design Department, where the equipment is determined and the information is registered on data sheets for process equipment, on flow diagrams, and on balance diagrams for auxilliary services.

Other detail engineering groups not originally included are: the systems engineering group, where documents fundamental for starting activities within other design specialties are drawn up. The work of this specialty is connected with the development of the basic engineering of a project, since its activities begin in the final phase of the basic engineering and are completed in the final phase of the detail engineering. In this specialty diagrams are prepared for piping and instrumentation, localization plans, design of saftey systems, testing of hydraulic performance, etc.

The following in a brief description of departaments not in existence during the first three proyects for lack of process engineering, when information was received by a group of engineers who checked and concentrated it.

The Plant Operation Department participates in proyect detail engineering with the preparation of operation and maintenance instructions for the training of the personnel required in due time for the start-up of the plant. This department can also offer special complementary project engineering services such as training and familiarization of new plant personnel, relating equipment test circuits, equipment inspection, equipment testing, instrument calibration, organization of personnel in place of operation, critical starting route, etc.

Another of the design groups now participating in the project is the - Heat Transfer Equipment Design Group, whose advantages in the MPI - as concerns heat exchange equipment design were mentioned above in - the section of technological advances. The objective of this department is the thermodynamic and mechanical design of heat transfer equipment required in the project, including sheaf and wrapper dual tube exchangers and direct fire heaters.

Other groups already referred to in technological advances are those - devoted to pipe stress analysis and rotary analysis, which have been - set up as work has required.

Since the beginning of project engineering activities and up to the - - present, various customers have contracted the projects which appear in tables T.V. 15/16 and which are now in operation, construction or development.

IV.3 STANDARDIZATION OF PROJECT ENGINEERING

I. BACKGROUND

In the late 1800's and the early twentieth century, the Mexican - - -

petroleum industry was in the hands of foreign corporations. All technology used then belonged to the country of origin of each of the development companies, working the oil fields.

Following the 1938 oil expropriation, Petroleos Mexicanos, the firm created to run the industry, lacked the required technical personnel, making it necessary to use the existing foreing standards, few though they were, left behind by the expropriated companies.

Later, standards were acquired from those engineering and construction firms with which PEMEX contracted the designing, plans, installation and manufacturing of equipment, pipes and services for new facilities or changes in existing plants.

In a later process this technology was amassed, modified and adapted with the object of creating Mexican standards for those subjects and fields where it was felt advantageous to carry out such developments. The formulation and creation of a standard in most cases implies specialized research and development technologies with high-level requirements as regards economic resources, know-how, equipment and laboratories which the country more often than not lacks.

For most of the items which can be standardized in the oil industry, Mexico has adapted widely diffused international standards; others have been taken as is, since it would be neither practical nor economical to try to create or develop new ones different from those already tested and applied successfully in more technologically advanced countries.

I. INTRODUCTION

While there are considerable benefits in standardization, it should be - noted that in the scheme just discussed, which not only pertains to - underdeveloped or developing nations, but also, in a lesser degree, to developed countries, standardization is indirectly a factor in technological colonialism and economic penetration of powerful nations in the - markets of others.

Intelligently used, the adaptation and adoption of foreign standars can - open world markets to our manufacturers of capital goods who could - profit by, for instance, low domestic labor costs in comparison with - capital goods prices in international markets.

III. STANDARDIZATION

The following is an analysis of three aspects of standardization which summarize present standards in the oil industry, especially as concerns proyect engineering:

1. Codes and standards used in the MPI's development of proyect - engineering.

2. Standardization in the MPI.

3. Advantages of standardization.

Some definitions are necessary in order to concentrate the concepts used. Even though there are national and international agencies which have studied the different ways of defining standardization, each has adopted its own definitions. Of course, there is no difference in the basic principles, but only in the expression for the sake of better local understanding.

IV. CODES AND STANDARDS USED IN THE MPI'S DEVELOPMENT OF PROJECT ENGINEERING.

The purpose of this section is to give domestic capital goods producers an idea of what the main codes and standars are for the MPI's engineering designs. The value of this information lies in the orientation it provides for planners in the capital goods industry.

As mentioned above, in most of its standards the petroleum industry directly uses or adapts standards created by others, but to a lesser degree also uses its own standards.

The following is a breakdown into type of design or item of the most used codes at the MPI.

For piping materials and manufacture ASTM (American Society for Testing and Materials) standards are used, for pipe design the API (American Petroleum Institute) Code is used, and for pipe and joint dimensional requirements the standards of the ANSI (American National Standards Institute) are used, all these covering design code.

The design of pressurized containers is standardized by the furnace and pressurized container section of the ASME (American Society of Mechanical Engineers and the PTTC's (Performance Test Codes).

For rotary equipment the API Standards and the ASME Code are used; for heat exchangers the TEMA (Tubular Exchanger Manufacturers Association) is used; for electric motors the NEMA (National Electrical Manufacturers Association) Code is used; for electrical installations the NEC (National Electric Code), the IEEE (Institute of Electrical and Electronic Engineers) Code and the NEPA (National Fire Protection Association) are used.

V. ADVANTAGE OF STANDARDIZATION

Adequate standardization allows Mexico to regulate various areas of production, and, therefore, the standardization developed in other countries must be studied in order to be informed on world technological advances and to make use of such advances through proper -

technological adaptation. Such endeavors enrich the experience of local companies and lead to higher productivity.

The benefits obtained through standardization at Petroleos Mexicanos and the Mexican Petroleum Institute are:

1. Criteria for the items affected have been unified.
2. Technical language has bee made uniform.
3. Unity at other institutions has bee aided by the use of our standards.

Standardization generally contributes the following advantages:

1. It facilitates administrative, technical and scientific processes.
2. It makes for economical and optimal use of resources.
3. It cuts production costs.
4. It guarantees input and product quality for the customer.
5. It reduces inventories.
6. It improves the productivity of man and machines.
7. It provides a means for the transfer and spread of technology.
8. It fosters scientific and technological research.
9. It guarantees product application and use.
10. It guarantees the workability and performance of the standardized goods.

VI. STANDARDIZATION IN THE MEXICAN PETROLEUM INSTITUTE

The technological development achieved by both Petroleos Mexicanos and the Mexican Petroleum Institute has allowed them to draw up national standars through a number of advisory committees controlled by the Standard Bureau of the National Patrimony and Industrial Development Ministry, and which include the following:

Basic Standardization Advisory Committee. (CCNB)

Electric Industry Standardization Advisory Committee. (CCNIE)

Steel Industry Standardization Advisory Committee. (CCNIS)

Building Products and Materials Standardization Advisory Committee. (CCNPMC)

Chemical Products Standardization Advisory Committe. (CCNPQ)

Industrial Processing Equipment Standardization Advisory Committe. (CCNEPI)

Refractory Materials Standardization Advisry Committee. (CCNMAR)

Iron adn Steel Industry Standardization Advisory Committe. (CCNIHA)

The MPI also cooperates with other institutions working on standardization in Mexico and, internationally, with the Standards Committe for furnaces and pressurized containers of the AMIME (Mexican Association of Mechanical-Electrical Engineers), Pemex's Departament of Standards and Specifications, the Panamerican Technical Standards Commision - (PATSC), and the International Standars Organization (ISO).

In addition to being an aid in standardization in Mexico and the above - organizations, the participation of MPI personnel in the organizations - enriches MPI's experience while also improving its own standardization.

As a result of the joint standardization activities (1) between Petroleos Mexicanos and the Mexican Petroleum Institute, there are now available 47 proyect standards, 73 construction standards, 21 materials quality - requirements standards, and 16 quality, sampling and testing control - standards, plus 115 industrial safety standards for Petroleos Mexicanos. For the Mexican Petroleum Institute 55 proyect standards, 25 materials quality standards and some 650 engineering standards have been prepared.

Together with the above-mentioned standards, use is also made of the proyect and construction standards and specifications (1) jointly developed by the Mexican Petroleum Institute and Petroleos Mexicanos, of - which more will be said later.

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(1) See Proyect and Construction Standards and Specifications Table - (T.V.14).

IV.4 DEVELOPMENT OF DESIGN ENGINEERING AT MPI

In this section, the subject of both processing and equipment design - engineering at the MPI is discussed. In the first of the two cases - reference will be to engineering design achievements in the area of - heater transfer, after which mention will be made of achievements in basic processing engineering.

Since the beginning of the Mexican Petroleum Institute, one of its chief objectives has been the development of a technology suitable for - Processing Plant Design Engineering by the formation of the work - groups required for this technological development, training of personnel, and continuous updating of calculation methodologies used in designing.

In general, the technology required in Design Engineering can be divided into two parts:

a) Technology of each process, including basic information on the - process features, design criteria, effect of operational variables, - specific control requirements, load specifications, and physical and chemical products and properties of the components involved. The overall mastery of this technology defines an engineering company's capacity to design a wide range of processes.

b) Overall technology, including the capacity to correctly and efficiently design the processing elements common to most processes, such as distilling columns, heat exchangers, compressors, furnaces, reactors, auxilliary service systems, etc. The quality of this technology defines the capacity of an engineering company to achieve an economical design which is both reliable and efficient in each process.

The Mexican Petroleum Institute has devoted its activities to technological development, with the satisfactory and encouraging results outlined in this paper.

I. THE PROCESS OF PROVIDING TECHNOLOGY

The rising demand for petroleum industry installations in Mexico in recent years, and the increase in demand expected for the 1978-1982 period, has been reflected in more demand for MPI designs for processing plants. Meeting this demand on the short and mediun terms in the area of process engineering and equipment designing has made it necessary for the Mexican Petroleum Institute to take up the task of developing and integrating the technology needed.

The incorporation of technology at the MPI is based mainly on the development of its human resources who obtain most of their know-how in the following way:

a) Basic knowledge acquired by advanced technological studies.

b) Foreing publications.

c) National and international meetings.

d) Theory-practice specialization courses.

e) Experience obtained at PEMEX installations.

In the first phase of the technological incorporation process the task faced is that of identifying the immediate needs of analysis and designing; it is then necessary to know the trends int technological advances, which is achieved by improving the means of gathering and distributing information. The latter services make it possible to compile open literature type information, while the necessary constacts are made to recover other information, this being used to proceed with the planning of the development project at hand.

On the above basis, the advances achieved, for example, in heat transfer, have thus far covered the basic requirements for drawing up a key technological blueprint in equipment design engineering, solidly backed by the related mechanical and structural engineering.

It is to be noted that the achievement of each objetive implies the appearance of new limitations, which in turn become yet other objective to be reached. In this way the technological puzzle is being put together, with each new piece contributing to the completion of the picture.

The different viable alternatives which meet the need are established further on. The most appropriate selection is made on the basis of the time limits, information availability and reliability (as well as its potential use), possibilities of domestic and/or foreign manufacture, and its profitability. The development of the proposed project then proceeds along planned lines until satisfactory completion, including a checkout phase using available, usually published, information as well as field data.

In the final specification phase, documents must be drawn up to show the features, breadth and form of application of the technology developed. This documentation may consist of a calculation procedure, a designing manuel, or an overall set of specifications for designing or manufacturing a piece of equipment.

Lastly, the designing and manufacturing engineering technology is incorporated and applied. Feedback on the procedure is obtained by observation of the performance of the equipment in operation.

II. ACHIEVEMENTS AND OBJECTIVES REACHED.

In this section we will analyze the fruits of MPI efforts, both in the area of heat transfer and in the area of process design, to incorporate technology as per the above-described mechanism.

DIRECT SOURCE OF WORK.

In the last four years the Heat Transfer Department has acquired around one thousand pieces of process equipment, each of which had to be submitted to a rigorous analysis in its design and purchasing alternative, always seeking that the designs had the best prospects of meeting the needs of the customer, from the standpoint of economy and operation.

Such analysis and study have involved a great many man-hours in round numbers, some three million. Indicative of this is the fact that the Heat Transfer Department invoices an average of 3% of the engineering costs of an industrial project.

GENERATION OF INFORMATION AND WORK.

Information is produced for the areas involved in other types of design of the Project Engineering Office, and other connected areas are incorporated in sequence. Among the latter are the following:

electronic computation, accounting, administration, raw material suppliers, manufacturing shops, skilled workers, transportation of freight, banks, and credit institutions, all of them economically benefitted by this activity.

WIDENING MARKETS.

The monopolizing tendency of the foreign and transnational companies is counterbalanced by access of blueprints to a larger number of shops lacking the engineering facilities and structure necessary for them to be rated as designers and not merely as producers. This widens the manufacturing market within Mexico and abroad as well, thus improving the supply of manufactured goods and with resultant price savings in equipment.

The incorporation of technology can and must be used to shore up the domestic market, adjusting it to internal conditions with the consequent savings in foreign exchange and stimulation of the capital goods industry; it also spurs exports of manufactured articles in that it works as technological support for industries which must avail themselves of the competitive level of Mexican labor in comparison with labor costs abroad.

Processing units go on stream sooner because technological incorporation increases availability of information for the continuation of plant -

design, even when purchases of equipment are deferred in order to schedule the flow of investment in a more adequate way.

The incorporation of technology in Mexico raises the quality of the plants purchased for the following reasons:

1. Supplier products must prove to be adequate and optimal for the service intended, this involving the quantitative evaluation and comparison of the benefits they will yield on the short-, medium- and long-term views considering investment, operation and maintenance.

2. It favors the capacity to set design and manufacturing standards, which are used as reference patterns in calls for bids, meaning that quality, and standardization are increased and that the domestic market is considered.

3. It gives specialized technical backing to equipment purchasing engineering.

4. It provides a capacity for technical assistance to Mexican and international industry and engineering.

The preparation of better specialists in the different fields in which the MPI works logically brought about the reversal of the role the Institute previously played in project engineering, that is, rather than consulting several companies, it advised both Mexican and foreign companies.

The hiring of technical personnel at the petroleum industry's plants made it necessary to set up training for the different specialties - required, and this training is given by MPI specialists.

The fact that processing equipment are in common use in industrial plants makes it necessary to prepare personnel as experts in the - operation of such units.

FAST SOLUTION OF FIELD PROBLEMS

The process of technological incorporation in different technical areas - makes it possible to have the proper knowledge and methods for fast, - effective solution of problems which come up in the operation of equipment and plants in the field, with considerable savings in money - thereof because the plants reduce their stoppage time, just the opposite of what occurs when they must seek the help of foreign specialists. - In other words, if the foreign companies had a part in designing and - manufacturing plants and equipment, there would be a strong dependency in the solution of the problems which might come up.

MOTIVATION.

The development of technology and the results achieved in its application is a strong incentive for the personnel involved.

CUTTING DESIGN COSTS.

The development of technology leads to savings in foreign exchange which can be judged from the following example: the heating, mechanical and structural designing of a direct fire heater comes out 40% cheaper if done by MPI rather than abroad.

INFLUENCE ON EDUCATIONAL INSTITUTIONS.

MPI personnel often teaches at educational institutions, thus creating a two-way support system which means continuous development on a firm basis.

INTERNATIONAL OPERATIONS.

Mexico's technological capacity in, for instance, the area of heat transfer is highly developed when compared with other sectors. The country is self-sufficient in the basics and details of heating, mechanical and structural designing of the various units. One good measure of the achievements in this area is the fact that Mexico has participated in international projects, which implies that there is a capacity to export technology.

III. OBJECTIVES REACHED

In the field of process technology, the MPI has the capacity to design a wide variety of processes, including the following:

Atmospheric distillation processes for crudes.

Vacum distillation process for atmospheric residues.

Hydrodesulphurization processing of naphtas and intermediate distillates.

DEMEX processing of extraction for production of demineralized oils.

Cryogenic processing for recovering ethane and natural gas - liquids.

Absorption processing for recovering natural gas liquids.

Sweetening process for gases and liquids.

Fractioning process for liquids.

Stabilization process for crudes.

Purification process for acetonitryle.

Production process for propylene tetramer.

Production process for alkyltolbene"

In the field of processing equipment technology, there is now a capacity to design and analyze the performance of a wide variety of equipment, - including the following:

Centrifugal pumps

Positive displacement pumps

Compressors

Expanders

Ventilators

Pneumatic conveyors

Conveyor belts

Distillation columns

Absorption columns

Drainage columns

Liquid-liquid extraction columns

Bubble cap plates

Orifice plates

Fire screen plates

Valve plates

Packed columns

Hydrodesulphurization reactors

Acetonitryle purification reactors

Suphur reactors

Dehydrators

Tube bundle and wrapping heat exchangers

Compact heat exchangers

Surface condensers

Air coolers

Cooling towers

Evaporators

Crystalizers

Direct fire heaters

Furnaces

Chimneys

Dryers

Burners

Balancing tanks

Settling tanks

Gas-liquid separators

Liquid-liquid separators

Gas-liquid-liquid separators

Gas-oil field separators

Storage tanks

Filters

Granulators

Centrifugals

In the field of general technology a series of programs and methodologies for process and processing equipment design and simulation has - been developed allowing high quality process designing for each project; reliable results enable the process engineer to make better -

decisions concerning the design and selection of operating conditions. - The following is a sampling of these elements of calculation:

SIMPROC GENERAL PROCESS SIMULATOR.

This is a computer program which carries out process matter and - energy balancing in a stationary state on the basis of an arrangement of operational equipment and conditions specified by the user. It - additionally provides the basic specifications for equipment and the - thermodynamic and transport properties of the process stream. - Because of its modular nature and the variety of processing elements - it can handle, SIMPROC is very useful in process designing.

CALCULATING PROGRAM FOR ATMOSPHERIC TOWERS.

This program covers matter and energy balancing in complex distillation systems, such as primary plant atmospheric-drainage towers, - with a number of interconnected distillation sections.

CRUDE OIL DESCRIPTION PROGRAM.

This is an auxilliary program in which information reported in crude - oil testing (distillation curves, general properties of distilled fractions and residuals) is put into a useful form in the matter and energy - balancing programs, and expressed in terms of composition and proper ties of a series of representative pseudo-components.

HEAT INTERCHANGE EQUIPMENT PROGRAM.

Here the energy balances in complex arrangements of heat exchangers are analyzed, with the user specifying the arrangement and characteristics of the equipment.

For calculating stream properties, all these programs make common - use of what is called the thermophysical properties package and a pure component physical constants file. The number of components included in the file and the diversity and applicability of the calculating methods for properties make the designing programs useful in a wide range of - systems and processes.

Some of the designing and/or evaluation programs developed by the - MPI are listed below:

- Reboiler and chiller design
- Horizontal thermosiphon and vaporizer design
- Transfer line design
- Vertical thermosiphon design
- Multicomponent condenser design
- Uncondensable condenser design

- Cooling pan design
- Heat exchanger equipment optimization
- Air cooler dimensioning
- Double pipe heat exchanger design (smooth and finned with and without phase change)
- Thermal design of oil pipelines
- Simulation of exchangers having vaporization on the inside and outside of pipes, with a no phase change fluid.
- Exchanger mechanical design.
- Exchanger template design.
- Flange design
- Analysis of vibration problems in heat exchanger piping.
- Heat transmission evaluation in direct fire heaters, horizontal type by global method.
- Heat transmission evaluation in direct fire heaters, vertical type by global method.
- Heat transmission evaluation in direct fire heaters, horizontal type by zone method.
- Heat transmission evaluation in reformation heater radiation zone by zone method.
- Horizontal cell type direct fire heaters design.
- Vertical cylinder type direct fire heater design.
- Geometry proposal for direct fire heaters.

- Convection zone design for direct fire heaters.
- Chimney design for direct tire heaters.
- Ethylene furnace design.
- Flux reformer heater design.
- Determination of flow patterns of combustion gases.
- Determination of heater liberation patterns.
- Heater structural analysis.
- Wind pressure evaluation.
- Modal analysis of chimneys
- Tridimensional non-linear structural analysis with finite element.
- Thermal evaluation of boilers.
- Evaluation of cross flow cooling towers.
- Evaluation of countercurrent flow cooling towers.
- Calculation of optimal isolation thickness for equipment and piping.
- Surface condenser evaluation.
- Economic evaluation of equipment.
- Algorithm for calculating coefficients of the fournier series.
- Analysis of temperature distribution through finite elements.
- Analysis of stress distribution due to temperature gradients.

IV. OUTLOOK FOR MPI DESIGN ENGINEERING.

The MPI plans to continue doing research in order to meet the needs of the design and purchasing engineering of its customers, particularly PEMEX, with its vast investment plan for refining and petrochemical plants. Furthermore, the MPI will act as an engineering firm in the designing of process equipment for manufacturers who, lacking design-engineering, will contract the MPI. The Institute will also act as a training center for PEMEX and other organizations which request training, especially domestic producers of process equipment.

V. PLANS AND THE DEVELOPMENT OUTLOOK

Because the Mexican Petroleum Institute has adequate human and material resources, and has formed groups devoted to development, designing, evaluation, purchasing engineering, equipment operation, etc., the outlook is highly promising.

The trend is toward the widening of MPI's capacities in the above fields and toward its active participation in designing at the international level. This forecast stems from the fact that design and purchasing engineering in process equipment is expected to reach very significant volumes in the coming years to keep pace with the expansion of PEMEX and FERTIMEX and with calls for bidding of manufacturers to whom the MPI will sell its engineering. Additionally, the MPI expects to provide training services for PEMEX and a number of producers of process equipment.

In view of the above, the MPI will emphasize the following activities and development plans.

Technical consultation will be arranged in the areas of research, designing, operation, manufacturing and maintenance of plants and process equipment. In these meetings technical papers and published material will be presented; at the same time, seminars and round tables will continue to be held for domestic and foreign suppliers of equipment.

The specification for which the MPI is responsible will be supervised and updated continuously.

Field publications will be constantly monitored in order to detect new trends and modifications which must be dynamically implemented to improve the MPI's existing tools.

The MPI will collaborate with educational institutions by teaching pertinent technical subjects and by giving orientation services to recent graduates in the fields of engineering and research for the petroleum and petrochemical industry.

Lastly, the incorporation of new technologies is a main goal in every development plan. In the area of heat transfer, for example, the MPI has included in its future projects the complementation of technology in areas not yet fully incorporated, including the following:

- Heat exchangers for high molecular weight fluids.
- Multicurrent heat exchangers.
- Parallel technology for developing the mechanical designing of special heat transfer equipment.
- Design optimization by energy consumption
- Heat transfer by combined radiation-convection mechanisms in direct fire heaters.
- Exhaust flow patterns of combustion gases.
- Heat and mass transfer by direct contact.
- Furnace heat distribution with multiple stage coils.

Development plans in the area of process technology focus on building the technological capacity required for designing a number of processes, especially in the petrochemical area.

Among these processes are the following:

Naphtha reformation process.
n-paraffins isomerization process.
Sulphur production process

Ammonia synthesis process

Viscosity reduction process

Nonylphenol production process

In the area of general development, the main activities are devoted to the setting up of a general computation system, with the latter understood as a calculation program system for each designing discipline and which will be the single, exclusive source of information for the calculations required in each phase of a project.

Furthermore, emphasis will be given to the development of synthesis and optimization of processes and reactor engineering, while also maintaining updating in those aspects of design engineering previously mentioned.

From the above it can be inferred that, together with an expected and planned volume of work, investigation and training, it will be necessary to increase and lend support to those activities the objective of which is to attain greater scientific, technological and economic independence for Mexico.

IV.5 CRITERIA INFLUENCING THE DECISION ON THE LOCAL OR FOREIGN PARTICIPATION OF PROJECT ENGINEERING.

Petróleos Mexicanos has never agreed to contract projects without conditions. This policy has been the basic principle behind development, first, of construction engineering and, second, project engineering in Mexico, as well as the manufacturing of capital goods for the petroleum industry.

In its contracts PEMEX has always separated engineering, which 10 or 15 years ago was bought abroad, from the purchase of materials and from construction. This has lead to training here in Mexico, both inside and outside of PEMEX, since it has spurred the development of building contractors to a point that at present the domestic construction industry is technically able to meet the needs of the petroleum industry. Parallel to this growth in capacity, a corps of project supervisors and contractors has been built up.

The development of project engineering at PEMEX commenced in an organized sense in late 1959, less than 20 years ago. This important step was taken in the New Projects Department, whose name has now been changed to Projects and Construction Office.

The first engineering jobs were simple tasks involving reception and - distribution terminals, oil pipeline pumping stations, and gas compression stations. In 1965 came the foundation of the Mexican Petroleum - Institute, whose role in the development of project engineering in - Mexico has been decisive.

While in the 1960's private Mexican firms were already undertaking - simple engineering projects such as reception and distribution terminals and gas compression stations, it was not until 1972 when the first - processing plant engineering was contracted to privately-owned domestic engineering firms. This gives an idea of how recent project engineering is in PEMEX. Yet, by 1977 fully 85% of the work for project - engineering required by Petróleos Mexicanos was developed in Mexico. With this breakthrough we have even perhaps reached the practical - limit possible for engineering in Mexico.

PEMEX at present employs some 1,500 people in its engineer ing groups, which include every project engineering specialty and deliver about three million man-hours of work per year. For the purpose of outlining the criteria entering decisions on local or foreign participation in project engineering, the different types of such, as per PEMEX's recent needs and the engineering involved, are listed below.

The projects range from the simplest, non-capital goods type public works, to those involving capital goods on an increasing scale: sales terminals, pumping and compression stations, pipelines, development structures, refining plants and petrochemical plants.

I. PUBLIC WORKS ENGINEERING

These projects include school, workers' homes, hospitals, etc. The engineering for this type of projects has always been developed in Mexico by local engineering firms or by PEMEX.

II. CONSTRUCTION ENGINEERING FOR SALES TERMINALS

This engineering already involves capital goods, since tanks, piping, pumps, etc., are used in the projects. It is a 100% Mexican engineering contribution, developed over the years by local companies. In this type of construction PEMEX has typified around 60% of the architectural aspect of each proyect, tank and dike design, filling pumps, pump characteristics, and control and metering systems; at present, 75% of the piping plans have been typified.

This type of engineering jobs are normally given to Mexican firms which are just beginning their operations with PEMEX. Such projects are a good opportunity for newly-formed engineering because of their simplicity and the important know-how they provide the contractor as concerns specifications and developments of engineering skills.

III. PUMPING AND COMPRESSION STATION ENGINEERING

As in the above case, these are relatively simple projects involving 100% Mexican engineering. This type of project consumes a substantial amount of capital goods, but is also sub-contracted to engineering firms just beginning their operations, the jobs serving as an introduction to PEMEX procedures and working methods.

IV. PIPELINE ENGINEERING

Traditionally it has been developed by PEMEX, although recent for the engineering of the national gas trunk pipeline a private Mexican company was contracted. This type of engineering is also 100%

Mexican.

V. DEVELOPMENT PROJECT ENGINEERING

This engineering is done entirely in Mexico. 85% is done in PEMEX, and the remaining 15% is done by local engineering companies. Efforts have been made by PEMEX to dimminish its share for the sake of local private firm participation. However, the high degree of this engineering by PEMEX is almost obligatory because of two basic requirements speed of execution in the engineering and constant changes in the design basis. The latter factor is due to the fact that it is difficult to know what the characteristics of the fields are before they are developed, leading to frequent changes in location, capacity changes for the installations required in the development of the fields, etc. Therefore, outside contracting poses serious coordination problems. On the other hand, this engineering is highly typified as concerns containers and pumps, whose characteristics are known and very specific.

VI. REFINING PLANT ENGINEERING

Of the engineering required in this category by PEMEX, 98% falls to the MPI and private local engineering firms. Some processes such as hydrodesulphurization, Demex, etc. are MPI licenses. There has been need in some cases to contract licenses abroad, as, for instance, FCC (fluid catalytic cracking) and the reformers purchased outside Mexico. But detail engineering is basically in the hands of local companies. Examples of this are the Tula, Cadereyta and Salina Cruz refineries, where with the minor exception of the reactor area of the FCC units, which were made abroad, the engineering was developed entirely in Mexico. The policy applied to the reactor area had the purpose of obtaining the full guarantee of the licenser, and did not reflect any incapacity of local engineering firms, which would have been able to do the engineering for that section with results comparable to those obtained by the foreign company.

VII. PETROCHEMICAL PLANT ENGINEERING

Here, as also in the case of refining, up to 1966 all detail engineering was imported. At present the picture is totally different, although some process engineering will have to continue to be purchased abroad, one important factor in the decision being time, since production schedules cannot wait for processes to be developed domestically.

In petrochemical plant detail engineering the situation at this point is as follows:

Petrochemical plants whose engineering is being developed now number

70, not including projects which are virtually completed. They are contracted in the following way: Six plants, with engineering developed in Mexico, are repetitive, and the contractor is at present repeating the purchase, partly in the United States and partly in Mexico. This involves gas and sulphur sweeteners.

Two cryogenic modular plants are being developed in the United States as agreed by PEMEX, since they are slated for completion in the record time of eight months to avoid having to burn off the gas.

Of four other plants being designed abroad -two of which are ammonia plants- two were ordered outside because of the good results with the operation of identical units previously imported, and the purchase was made from the company considered to make the best design for this type of plants. One polypropylene plant involves experience which has not been obtained as yet in Mexico. The fourth plant is a low density polyethylene unit being developed in both Great Britain and Mexico; the civil and electrical engineering is local, and the remainder was contracted abroad to retain the guarantees of the licenser. However, this plant has equipment and materials which, because of the extremely specialized nature and the high performance pressures (2,200 ATM), cannot be profitably manufactured in Mexico at the present time.

The reactors of a new propylene plant will be U.S. designed, the rest will be developed by the MPI. The reason why part of the detail engineering was developed abroad was to force the licenser to uphold his process guarantees, which he would not be compelled to do if the reactor section detail engineering were done in Mexico.

The other 56 plants are being designed in Mexico. This figure gives a clear idea of the volume of engineering work going on in this country. In fact, a review of the types of engineering done in Mexico reveals that the only field in which the engineering is not 100% Mexican is petrochemicals. This is because petrochemicals often require sophisticated technologies. Despite this, however, of the 70 new plants, 56 are being completely developed in Mexico, while in others part is done in Mexico and part in other countries.

The 56 plants are the following:

Cangrejera

9 process plants

1 effluent treatment

1 auxiliary services

1 integration of plants and tank yards

12

Cactus

5 process plants

1 auxilliary services

1 integration of plants

1 effluent treatment
8

Pajaritos

3 process plants

3 refrigerated products terminals

1 integration

1 electric plant

1 effluent treatment
9

San Martín Texmelucan

3 process plants

1 integration

1 auxiliary services

1 effluent treatment
6

Topolobampo

2 refrigerated storage installations

Morelos

3 process plants

1 auxiliary services

$\underline{1}$ integration
5

Cunduacán

12 process plants

1 auxiliary services

$\underline{1}$ integration
14

The above gives an idea of Petroleos Mexicanos' policy of doing as much engineering as possible in Mexico, and the only exceptions today are:

a) When the engineering and manufacturing cannot be accomplished in Mexico in the required time, as was the case of the cryogenic modular units.

b) When Petroleos Mexicanos has no previous experience in the projected plants because the products are new, as was propylene.

c) When very few plants or even a single plant have the experience, as was the case of ammonia.

d) When the plants are highly specialized in materials and equipment, as was the case of low density polyethylene.

IV.6 SELECTION OF PROJECTS FOR STUDY

In this section, two points will be discussed: the circumstances which set the pace for work on the selected projects, and the interrelation between the origin of the engineering and the source of the capital goods used in the projects.

In selecting projects for study it was attempted to bring together circumstances which would test the validity of the idea that the origin of the engineering determines the source of the capital goods. Projects for PEMEX were therefore divided into two types: (1) projects with imported basic engineering, and (2) projects developed with local basic and detail engineering.

In order to evaluate the effects of the experience it had gained, MPI sought projects it might have developed in its first years as an engineering firm and others developed recently or which are now under development, though those in the latter category had to be far enough ahead to provide necessary information such as equipment and engineering costs.

As concerns processes, the plants chosen for analysis were those for which there are to be sister units, as per PEMEX's development plans, in the refining and petrochemical areas and with which the MPI has experience.

I. PROJECTS WITH FOREIGN BASIC ENGINEERING

The refining plants selected were the naphtha reformation units (1048) (1) and viscosity reduction units (1053) (1) at the Tula refinery, all completed in 1977.

Of the petrochemical plants developed during the MPI's early period (1966-1971) those selected were: the ethylene plant at Pajaritos, Veracruz (5999) (1), the cryogenic plant at La Venta, Tabasco (6417) (1) and the more recent ethylene plants at Poza Rica, Veracruz (6113), and at Cangrejera, Veracruz (1085).

II. PROJECTS WITH MEXICAN BASIC AND DETAIL ENGINEERING

The plants dating from the MPI's first phases as an engineering firm were the cryogenic units at Poza Rica, Veracruz (1041) (1) and the more recent plant at Cactus, Chiapas (1083) (1) -selected as examples of petrochemical plants (2)- and the refining plants for the Tula, Hidalgo, refinery combined distillation plant (1045) (1). Naphtha hydrodesulphurization plant (1047) (1), intermediate distillate hydrodesulphurization plants (1066, 1069) (1), hydrocarbon treating and fractionating plant (1050) (1), and common area (1072) (1).

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(1) Project identification number.

(2) Some authors place cryogenic plants in the refining sector. In this paper we place them in the petrochemical sector in line with PEMEX's classification.

In table T.V.1 an abstract of the projects studied is shown.

IV.7 ENGINEERING IN THE SELECTED PROJECTS

The Mexican Petroleum Institute began its operations on March 18, 1966, as a decentralized public agency of the federal government with separate legal capacity and capital; its activity is devoted primarily to serving Petroleos Mexicanos.

The basic functions of the MPI embrace three broad fields of activity:

a. Providing technological services for Petroleos Mexicanos and other oil companies, and for the chemical and petrochemical industries.

b. Research in and development of new technologies within the petroleum and petrochemical industries, as well as the assimilation, adaptation and improvement of existing technologies.

c. Training of personnel at all levels, from PEMEX workers to high level researchers for the MPI.

One of the technological services is engineering projects for industrial installations. This function is carried out by the Mexican Petroleum Institute's Project Engineering Office (1). On December 31, 1977,

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(1) See the MPI organizational chart in appendix G.V.1.

this office employed 952 persons, of whom 51% were college graduates (2), 31% draftsmen and administrative personnel, representing a yearly work capacity of 1,740,000 man-hours (3), (4).

In order to clarify the concepts discussed below and for an understanding of the role played by foreign consultants in the MPI project engineering group, a brief explanation will be given at this point of the meaning given to this work as regards basic and detail engineering.

BASIC ENGINEERING. As its name indicates, this engineering draws up the basic documents for a project from project plans onward. Included in this engineering are the process flow and auxiliary services diagrams, the matter and energy balances, equipment and piping dimensioning, data sheets on equipment and instruments, piping and instrumentation diagrams, general location plans for equipment and facilities, auxiliary services and chemical reagents requirements, operational philosophy, and ultimately all documents and drawings which conceptually define the project so as to provide the basis for the detail engineering to follow.

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(2) See table T.V.2 for specialty distribution and level of know-how.

(3) This figure shows effective working hours delivered by personnel, 62% of whom has a 44-hour work week, plus 4% a year in verified overtime.

(4) On diagram G.V.2 the growth in the Project Engineering Office's staff is shown.

DETAIL ENGINEERING. This engineering, which follows and is based on basic engineering, defines and works out the details necessary for the purchase, fabrication, manufacturing, construction, erection and assembly of the elements which make up an industrial installation.

This engineering includes the specific requirements of the projects, procurement of materials and equipment, as well as such specialties as mechanical, container, pipe, stress analysis, electrical, instrumentation and heat transfer engineering.

The first selected project was undertaken by the MPI in 1966 a 183,000 tons-a-year ethylene plant built at the Pajaritos, Veracruz, petrochemical complex. This project involved the use of foreign technical consultants, who took part in both the basic and detail engineering aspects; this consultation represented 59% (5) of the engineering expenditures for the contract. The project's basic engineering was contracted with Lummus, a firm located in the state of Delaware, U.S.A.

Lummus' involvement in project 5999 was as follows:

a) It did the process designing and calculations, as well as the equipment and piping dimensioning.

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(5) See table T.V.3 B in appendix.

b) It drew up the project's specifications and design bases.

c) It prepared the process flow diagrams and the general location plan.

d) It furnished the mechanical specifications for the equipment.

e) It provided the drawings and lists of materials for the desintegration heaters, steam overheaters, the regeneration converter heater and the regeneration dryer heater.

f) It supplied the heating and mechanical designing and detail drawings of the transfer line heaters.

g) It prepared the requisitions needed for the purchase of the heaters mentioned above and transfer line exchangers.

h) It drew up the heating and mechanical design and did the manufacturing blueprints for all the casing protector exchangers and air-cooled exchangers in the plant.

i) It supervised in Mexico the preparation by the MPI of blueprints, lists of materials, and specifications (except the mechanical ones) required for the purchase and manufacture of equipment and materials to be used in the erection, installation and assembly of the plant components.

j) It called for quotations and bids from foreign suppliers and manufacturers of the machinery, equipment, materials and services for the plant which were purchased abroad.

k) It helped the MPI to get quotations and bids for the machinery, equipment, materials and services bought in Mexico.

l) It prepared the comparative tabulations of the aforementioned bids, and helped the MPI in the technical selection of suppliers.

m) It drew up purchase orders on the MPI's behalf.

n) It checked out all blueprints prepared by Lummus itself, suppliers or subcontractors, and carried out the expediting, inspection and testing of machinery, equipment and materials purchased for the project.

o) It checked out all the blueprints prepared by the MPI.

p) It supplied construction supervisors, operation instructors and instrumentation technicians during the mechanical testing, at start-up and until formal acceptance.

The MPI's role consisted of the following:

a) It provided the basic design data and checked and approved the engineering work.

b) It contributed the necessary additional engineering not provided by Lummus, including ground mechanics, topography and coordinates for design and construction.

c) Made joint decisions with Lummus in selecting equipment, approving blueprints, etc.

d) Under Lummus' supervision, it prepared drawings, lists of materials and specifications required for the purchase and manufacture of machines, equipment and materials needed in the erection, installation and assembly of the plant components.

e) With the help of Lummus, it obtained proposals and quotations from domestic suppliers of equipment.

Project 6417, that is, the ethane and liquid recovery plant at La Venta, Tabasco, with a processing capacity of 175 million standard cubic feet a day (MMSCFD), is another example of a project where a foreign firm not only did all of the basic engineering but part of the detail engineering. The foreign participation represented 47% of project expenditures.

Of the previously mentioned type of projects, that is, with foreign basic engineering and direct participation of foreign technician in both basic and detail engineering, there was only one more: project 6423, the 200 MMSCFD ethane and liquid recovery plant at Pajaritos, Veracruz. Since this project, there has no longer been foreign participation in detail engineering plants where it has been necessary to contract foreign basic engineering.

The following group of plants which will be described in the group of projects studied, are those whose the basic engineering was contracted with foreign firms, while the development of the detail engineering was done by the MPI.

Among these plants are projects...

1048 Naphtha reformation plant at Tula, Hidalgo.
1053 Viscosity reduction plant at Tula, Hidalgo.
6113 Ethylene plant at Poza Rica, Veracruz.
1085 Ethylene plant at La Cangrejera, Veracruz.

1048 was a naphtha reformation unit with a 30,000 BPD capacity, where the foreign technical assistance accounted for 9% of total engineering expenses. The MPI used 84,400 man-hours in this project for the development of the detail engineering.

In the 41,000 BPD viscosity reducer, foreign consultant fees amounted to 4% of overall engineering costs, and the MPI used 127,000 man-hours in the development of the detail engineering.

Project 6113 was an ethylene plant located at Poza Rica, Veracruz; a sister plant of project 5999 just mentioned, it consumed 265,900 man-hours.

Number 1085 was an ethylene plant project, but in this case with a capacity of 500,000 tons a year; the project required 496,500 man-hours for its development.

The remaining projects selected were done at the MPI in both their basic and detailed engineering aspects. These projects were the following:

Combined distilling plant with 150,000 BPD, project 1045; both the basic and the detail engineering were developed by the MPI.

In project 1047, a 36,000 BPD naphtha hydrodesulphurization plant, 8,188 man-hours were consumed for doing the basic engineering, and 67,500 man-hours went into the detail engineering.

The two 25,000 BPD intermediate destillate hydrodesulphurization units, projects 1066 and 1069, involved the investment of 6,809 - man-hours in basic engineering and 94,400 man-hours in the detail -- engineering.

Project 1050, the hydrocarbon treating and fractionating unit, represented an effort of 82,500 man-hours.

Lastly, as part of the work done for the Tula refinery, the area --- selected for study was services common to naphtha reformation plant 1048, naphtha hydrodesulphurization plan 1047, intermediate distillate - hydrodesulphurization plants 1066 and 1069, and hydrocarbon treating - and fractionating plant 1050. This area includes the designing of services and equipment used in all the above plants and includes underground pipage, force distribution system, ground lines, pipe hangers, fuel system, etc. - Designing for this area required 133,500 man-hours.

The first cryogenic plant involved basic engineering developed by the MPI was project 1041 with 275 MMSCFD, where 305,300 man-hours were - consumed.

Another of the cryogenic units under study also involving Mexican basic engineering was project 1083 with 500 MMSCFD, into which went -- 240,000 man-hours.

On the basis of the above data, which are summarized in table T.V.4 A/B of the statistical appendix, it is difficult to evaluate the learning obtained and to determine the degrees of efficiency attained. However, - a comparison of the data on ethylene plants 5999 and 1085 shows a 7% decrease in man-hour consumption and a two-year saving in the time - required to carry out the project.

In a like sense, a comparison of cryogenic plants 1041 and 1083 shows that man-hours consumed dropped by 21% and that project time was - reduced by three years.

The data included in tables T.V.3 A/B show that the MPI's participation in refining projects was predominant, which was not true in petrochemical plants, although the decline in foreign participation with the passage of - time is significant.

Mexican participation in the engineering for ethylene plants rose from 41% of costs in project 5999 to 63% in project 1085, and in cryogenic plants from 53% in project 6417 to 100% and 96% in projects 1041 and 1083.

The above porcentages refer to total engineering cost, so that for a - clearer understanding of MPI's participation in the engineering of the selected projects it can be said that in both the refining and the --- petrochemical projects all detail engineering was developed by Mexican technicians, with the exceptions noted above.

As concerns basic engineering, it was purchased in the case of project 6417 but was later developed in the MPI to meet the requirements of projects 1041 and 1083. All of these were cryogenic plants.

As mentioned previously, for refining plants the MPI developed all the basic engineering of the selected units, with the exception of the naphtha reformer and the viscosity reducer.

IV.8 PROJECT ENGINEERING COSTS

The natural frame of reference for engineering costs in plant cost, -- particularly costs of materials and equipment, erection, assembly and construction, including the indirect costs of each item. Among such - indirect costs, as classified by several authors (1) (2), is proyect -- engineering cost, which embraces both basic and detail engineering.

In table T.V.5 A/B of the appendix, which presents the engineering - costs of the selected projects, can be seen the direct labor cost of - each specialty used in said projects (at December 1977 prices) and - the share of each specialty in the projects.

In the petrochemical plant section of the table, the process-by-process breakdown of the installations reveals a decline, despite the differences in plant capacities, in the cost of Mexican engineering with the passing of time (which is an undeniable sign of learning) and the disappearance of foreigh consultation as of project 6417.

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(1) Kenneth M. Guthrie
(2) H.C. Bauman

Cryogenic Plants:

6417, the 175 MMSCFD cryogenic plant at La Venta, Tabasco, had a - direct Mexican labor cost at December 1977 prices of 9.5 million -- pesos. However, as noted above, foreign participation represented 47% of total engineering expenses, including direct labor. Then came the - 275 MMSCFD project 1041 cryogenic plant, whose direct labor cost at December 1977 prices totalled 26.7 million pesos. For the third of the cryogenic plants analyzed--the 500 MMSCFD project 1083 at Cactus, Chiapas--the direct labor cost of the engineering came to 21.2 million pesos at December 1977 prices, with this cost falling despite the fact that the plant has almost twice the capacity of project 1041. It is to - be emphasized that in the latter two cryogenic plants direct foreign -- labor cost was zero.

Ethylene Plants:

The first plant constructed, and where foreign engineering firms were consulted, was the 183,000 tons/year project 5999, located at Pajaritos, Veracruz. At December 1977 prices, direct Mexican labor cost there amounted to 36.4 million pesos, with foreign participation accounting - for total engineering expenses, including direct foreign labor.

There was no longer any direct foreign labor in the next two projects, numbers 6113 and 1085. Unit 6113 was a duplicate of project 5990 and -its cost came to 23.1 million pesos at December 1977 prices. The case of project 6113 illustrates in its figures the advantages of duplicating a - modular project, since there was a reduction of 36% in cost and 43% in construction time; the savings failed to be even greater because the -- duplication began six years after starting the base, making it necessary to repeat buying procedures for equipment and materials.

It is best that the advantages of plant duplication be truly valuable only when the process and size of the module base have been correctly -- chosen. Also important are the project construction schedules, a key factor in production schedules of the capital goods industry.

In the case of ethylene plants, the 500,000 tons/year project 1085 has been chosen as a module for duplication in future plants. This project had a direct labor engineering cost of 43.9 million pesos at December 1977 prices, and the increase in this cost is proportionately lower than the increase in the plant's capacity when compared with project 5999.

In the refining plants section of table T.V.5 A are projects built at the same time and integrated with respect to process, since they all form part of the Tula refinery.

Of the eight projects analyzed, only 1048 and 1053--naphtha reformation and viscosity reduction plants, respectively involved foreign engineering, basic in both cases, as shown on table T.V.6 A/B. The detail engineering was developed by the MPI. Project 1053 had a cost of 10.8 million pesos, and 1048's cost was 7.2 million pesos, both at December 1977 prices. The remaining projects had basic engineering by the MPI.

The costs in table T.V.5 A/B include the cost of the basic engineering when this was done by the MPI, except for projects 1047 (36,000 BPD naphtha hydrodesulphurization plant), 1066 and 1069. In the case of the 25,000 BPD intermediate distillate hydrodesulphurization plants, the cost accounting of the basic engineering was separated from that of the detail engineering for statistical reasons, because it was thought that the capacities and designs of the units could be taken as modules of future plants. Furthermore, such hydrodesulphurization processes are based on use of catalysts developed by the MPI. The modules were therefore also created for inclusion on the list of processes and technological developments the MPI is in a position to license.

The labor cost, at December 1977 prices, of the basic engineering package for the naphtha hydrodesulphurization process was 858,000 pesos, which added to the detail engineering labor cost, gives a total direct labor cost of 5.5 million pesos for the project. In projects 1066 and 1069--25,000 BPD intermediate distillate hydrodesulphurization plants--can again be seen the benefits gained through modulation and engineering duplication, since both plants are the same.

The base (1066) direct labor cost was 4.8 million pesos, while that of the duplicate was 3.0 million pesos, this 37% cost reduction again being traceable to the duplication. In the case of these two identical plants, 714,000 pesos could be added to the detail engineering direct labor cost of 7.9 million pesos to include the basic engineering package, thus -- bringing the total to 8.61 million pesos. Also to be taken into account is the possibility of using the process package, which has been used, as a basis, with minor modifications, for the detail engineering of many - other plants, such as the Salina Cruz and Cadereyta refinery units.

In the project 1045,combined distillation unit, so called because of the heating integration in the streams of its two component plants, the -- 150,000 BPD atomospheric distillation plant and the 70,000 barrel -- vacuum section, the direct labor engineering cost amounted to 20.7 -- million pesos at December 1977 prices, the figure including basic --- engineering cost.

The cost of project 1072, common areas, totalled 11.9 million pesos and, as mentioned above, covers the designing of systems and use -- services shared by projects 1047, 1048, 1050, 1066 and 1069. The - cost of the direct labor for this common area represents 43% of total direct labor engineering cost for the projects served.

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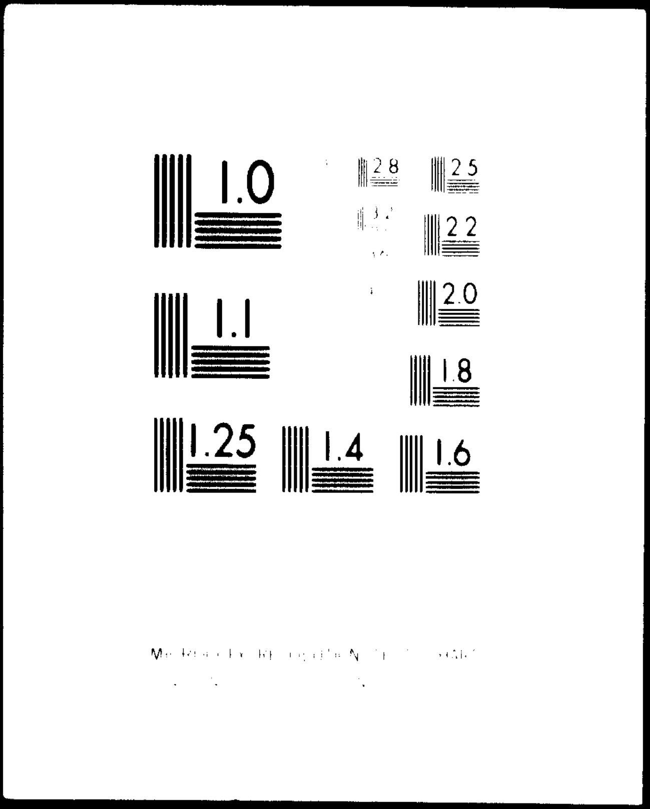

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IV.9 CAPITAL GOODS

Petróleos Mexicanos has had to continue contracting foreign project -- engineering for some of its industrial installations in order to solve -- certain problems connected with petrochemical .production. However, there has been a growing number of projects involving Mexican -- engineering, meaning that project engineering contracted abroad has - decreased. Technology and engineering has been imported only in -- specific cases where some advantage is gained for both the country - and for the oil industry. This was the case of certain petrochemical plants whose technology was entirely unknown in Mexico.

Undoubtedly, project engineering is a decisive influence in the origin of the equipment and materials purchased for any given project. Proper development of project engineering must be oriented in such a way so - as to favor to the utmost purchasing of equipment and materials made in Mexico, namely via a constant and energetic promotion of domestic project engineering. However, it is often necessary to buy equipment which is more efficient and advanced than what domestic industry is not yet in a position to produce, thus making importation justifiable and - necessary for a more efficient project.

One aspect to be closely watched in contracting foreign enginnering is the need to minimize the danger that the firms supplying the - - -

engineering choose equipment and materials not manufactured in Mexico. This can also happen, although on a smaller scale, when local --- engineering services are used, since there is then more familiarity - with the catalogues of foreign manufacturers and with the solutions -- found in other countries to similar technical problems, this to the -- detriment of an adequate share of locally made equipment in petroleum installations.

In table T.V.17 can be seen the figures for purchases of equipment and materials for new construction as made by Petroleos Mexicanos - from 1971 to 1977 in the area of local and imported components. -- According to this table, in the 1971-1976 period local equipment and materials represent 56.39% of the purchases for new projects, whereas in 1977 this group accounted for 54.17 of the total.

As previously noted, the share of Mexican project engineering in --- PEMEX projects is now quite high. We can therefore state that local purchases, at the mentioned 57.17% of the total, have other factors, in addition to the origin of the project engineering, which has kept the percentage for local capital goods from increasing apace. Among -- these factors are the low capacity of the capital goods producers for complying with schedules or quality demands, high prices, lack of -- production, and so forth.

For a better understanding of the development road followed by the -- Mexican capital goods industry as concerns its participation in the -- petroleum industry, we will now discuss purchases of the most important types of equipment as these developed in the case of the 14 projects - analyzed.

I. FURNACES

In the report under 1A of Refining and Petrochemicals (see appendix), it can be seen that in this type of equipment, independently of the -- national origin of the engineering in half of the projects analyzed, in all cases furnaces had a high level of foreign components which varied between 66.4 and 100%.

Refining: In the combined distillation plant (1045) two furnaces were bought, the BA-101 and the BA-201, for the atmospheric distillation and vacuum sections, respectively.

The Mexican share in both furncaces comes to 33.5%, with the --- following breakdown; designing, 14.8%; insulation, 18.71%; and --- refractory 0.03%. Foreign participation was made up of: basic -- materials (1), 64.06%; and blowers, 2.39%.

In the naphtha hydrodesulphurization plant (1047) Mexican participation represented 7.98% of furnaces BA-101 and BA-201, that figure --- reflecting locally bought insulating material. The 92.02% foreign --

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(1) basic materials are pipage, burners, blowers, cast iron materials, etc. for the furnace.

participation represented the remaining furnace materials (pipage, -- burners, refractory, structures, etc.) which were purchased in a -- package--and explains why there is no detailed information.

For the naphtha reformer (1048) purchases were made in Mexico of -- insulating, 6.09%, refractories, 3.18%; the remaining 91.56% was for purchases of basic materials abroad.

The viscosity reducer (1053) involved purchases in Mexico of ----- refractories, 6.04%, and insulation, 2.40%, while the basic materials, 91.56% were also bought as a package abroad.

In the case of furnaces BA-701 and BA-702 for kerosene - - - - hydrodesulphurization, the Mexican share came to 5.54% and consisted of refractories. The remaining 94.46% was imported (68.96% for --- basic materials, 0.54% for burner replacements, 1.48% for blower -- replacement parts, and 23.48% for replacement parts for other basic materials.

In the gas oil hydrodesulphurization plant (1069), the purchases for the two furnaces were as follows: 5.5% was local and represented refractory material, while the basic materials were imported, accounting for --- 69.21% of total purchases; the remaining 25.24% was also of foreign - origin and consisted of replacement basic materials.

Purchases for the petrochemical projects at the cryogenic plant (1041) in Poza Rica, Veracruz, consisted of three furnaces--BA-601, BA-701 and BA-702. All three were bought complete abroad, with 96.67% of the total for basic materials and 3.33% for replacement parts.

The furnace for the Cactus, Chiapas, cryogenic plant (1083) was also bought complete abroad, with spare parts accounting for 6% and basic and structural materials for the furnace, 94%.

At the cryogenic plant in La Venta, Tabasco (6417), it is seen that - the furnace was bought locally. Of the total purchases, 97% --- represented basic and structural materials and 3% replacement parts.

At the ethylene plant (5999), the purchases had the following make-up: 97.95% were made abroad with this breakdown: refractories, 0.35%; insulation, 1.40%; burners, 3.25%, pipage, 80.85%; replacement pipage, 12.13%, adding up to 100% for furnaces (2) BA-101, BA-102, BA-103, BA-104 and BA-105.

Heater BA-901 was bought complete in Mexico and represented 2.05% of the furnaces purchased for the contract. This equipment was -- supplied by Brown-Fintube de Mexico, and supposedly it was assembled in Mexico with foreign-made components.

The purchasing of the furnaces in contract 6113, a duplicate of the

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(2) Only purchases by the MPI are included. The structures were bought by Petróleos Mexicanos.

previous project, was as follows: France (71.4%), the United States - (25.6%) and Great Britain (2.8%). The breakdown for type of supply can be seen in report No. 4.

Lastly, the furnaces for the La Cangrejera ethylene plant had a local supply of 4.4% as follows: basic materials for furnace BA-601 (3).

The foreign participation in this contract consisted in the supply of the components for furnaces BA-101, 201 and 401 as follows: basic materials 37.63%; basic materials replacements, 4.10%, burners, - 7.78%; burner replacement parts, 0.55%, pipage, 32.71%; replacement pipage, 0.43%; accesories, 8.49%; and supports, 3.82%.

From the above information it can be seen that foreign participation in furnaces has been very high (see report No. 1 for each case, -- mainly due to the fact that the local supplies in this field are little developed. However, those now operating and assembling this type - of equipment have a 60% domestic integration, a figure which can be expected to rise when pipage, at present imported, goes into ---- production in Mexico. In 1979, the required type of pipes will be produced in Lerma, outside of Mexico City in the state of Mexico.

In the equipment analyzed, local supply was modest in terms of both value and technological content because at the time it was limited -

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(3) In this case the local suppliers assemble foreign-made parts (pipes, burners and blowers) with locally-made parts (structure, steel plate, insulation, refractory, etc.)

to materials such as insulation and refractories (4). As noted above, there were also times when this type of materials was purchased -- abroad when a package arrangement was made.

II. TOWERS AND TOWER INTERIORS:

In this type of heavy boiler equipment, Mexican industry had a good - showing in the plants analyzed. In project 1045, four towers were -- purchased, and their value amounted to 1.07 million dollars at December 1977 prices, with all purchases being made in Mexico. The interiors - of this equipment were also made in Mexico and their cost came to -- 0.472 million dollars. In the rest of the refining plants analyzed as well, all towers were bought in Mexico at a total cost of 1.09 million dollars. In the case of the interiors, however, foreign suppliers did have a participation, as seen below. In project 1047 (naphtha ---- hydrodesulphurization), 30% of the plates were purchased in Mexico - and the remainder in the United States. Both the locally bought and the foreign plates were 100% alloy steel. The plates for tower DA-501 of naphtha reformer (1048) were supplied locally. These plates were also 100% steel alloy.

In project 1050, all tower interiors were supplied from abroad, with the only Mexican participation being the packing used in tower DA-602.

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(4) Local share in the whole was probably greater than indicated in the above percentages because of the share of structures as a domestic component. The MPI has no data on these materials because they were purchased by PEMEX directly abroad.

The supply of packing trays was also from abroad (U.S.). For towers DA-601, 603, 604, 605, 606, 607, 608 and 609, the interiors were -- steel alloy and purchased in Italy at a price of 0.128 million dollars. The interiors of towers DA-101 and 102 in the viscosity reducer unit were tray type alloy plates bought in Mexico.

For the intermediate distillates hydrodesulphurization units (1066, 1069) all the interior parts, in this case alloy block plates, were purchased in Mexico.

In petrochemical plants foreign participation in tower supply was larger than in refining, while the opposite was true in the case of tower --- interiors (reports 1 and 1A).

For the first cryogenic unit designed (6417), tower DA-0001 was --- purchased in France. It weighed 43 tons and had 88% alloy components. It required 40 100% alloy block plates, which were locally supplied.

For the construction of the cryogenic plant at Poza Rica, Veracruz, - the five towers and the steel alloy block plates required were all ---- bought locally. As to the interiors for this contract, only the fog -- eliminators were procured abroad (U.S.) for installation in tower --- DA-601, and they represented only 1.33% of the value of the tower - interiors in the contract.

Of the 2.5 million dollars in tower investment for project 1083 (Cactus, Chiapas, cryogenic plant), 71% was for foreign procurements (tower -- DA-102 from Japan) and the remaining 29% for local purchases (DA-101). Tower DA-102 was a carbon steel packed tower measuring 438 cubic -- meters and weighing 460 tons. The Mexican-made tower has a volume of 243 cubic meters, weighs 127 tons, and its interiors are 30 block - type plates supplied locally.

As concerns towers and interiors for ethylene plants, in project 5999 - (Pajaritos, Veracruz) 87% of the towers were bought in Mexico, while the remaining 13% represents the cost of the Frech-made tower DA-101. All tower interiors for this project were Mexican-made steel alloy -- block type plates.

In project 6113, a duplicate of the above, towers and their interiors - were all purchased locally. In the third ethylene plant analyzed (1085, La Cangrejera, Veracruz), 72% represented towers procured abroad - as follows: France, 54.5%, and Italy, 17.6%. The tower interiors - were 100% block type plates of Mexican manufacture.

To sum up, in the refining projects analyzed, all towers were purchased in México, while 23% of the interiors for these towers were procured - abroad. In the petrochemical projects, 62% of the towers were bought abroad.

Tower plates for the petrochemical plants were all Mexican in origin.

In the case of the petrochemical plants, the change in buying procedure involving occasional foreign procurement rather than, as in previous projects with the same type of process, local purchases of the same kind of equipment, was often due to the long delivery times offered by local manufacturers or to lack of competitive prices.

III. REACTORS:

The only petrochemical project with this type of plant equipment is number 1085. Reactors DC-301 and 401 both have a wall thickness of less than two inches, this former being French-made and the latter Italian-made.

For the refining projects all reactors were purchased abroad as follows:

In the naphtha hydrodesulphurization unit (1047), reactor DC-401 with a wall thickness of under two inches was bought in Italy. Its volume is 80 cubic meters and it weighs 61 tons. Project 1048 reformation reactor DC-501 was also purchased abroad. The body of the 348 ton reactor was manufactured in Italy, and it also has a wall thickness of less than two inches. The reactor interiors were supplied from the United States.

Reactors DC-701 and DC-801 for the intermediate distillate hydrodesulphurization plants, both with wall thicknesses of less than two inches, weigh 138 tons each and are made of steel alloy. This equipment was bought in France.

IV. HEAT EXCHANGERS

In the procurement scheme followed for this family of equipment, the origin of the engineering has a clear influence on the origin of the capital goods, although not in all cases. In the combined distillation plant all exchangers were bought in Mexico, all were of the AET type and most were designed by the MPI.

The exchangers for the naphtha hydrodesulphurization unit (1047) were also largely (91%) (5) designed by Mexican firms; 74.6% were purchased locally (6).

In the naphtha reformer where the process package was foreign in origin, only 6.2% of the heat exchangers were procured in Mexico.

In contrast for the hydrocarbon treating and fractionating unit, all the heat exchangers were purchased locally. The designers of this equipment were also Mexican. The basic engineering for the viscosity reduction plant was also foreign. Heat exchanger procurement was 92% foreign. In the kerosene hydrodesulphurization unit (1066), foreign purchases amounted to 86.5% and proceeded as follows: The United

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(5) As concerns quantity

(6) As concerns value

States, 60.5%; Great Britain, 26.0%. Mexico's share came to 13.5%. In the gas oil hydrodesulphurization unit the local share rose to 43.1%. Since projects 1066 and 1069 (intermediate distillates hydrodesulphurization units) are identical, it would be expected that the origins of the equipment would also be identical. Yet, as noted above, Mexican participation was higher in project 1069 than in project 1066. Supposedly, this was because the purchasing pattern was not the same due to the - saturation of local shops, which were unable to meet delivery schedules and forced orders to be placed with foreign firms.

Lastly, all heat exchangers for the common services area (1072) were supplied locally and designed by the MPI.

In petrochemical plants, the exchangers purchased for the cryogenic - unit at La Venta, Tabasco (6417), were 63% of foreign origin (France) and 37% Mexican (7) (Metalver and Swecomex).

For the (1041) cryogenic unit at Poza Rica, Veracruz, the exchangers, bought three years after those purchased for project 6417, were - supplied by Mexican producers, who also provided the designing (8).

At the recently completed cryogenic plant at Cactus, Chiapas (1083), all the heat exchangers were procured abroad (U.S., 76.3%; Germany, 18.6%; and Canada, 4.9%). At the (5999) ethylene plant at Pajaritos,

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(7) At the time this project was being developed, the MPI had not yet begun to design the heat exchangers.

(8) At the time this project was under way, the Mexican suppliers subcontracted the designing abroad, mainly in the U.S.

Veracruz, the national origin of the heat exchangers showed the following pattern: France, 59.3%; Mexico, 36.1%; and U.S., 4.5%. Mexico's share in the supply of ethylene plants improved in project - 6113, where 82.9% of the purchases were made in Mexico, although its share in project 1085 at La Cangrejera, Veracruz, dropped to only 17.1%.

The family of equipment with the above purchasing patterns was also faced with the inability of manufacturers to meet the delivery schedules requested, high prices in some cases, or unavailability of basic inputs such as alloys--allfactors which contributed to making foreign purchases preferable to local procurement.

V. PROCESS CONTAINERS:

As in the case of towers, all process containers at the Tula refinery plants analyzed were bought in Mexico.

However, in petrochemical plants the Mexican participation came only to 65%, as seen below. The cryogenic plants of project 6417 were - 57.2% of Mexican origin, this figure rising to 100% in project 1041, and falling again to 66.4% in project 1083.

In ethylene plants, the procurement pattern was as follows:

In the first one (5999) Mexico's share came to 48.4%, increasing in - project 6113 to 96.6%, and dwindling in project 1085 to 41.6%. This decline in the Mexican share in recent projects, as concerns this family of equipment, may have also been due to lack of local production capacity, as well as to the difficulties met by the manufacturers in attempting to purchase their basic inputs quickly and at good prices.

VI. PUMPS:

As in compressors and turbines, with this type of equipment the origin of the engineering seems to have no appreciable influence on the origin of the capital goods. This seems to be true because their origin depends on the origin of the designing and on the technological capacity of the installations for the manufacture of the capital goods.

In project 1045, the locally supplied pumps were of the centrifugal type in the 10-265 BHP range, while the foreign-made pumps covered a wider range of from 1 to 695 BHP in different types (centrifugals and reciprocating). The Mexican share in this project came to 21.2%.

In project 1047, the pumps supplied by Mexico were centrifugal types types with 4-30 BHP and represented 7.6% of pump costs for the project.

In the naphtha reformer (1048), of the total of seven pumps, five were bought in Mexico, but in value they accounted for only 41% of purchases.

In the hydrocarbon treating and fractionating plant, Mexico's share amounted to 21.3%.

Mexican-made pumps for the viscosity reducer plant (1053) accounted for 10.8% of the total.

All the pumps bought for the intermediate distillates hydrodesulphurization plants were supplied by a foreign company, and this was also the case in the common services area (1072).

In the selected petrochemical plants, the Mexican share came to only 11.36%, and in the particular case of the cryogenic units the figure - was 18.43%.

Local share in the ethylene plants was 9.89%.

In the cryogenic plant at La Venta, Tabasco (6417), 100% of the pumps were procured abroad.

In the Poza Rica cryogenic plant, where the pumps were purchased an average of three years after procurement of those for project 6417, - local participation rose to 68.3%, this figure declining to a mere 0.7% in the cryogenic plant at Cactus, Chiapas, whose purchases were made in the 1975-1976 period.

In the ethylene plant al Pajaritos, Veracruz (5999), local suppliers got a 11.4% share, with purchases taking place in the 1969-1970 period.

In the duplicate of the above plant, bought in the 1973-1976 period, Mexico's share failed to improve and even fell to 10.7%. In project 1085 (La Cangrejera, Veracruz), local participation was 8.6%.

In this family of equipment, the chief reasons for deciding to buy -

foreign supplies rather than those manufactured in Mexico have been, in the order of importance, in compliance with technical specifications by suppliers. high prices and excessive delivery times, with the latter apparently due to difficulties encountered in obtaining prompt delivery of inputs and at the required prices and quality for the pumps.

VII. COMPRESSORS:

For the plants chosen for analysis at the Tula refinery, only imported pumps were installed.

In the petrochemical plants, only 0.51% was contributed by local suppliers. In the cryogenic plants, 0.75% was local, while in the ethylene plants the figure was only 0.24%.

In project 6417 (the cryogenic plant at La Venta, Tabasco), the participation of local suppliers of average purchases during the 1969-1970 period consisted in GB-0004 and GB-0006 air compressors (1.55%) and their replacement parts (0.08%). In the cryogenic plant of project 1041 (Poza Rica, Veracruz), foreign purchases of compressors represented the whole of the average procurement in 1973. Lastly, at the cryogenic plant al Cactus, Chiapas (1083), local participation came to 0.48%.

As concerns the ethylene plants, project 5999 was locally supplied with GB-0951 and GB-0952 air compressors which accounted for 0.67% of the value of compressor equipment bought for this project. In the duplication of this project local participation disappeared completely, and in project 1085 there was likewise no local share in compressor supply. Mexican producers of compressing equipment have in general had a very restricted role as suppliers, and have only provided reciprocating air compressors.

As regards process compressors, the local capital goods sector lacks up-to-date technology, mainly in centrifugal compressors, and these - are not manufactured in Mexico.

VIII. TURBOEXPANDERS:

This family of equipment is characterized by its high level of technological content, this being one of the reasons turboexpanders are not made in Mexico. As a matter of fact, so specialized is the designing of this equipment that all of the turboexpanders purchased for four of the petrochemical plants analyzed were supplied by a single producer.

IX. TURBINES:

The unavailability of this equipment in Mexico has meant that all units required for both refining and petrochemical plants was bought abroad from the following sources: for petrochemical plants, Japan (73.27%), the United States (20.06%), Germany (6.22%), France (0.33%) and - Switzerland (0.14%); for refining plants, only U.S. turbines were purchased.

X. MOTORS:

Local producers supplied 6.73% of the motors required in the selected refining plants, as seen in the breakdown below.

For the combined distillation plant local purchases consisted of 15 motors of the 24 needed in the installation (63%). Value-wise, however, Mexican participation came to only 21.6%, this being chiefly due to the fact that local supplies was limited to low horsepower motors (9).

At the naphtha hydrodesulphurization unit (1047), 33% of the number of motors required were bought in Mexico, but in value their share came to only 6.8%. Mexico supplied 60% of the naphtha reformer's motors, but in value terms this project (1048) spent a mere 0.2% of its motors allotment on Mexican-made units.

16% of the motors required for project 1050 (hydrocarbon treating and fractionating plant) were purchased in Mexico, and there the value figures accounted for 5.5% of the total cost of motors used in the project.

No local supplies of motors were used in the intermediate distillates - hydrodesulphurization plants (1066 and 1069) and in the common services area (1072).

As can been seen from the above data, in terms of quantity the local share was always much higher than the value amount, this being a reflection of horsepower limitations in local manufacting, which in turn - could be indicative of technological and installed capacity limitations.

Local manufacturers of motors had a 5.73% share in petrochemical -

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(9) See the computer file in the appendix, which includes a breakdown of individual horsepower ratings.

plant purchases as per the following breakdown:

At cryogenic plant 6417, no procurement was made in Mexico. However, in project 1041 all the motors were bought in Mexico. Mexican purchases for project 1083 consisted of two motors of the eight required for the contract (25%), and the contribution terms of value - was similar (24%).

In ethylene plants, local producers supplied 48% of the units required for project 5999, where the value contribution came to 11%. In project 6113, which was a duplicate of the above one, Mexico's - share fell to 5%. Lastly, in project 1085 no electric motors were - supplied by local manufacturers.

XI. MOTOR SUBSTATIONS AND CONTROL CENTERS:

All of this type of equipment for refining plants was supplied by Mexican producers. 95% of the supplies for the petrochemical plants was of Mexican origin, as can be seen in the computer reports in the - appendix.

XII. INSTRUMENTS:

The refining projects bought 28% of this kind of equipment in order to meet their requirements. In project 1045, 68.5% of the instruments needed were purchased abroad (the United States, 61.2%, and Great - Britain 7.3%). Mexico provided 31.3% of the total required.

Mexico's share increased to 52.3% in the naphtha hydrodesulphurization plant, and foreign participation was limited to the United States with - 47.6%.

In project 1048 (naphtha reformer) the share of foreign producers came to 70.6%, and this can be understood to be a direct consequence of the fact that the basic engineering was done outside of Mexico.

In project 1050 (hydrocarbon treating and fractionating plant) the local share amounted to 36.6%.

In the viscosity reduction plant (1053), foreign instrument producers - got a 64.6% share (the United States, 58.9%, and Great Britain, 5.7%), and with a 35.3% share for Mexico.

Mexican participation in the intermediate distillates hydrodesulphurization plants came to 44.5%. Lastly, the lowest Mexican share in the - projects of the Tula refinery was in common services areas, with 6.0%.

Instrument purchases for petrochemical plants showed a 35% share for Mexican suppliers.

In cryogenic plants, local suppliers took a 49.55% share, and the plant-by-plant breakdown was as follows: 6417,21.7%; 1041, 53.4%; 1083, 58.8%.

For the ethylene plants, 29% was bought in Mexico, with the following plant-by-plant percentages: 5999, 20.9%; 6113, 60.6%; 1085, 18.5%.

It is to be noted that Mexico's share rose with the passing of time and with the increase in the amount of local engineering involved.

An exception to this was contract 1085, where the fall in the Mexican share can be attributed to the change in the technological scheme for the instrumentation of the ethylene plants and with respect to the previous two plants, since electronic instrumentation was decided on rather than pneumatic instruments.

From the above data, the computer reports given in the appendix, the tabulations of the technical and economic bids (10), and also on the basis of statements made by different MPI specialists, it can be said - that the typical reasons why the purchases for the selected projects - were sometimes made abroad are, in order of importance:

a) No local production.

b) Incompliance with the required delivery schedules, that is, excessively long manufacturing time.

c) High prices, usually for equipment with imported basic inputs and in companies lacking adequate national integration, and, in some cases, for lack of modern technology and manufacturing capacity.

d) Incompliance with technical requirements.

As part of the ideas presented at the beginning of this capital good section, the following suggestions are related to the future improvement of Mexican capital goods producers' share in the supply of equipment to - the petroleum industry, and were first set forth during the round table of experts held in February, 1978 at the Mexican Petroleum Institute (11).

First of all it will be necesary for PEMEX to draw up programs for -

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(11) See participant list in appendix.

equipment and materials purchases and distribute them opportunely - among Mexico's manufacturers. giving specifications for quantity, quality and delivery time required, etc. This would help develop domestic production and allow PEMEX to be less hasty to place its orders - abroad in those cases in which petroleum project investment cannot be delayed.

The evident lack of communication between the project personnel and - local industrialists leads to easy solutions in which the advantages go to the foreign supplier, since he ordinarily presents his bids complete with full documentation. while local suppliers often fall to do this, - owing in some cases to their lack of experience.

The above is one to the basic points which could sway the balance in favor of purchases of Mexican-made capital goods. It is therefore advisable to give decided and unwaivering aid to Mexican project engineering which should not be done abroad unless it is convenient for the oil industry and the country.

In those cases where the engineering is developed abroad, local engineering must have a maximum share in the work by making its own - contribution or by sending personnel abroad to partake in the engineering there.

Another policy which is fundamental for increasing the amount of local engineering, and for local production of equipment as well, would be - the development of project bases for type projects, of general standards and specifications as a framework for all oil industry project development; and all such criteria and bases, all thoroughly analyzed, must be widely distributed among the Mexican producers, who may be in a position to propose suitable solutions for projects of the same type.

It will also be important for local manufacturers to carefully analyze - the markets, particularly the capital goods market for the petroleum - industry, this with an eye to adjusting their production schedules and - improving their delivery times, the efficiency of their installations, the quality of their products, etc., and, in general, bringing down their - costs to competitive levels.

As a step toward promoting local manufactures of capital goods, Petroleos Mexicanos gives preference to Mexican-made equipment and materials in cases where the cost differential is no more than 15% higher - than the foreign price. This policy is being applied by PEMEX to those local producers who can guarantee compliance with the specifications of the products as concerns quality and delivery time.

CHAPTER V. CONCLUSIONS AND RECOMMENDATIONS

V.1 CONCLUSIONS

The basic requirement for an efficient transfer of technology in that there be a suitable receiver for it so that the purchase of technology insures its transfer.

In the case of transfer of technology for the petroleum industry, the

Mexican Petroleum Institute has been the receiver.

The formation of the MPI engineering group, together with the first work done with help of foreign technicians, led to speedy and purposeful training.

The balance of the project engineering training, with the direct participation of foreign technicians, was positive for the MPI.

The technological progress achieved by the MPI in 11 years of efforts embrance such technological areas as process designing, basic engineering development, heat transfer equipment design, detail engineering designing in several specific fields--which as a whole are competitive internationally.

The number of specialities now involved in the detail engineering of a project in greater than at the time of the first contracts, and their schemes are more complete and sophisticated.

In most of the areas requiring standardization in the petroleum industry, what has been done in Mexico is to adapt existing standards which have been tested and applied successfully in other more technologically advanced countries. However, Petroleos Mexicanos and the MPI have jointly developed standards such as "Standards and Specifications for Projects and Construction".

Standardization in general tends to unify criteria in the different aspects and areas of standardization; it brings uniformity into the technical language; it facilitates administrative, technical and scientific processes;

it economizes and optimizes the use of resources; it cuts production costs; it protects input and product quality, with subsequent guarantees for the consumer; it reduces inventories; it improves the productivity of men and machines; it provides a means for technology transfer; it spurs scientific and technological research; it guarantees application and use of products; and it guarantees the functioning and performance of the goods standardized.

Conversely, however, standardization can be a disadvantage in that it is indirectly a factor in technological colonialism.

Yet a knowledge of international standardization helps to up-date technological know-how in different areas of standardization, and proper application of standardization can open the door to world markets for local capital goods producers,

Since its foundation, the Mexican Petroleum Institute has endeavored to advance technological development by training its personnel and continually creating and updating the calculation methodology used in designing. The purpose of this effort has not been to establish a technological autarchy, but to achieve the capacity and knowledge needed for self-determination, that is, the ability to decide which technologies must be developed, which to buy, from whom, and how far we should go in each aspect, with no dependence in the decision-making except as concerns our own resources.

In the different aspects of technological development to which the MPI has devoted its efforts, results have been satisfactory and encouraging. For example, there are the achievements in the field of process technology, in the technology of processing equipment, in the technology of - detail engineering, and in general technology.

One of the desireable consequences development of the above technologies engenders is new jobs in areas such as heat transfer, where the analysis required for the procurement of close to a thousand pieces of equipment in four years consumed some three million man-hours.

And, speaking of heat transfer alone, the evocation of technical information fasters than it is obtained from outside suppliers provide timely - aids the work in other areas of detail engineering and thus cuts project time.

The development of equipment design technology is protection against - foreign monopolies, since it means that a large number of manufacturers with no engineering background can have access to designing and manufacturing plans for equipment.

Technological development indirectly raises the quality of industrial installations because it allows efficient authorization of supplier bids, the establishment of design standards as reference patterns, and the providing of technical consulting and assistance to the capital goods industry.

Another consequence of the MPI's development of design engineering - has been the organizations' swift transformation from "consulter" in - project engineering to consultant for a number of local and foreign -

firms. The development thus far achieved is an economizing factor. - For not only are there savings from reducing the time industrial installations are out of operation because of equipment and systems problems - (which can now be quickly solved through the knowledge and methods - acquired), but also savings in foreign exchange stemming from, for instance, the equipment designing done by the MPI rather than bought abroad.

One of the basic policies that Petroleos Mexicanos has applied in promoting project engineering technology is to avoid "key in hand" process contracting. At first this policy was used to encourage the formation of construction companies in Mexico, and later it was useful in helping to set up local engineering firms, which in the 1960's began to do the engineering of the simpler types of installations.

It was not until 1966 that the MPI, founded the year before, undertook the engineering for process plants, and in 1972 local private firms were first contracted for this work.

This reveals how new project engineering is in the Mexican oil industry. Despite its recent inception, local engineering is now (1977) able to provide 85% of the work required by Petroleos Mexicanos. Around 98% of the refining plant engineering and 80% of the petrochemical plant engineering is at present done in Mexico.

The only exceptions to PEMEX's policy of fostering local engineering - so that the greatest amount of work possible is done in Mexico are the following:

a) When the engineering and manufacture cannot be finished on -

schedule, as was the case of the modular cryogenic plants.

b) When PEMEX has no previous experience in the type of plants to be built because of the new products involved, as is the case - with polypropylene.

c) When it is known that very few companies or only one in the whole world have the required experience, as in the case of ammonia.

d) When it is known that plants are highly especialized in materials and equipment, as in the case of low density polyethylene.

Projetcts 5999 (ethylene plant at Pajaritos, Veracruz), 6417 (ethane and liquids recovery plant at La Venta, Tabasco) and 6423 (ethane and - liquids recovery plant at Pajaritos, Veracruz) were the only MPI - projects which required foreign consultant help in the detail engineering.

Of the cryogenic plants analyzed--6417 (La Venta, Tabasco), 1041 (Poza Rica, Veracruz) and 1083 (Cactus, Chiapas)--, the latter two were put up with basic engineering developed by the MPI, and in all three the - detail engineering was entirely local, with some foreign consultation in - 6417 as noted above.

For the ethylene plants selected--5999 (Pajaritos, Veracruz), 6113 - (Poza Rica, Veracruz) and 1085 (La Cangrejera, Veracruz)--, an - imported process package was required. The detail engineering for -

project 6113 and 1085 was 100% Mexican.

Only two of the refining plants required foreign basic engineering. These were project 1048 (the naphtha reformation plant) and project 1053 (viscosity reduction plant). The other six had MPI basic engineering.

The detail engineering for all the refining projects was done by the MPI.

A comparative analysis of plants with the same process but constructed at differents times since the MPI began to design, reveals a decline in foreign consultation, this being a result of the growing technical know-how of the Project Engineering Office and the subsequent improvement in Mexico's negociating position, as seen in the case of the ethylene plants. Foreign consultation is seen to disappear with the passing time in the cryogenic plants, and in projects 1041 and 1083 it is entirely absent.

In general, a good degree of technological indpendence has been won in refining projects, where the cost involved in foreign engineering is negligible when taken in terms of participations percentages. Such was not the case in petrochemical projects, where larger percentages were registered for foreign participation.

It is likely that in petrochemical projects there will continue to be a need for foreign basic engineering for some cases, the main factor in that decision being time, since production schedules cannot await the development of those processes in Mexico.

A further breakthrough which a time comparison of the plant engineering reveals, as concerns a singles process, is the decrease in man-hours consumed as experience increases and the decline in the time devoted to a given project. The savigs from greater efficiency through learning are greatest in projects duplicated from a base module, as in the cases of the two ethylene plants 5999 and 6113 with capacities of 183,000 tons/year and in the two intermediate distillate hydrodesulphurization plants 1066 and 1069, with outputs of 25,000 BPD.

In addition to the above advantages, plant duplication facilitates production scheduling for capital goods earmarked for the projects, thereby leading to, among other savings, economies by virtue of volumen purchases.

Engineering costs in Mexico are comparatively low and account for only a small part of total project costs.

Project engineering undoubtedly has a decisive influence on the origin of the equipment and materials purchased for a project, particulary during the phase when specifications for equipment and materials and selections of codes and standards are made, when capital goods origin is virtually established. This explains why a suitable development of - project engineering must favor local purchases of equipment and - materials as much as possible, which in turn becomes feasible with the strenthening of Mexico's engineering know-how.

On the basis of the project data analyzed it was not possible to pinpoint, as mentioned previously, the influence of the origin of the engineering on the origin of the capital goods involved, since in the projects of the same process done in different periods--sometimes in the first plants - designed certain families of capital goods were locally supplied, while - in projects of the same process done later, the same supplies (the - equipment for the same service) were foreign in origin, although - logically the reverse would be expected. Such it the case, for instance, of the 275 MMSCFD cryogenic plant at Poza Rica, Veracruz, where the supply was 100% local, this in contrast to project 1083's cryogenic plant at Cactus, Chiapas, with a 500 MMSCFD, where only 29.1% of the - procurement was local. This same equipment in the 180,000 tons/year ethylene project 6113 were bought entirely in Mexico, while the same - family of capital goods for the 500,000 tons/year project 1085 showed a Mexican participation of only 27.7%.

The situation was repeated in cryogenic plant heat exchangers, where in project 1041 all such equipment was bought in Mexico, and in project -

1083 it was purchased entirely outside the country. Pumps and electric motors showed the same procurement patterns.

Where there was generally most stability in local supplies was in the heavy boiler equipment family. There, the foreign origin of some equipment was due to causes separate from the origin of the projects engineering, and carried the most weight in the purchasing decision.

Among these causes or factors was the fact the local capital goods industry faces technological limitations which have a more decisive influence on the origin of the goods than on the origin of the projects engineering. Examples of this were the lack of production of pumps and motors beyond a certain capacity, the lack of materials suitable for specialized services, the unavailability of basic materials as in the case of furnaces (where local output is limited to low technological content items), and little output of process compressors, turbines, turbo expanders, certain instruments, etc.

On the basis of the information processed and opinions of PEMEX and MPI specialists, it can be concluded that at present there is not an acceptable relation between local supply of capital goods for the oil industry and present-day project engineering in Mexico, with their respective shares in the totals of 54.17% and 85%, since it would be expected that local supply of capital goods would show a higher figure.

It is therefore felt that other factors, unconnected with the origin of the engineering, are influencing the origin of project supplies of equipment and materials. Examples of such factors are the lack of Mexican production; incompliance with the required delivery schedules, that is, excessively long manufacturing time; high prices, mostly for equipment with imported basic inputs and a low level of national integration, but at times due to lack of modern and economical manufacturing techniques; and, lastly, incompliance with technical specifications.

V.2 RECOMMENDATIONS

Continued development and support must be given to those activities wich promote technological advancement, including the following: organization of technical meetings on research, designing, operation, manufacturing and maintenance of process plants and equipment; updating of specifications and standards; bibliographic research; cooperation with advanced studies institutions; incorporation of new designing and equipment technologies; development of new process technologies; technological exchanges with both local and foreign firms; standardization of projects; intensive use of electronic computation, etc. Taken together such efforts should improve the quality of projects engineering and also keep the share of local engineering in fulfilling the needs of the oil industry at a high percentage level.

Standardization efforts should by all means be continued, with local conditions being considered to the extent possible in the adaptation of the foreign standards to local materials and manufacturing realities. Participation in local and international standardization committees should also be continued as a means of maintaining contact with world-wide technological advancement.

It is considered recommendable that the criteria wich up to now have been the basis for decisions on whether project engineering contracts are to be granted to local or foreign firms should be maintained, since such criteria are aimed at promoting the growth of Mexican engineering.

PEMEX' and the MPI's good negociating position in contracting engineering services from foreign firms must be protected. This favorable position is best served by having up-to-date technical know-how to supplement a solid economic position. It will be necessary for PEMEX to draw up equipment and materials procurement schedules and distribute them in advance among local manufacturers to inform them as to specifications on quantity, quality and required delivery times.

Communication between project personnel and local capital goods producers must be encouraged so that the manufacturers know the designing requirements of the oil industry, while the designers must be familiarized with the capacities and limitations in the capital goods industry, the above for the purpose of achieving more coordinated and - effective actions between the two sectors.

In order to facilitate planning and programming in the capital goods - industry, it is necessary to promote modular projects, the standards - and general specifications for which must be passed on to local - manufacturers.

It will also be important that local producers analyze the petroleum - industry's capital goods markets, this for the purpose of matching their production schedules with requirements such as delivery deadlines, - installation operational efficiency, new product quality, and cutting costs to competitive levels.

Petróleos Mexicanos must continue to give the local producer some - price protection from foreign competitors.

CHAPTER VI 1977-1986 FORECAST

VI.1 INTEGRAL DEVELOPMENT PROGRAM OF THE PETROLEUM INDUSTRY. MEXICO 1977-1986

1. OBJECTIVES

The area of action of the Mexican petroleum industry embraces every phase of the petroleum economic process such as exploration, development, refining, basic petrochemicals, transportation and distribution, and marketing, these activities depending basically on trends in the domestic demand for petroleum derivates and, secondarily, on rational exports of surpluses of refined products, gas and crudes. Investment, operational and financial programs take very special account of the level of Mexican oil technology in comparison with technological progress abroad and, consequently, the possibilities there are of using technologies and capital goods of domestic origin or, in their absence, those of foreign origin. The objetives wich have been set for the 1977-1982 period (1) can be sumarized under the following points:

1. Maintain self-sufficiency in the production of crudes, condensates and natural gas to meet domestic demand and obtain growing surpluses for export.

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(1) The economic programs of Mexico's public sector are basically designed for six years, the length of each presidential term; the medium and long term plans are based on government policies which are subject to revision and change.

2. Handle the exportable surpluses with the rule that the additional income earned from such sales finances PEMEX's imports of production goods, technology, technical assistance, etc., and produces additional revenue for the government as well.

3. Increase the production capacity of refined products and basic petrochemicals in order to obtain the great variety of derivates required for industrial, transportation, household, commercial and other uses; produce new industrial inputs, particularly those reaquired by the secondary petrochemical industry; substitute unnecessary imports; increase stocks and produce exportable surpluses. Within this context, it is also an aim to improve the operational efficiency of present and planned plants.

4. Build new production units (refineries and petrochemical plants) at strategic points in relation to industrial and urban growth and to the locations of oil and gas deposits in order to raise operating efficiency.

5. Increase and consolidate present systems of transportation, distribution and sale in order to ensure timely, efficient supply of products to refining and petrochemical plants, and to storage and distribution areas for domestic consumption; and improve harbors and lines for efficient export operations.

6. Speed up exploration work (geological, geophysical, laboratory and drilling) in order to maintain discoveries of new reserves which will guarantee an adequate reserve-output ratio.

7. Speed up development drilling and well operation so as to guarantee a production capacity higher than scheduled production of crudes, condensate and gas.

8. Make more use of the most recomendable systems of secondary recovery in order to optimize production and reserves.

9. Improve the industrial safety systems and carry out the social and administration projects needed for the industry's development.

10. Modernize and streamline administrative systems and financial mechanisms in order to improve the operation efficiency of the industry; take down local and foreign credits when most opportune and under the best terms, as such are required for carrying out the oil industry's six-year program.

The above guidelines are the essence of Mexico's petroleum policy for the next decade.

The economic, political and social importance of Mexico's petroleum policy lies in the fact that around 88.2% of the total demand for secondary energy (2) has oil as its chief source, compared to 7.2% for electric energy and 4.6% for coal; and from now to the end of this - century, oil is expected to remain the source for about 80% of the - energy requirements of the country while other, non-conventional energy sources are under development.

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(2) Secondary energy demand is equal to primary energy demand less - the oil and coal inputs used in producing electric energy plus losses stemming from conditioning the coal.

FIG. F. VI. I

EXPLORATION & DEVELOPMENT PRIORITY AREA

1977 - 1982

II. INVESTMENT PROGRAM FOR 1977-1986

The investment program of Petróleos Mexicanos has as its frame of - reference the high-level objectives pursued by the Mexican petroleum - industry. These objectives are: to meet domestic demand for oil - products and basic petrochemical products; produce exportable surpluses to finance imports of equipment and materials required by the petroleum industry by rational, efficient use of reserves; and produce resources which will help accelerate Mexico's development process. On the other hand, the petroleum industry's investments, as planed for the coming - years, involve a number of measures aimed at maintaining a balanced - development between its various sectors.

By a detailed analysis of the investment foreseen for the 1977-1982 - period, the petroleum industry's policies and their application in each - branch can be clearly seen.

EXPLORATION

Exploration, to the exclusion of drilling of exploratory wells, will have a relatively small share of the six-year investment program, in that an average of 119.2 million pesos a year is to be allotted to construction, procurement and conservation between 1977 and 1982. However, when the estimated cost of exploration studies of 3,410.4 million pesos per year, as an average, is added, the total average annual investment - comes to 3,529.6 million pesos. This means that exploration will take 6.3% of the total investment of 333,186 million pesos for the 1977-1982 period.

Petroleos Mexicano's exploration policy is important for the near future since the investment in both exploration activities and in studies rise - quickly during the six-year period. Their totals are slated to increase from 4.4% in 1977 to 11.2% in 1982 as concerns their percentage share of overall annual investment. Such a rise reflect PEMEX's intention to intensify these activities in order to ensure an adequate reserve/production ratio.

DEVELOPMENT

In PEMEX's operations and investment program an increasing share of financial resources is earmarked for development due to the following - factors:

1. On the basis of geological and geophysical surveys done by - PEMEX's exploratory branch, oil and natural gas reserves at - mid-1977 were confirmed to be 2.3 time greater than the calculation made near the end of 1975 (14,600 million bls. vs. 6,338 - million).

2. Exploratory surveys indicate the existence of 60 fields not yet - drilled in the Chiapas-Tabasco zone (Reforma zone), 45 probable oil producing structures on the continental platform in the Campeche zone, and around 50 gas producing structures in the Sabinas Basin in northern Mexico. In order to confirm the existence of oil and gas in these structures, an ambitious exploratory program has been designed. And, of course, the development drilling - program will be expanded as productive deposits are found.

Average yearly investment in the development branch in the 1977-1982 - period will come to 24,434 million pesos, or 3.1 times greater than the allotment for refining, three times more that for petrochemicals and - 2.3 times over amount for transportation (including total estimated cost for constructing the Cactus-Reynosa gas pipeline).

In the period, investment in the development sector will account for - 44.0% of the 333,200 million pesos to be invested in the Mexican petroleum industry, with the share increasing from 35.3% of the total in 1977 to 56.0% in 1982.

REFINING

The refining branch will receive average yearly investments of 7,765.1 million pesos between 1977 and 1982. Investment in refining in 1977 - 1982 will account for 14.0% of the total, although in comparison with the development branch, in this case investments decrease in relation to the yearly totals, falling from 20.6% in 1977 to 11.9% in 1982. However, this will have little effect on purchases of capital goods for the sector because the refining plants are slated for continued construction - throughout the ten-year period between 1977 and 1986, with refinery - capacity to go from 865,000 barrels/day in 1977 to 1,670,000 barrels/day in 1982.

New refining units are to be built at the Tula, Cadereyta and Salina -

Cruz refineries. At the latter two sites, the first phase of 230 MBD each is in construction, and the second phases will double the installed capacity in all the mentioned plants.

BASIC PETROCHEMICALS

The basic petrochemical sector, reserved by law for operation by Petróleos Mexicanos, is to receive 14.7% of total investment during the six-year period, although as in the case of refining, its annual share will gradually decline, from 22.9% in 1977 to 6.3% in 1982. However, in this branch also investment in the next 10 years in petrochemical plants of various types will keep purchase of capital goods at a high yearly level. Average yearly investment in the sector will come to 8,112 million pesos for the six year period as a whole, and installed capacity will rise from 5.2 MM tons in 1977 to 18.6 MM tons in 1982 in over 35 petrochemical products.

A wide variety of process plants for the basic petrochemical industry will be built at La Cangrejera, Veracruz; Cunduacán, Tabasco; Cactus, Chiapas; Poza Rica, Veracruz; Cosoleacaque, Veracruz; San Martín Texmelucan, Puebla; Tula, Hidalgo; Pajaritos, Veacruz; Salamanca, Guanajuato; Minatitlán, Veracruz; Cadereyta, Nuevo León; Salina Cruz, Oaxaca; and at other plant sites not yet decided, all of which will be constructed on the medium and long terms.

TRANSPORTATION

The transportation and distribution sector will receive an unusually large increase in investment, taking 19.1% of the total during the six-year - period. Its largest share will be in 1978, when it will take 28.5% of - the total for the year, when most of the estimated expenditure on the - Cactus-Northeast trunk pipeline of 1,265 kilometers of the National Gas System will be made.

In this sector, the construction of eight new oil pipelines and additions to existing lines are planned. Twelve new gas pipelines and expansions, including the national trunk network, 22 new polypipelines and expansions, and storage facilities for distillates and fuel oils are also slated for - construction.

As concerns capitalizable constructions and purchases (that is, not - including social and administrative investments, exploration surveys and conservation expenses in each branch), the foreseeable situation is - substantially the same as the trends in total investments.

TABLE C.VI. 1
PETROLEOS MEXICANOS
1977-1982 INVESTMENT PROGRAM SUMMARY
Millions of pesos

	1977	1978	1979	1980	1981	1982	1977-82
Total Investment	39710.6	87124.3	58974.1	49580.4	47033.3	50763.6	333186.3
Exploration	81.7	115.1	111.3	122.8	135.0	149.1	715.0
Development	14045.8	28005.8	24824.6	25092.1	26192.3	28443.3	146603.9
Refining	8184.1	14722.6	6832.4	6031.6	4792.8	6026.9	46590.3
Petrochemicals	9079.2	15228.9	12342.5	5870.8	3412.9	3195.9	49130.2
Transportation	5990.4	24865.3	11253.8	8046.2	6997.1	6372.4	63525.2
Social & Admin.	656.9	1638.4	874.4	943.0	992.4	1053.7	6158.8
Explor. Surveys	1672.5	2548.2	2735.1	3473.9	4510.8	5522.3	20462.8

TABLE G. VI. I

PETROLEOS MEXICANOS

RELATIVE STRUCTURE OF TOTAL BRANCH-BY-BRANCH INVESTMENTS: 1977-1982

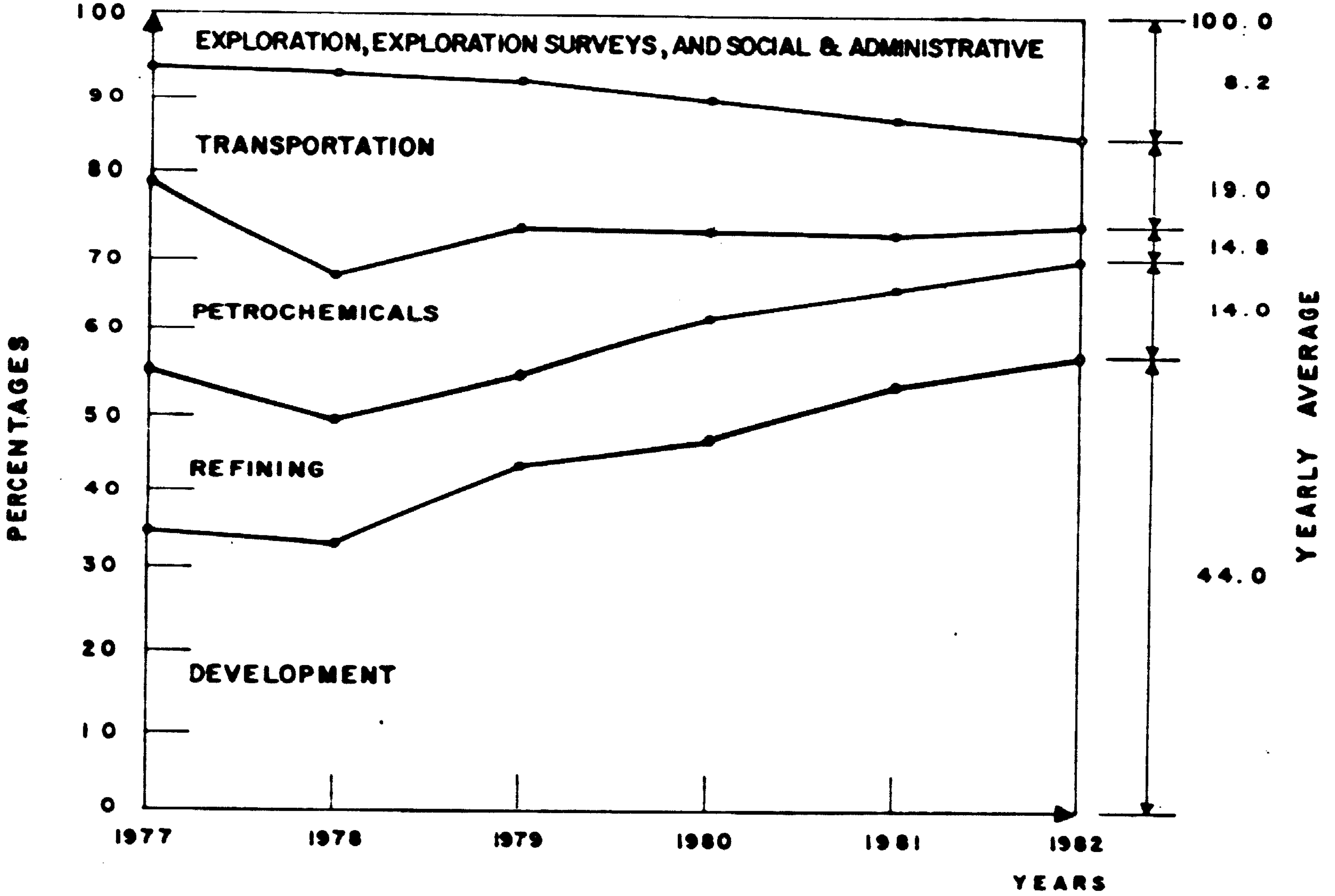

TABLE C. VI . 2
PETROLEOS MEXICANOS
TOTAL INVESTMENTS BY BRANCHES
(Percentages)

	1977	1978	1979	1980	1981	1982*	1977-1982
Total Investment	100.0	100.0	100.0	100.0	100.0	100.0	100.0
%	11.9	26.2	17.7	14.9	14.1	15.2	100.0
Exploration	0.2	0.1	0.2	0.3	0.3	0.3	0.2
%	11.4	16.1	15.6	17.2	18.9	20.8	100.0
Development	35.3	32.2	42.1	50.6	55.7	56.0	44.0
%	9.6	19.1	16.9	17.1	17.9	19.4	100.0
Refining	20.6	16.9	11.6	12.2	10.2	11.9	14.0
%	17.6	31.5	14.7	13.0	10.3	12.9	100.0
Petrochemicals	22.9	17.5	20.9	11.8	7.3	6.3	14.7
%	18.5	31.0	25.0	12.0	7.0	6.5	100.0
Transportation	15.1	28.5	19.1	16.2	14.9	12.5	19.1
%	9.4	39.2	17.7	12.7	11.0	10.0	100.0
Social & Admin.	1.7	1.9	1.5	1.9	2.0	2.1	1.9
%	10.7	26.6	14.2	15.3	16.1	17.1	100.0
Explor. Surveys	4.2	2.9	4.6	7.0	9.6	10.9	6.1
%	8.1	12.5	13.4	17.0	22.0	27.0	100.0

TABLE T.VI.1
STARTED PROJECTS TO BE COMPLETED BY 1982
1977-1982

EXPANSION OF EXISTING PLANTS

MADERO:	Expansion of catalytic cracking plant by 28,800 B/D.

NEW UNITS IN EXISTING REFINERIES

MADERO:	Intermediate distillate hydrodesulphurization plant of 25,000 B/D Residual desulphurization plant of 35,000 B/D
MINATITLAN:	Naphtha hydrodesulphurization plant of 25,000 B/D Naphtha reformation plant of 20,000 B/D Intermediate distillate hydrodesulphurization plant of 25,000 B/D Treating and fractionating plant Sulphur recovery plant of 85 Tons/Day
SALAMANCA:	Catalytic cracking plant of 40,000 B/D Naphtha hydrodesulphurization plant of 25,000 B/D Naphtha reformation plant of 16,800 B/D

NEW REFINING SITES

SALINA CRUZ I:

Refinery/a 170,000 B/D process capacity and the following plants;

- Primary distillation, 170,000 B/D
- Vacuum distillation, 75,000 B/D
- Catalytic cracking, 40,000 B/D
- Naphtha hydrodesulphurization, 25,000 B/D
- Naphtha reformation, 20,000 B/D
- Intermediate distillate hydrodesulphurization, 50,000 B/D (two units)
- Sulphur recovery, 85 Tons/Day

Continued.......

TABLE T.VI.1
STARTED PROJECTS TO BE COMPLETED BY 1982
1977-1982

Continued.............

CADEREYTA I:

Refinery with a 235,000 B/D capacity and the following **plants**:

Primary distillation of 100,000 B/D
Vacuum distillation of 62,000 B/D
Combined distillation of 135,000 B/D
Catalytic cracking of 40,000 B/D
Naphtha hydrodesulphurization of 36,000 B/D
Naphtha reformation of 20,000 B/D
Intermediate distillate hydrodesulphurization of 50,000 B/D (two units)
Sulphur recovery of 85 Tons/Day

LINES FOR TRANSPORTATION OF PRODUCTS

Cadereyta-Monterrey polypipeline
(San Rafael)
Cadereyta-Monterrey fuel oil pipeline

As you can see, this fiscal incentive package is one of the first guidelines towards a particular product. When granting those incentives, the geographical factor is less significant, to a degree, having been in the past more important. Furthermore, guidelines for fiscal incentives by industrial branches and longer than five year periods are being prepared. e.g. construction oriented towards an accelerated depreciation of equipment, machinery, etc. purchased from local manufacturers. Thus, it is estimated, considerable cash flow is generated and purchasing of domestically produced capital goods is promoted. Supplementary to these measures is the reduction of incentives for machinery and equipment importation except in cases of national economic priorities.

Differences in fiscal dealing between domestically produced capital goods and imported capital goods, are being held as low as possible. It is inequitable because foreign capital goods often enter the country with no corresponding fiscal lien, on CEDIS (Certificados de Devolución de Impuestos a la Importación -Import Taxes Return Certificates-) or even a support by their original countries.

So, while aggregate taxes are not imposed, such differences will be further analyzed until they are reduced to a minimum.

In Mexico, the need to instrument such specific measures to give -

incentives to technological development is known. Meanwhile, measures promoting the purchase of domestic capital goods should favor the development of engineering capital goods. These instruments, however, should be designed and implemented very carefully for negative experiences, such as that of 1973, when an agreement to grant CEDIS to technology exports and corporations promoting such exports, was issued. This incentive only had basically accounted for a certain kind of technology construction work exports but relatively no prints, projections, etc., have been sold... mainly works management and works performances were archieved. In addition the fiscal sacrifice derived is too great not only because no corresponding tax is collected but because it is subsidized with further moneys. Thus, the cost of this generated foreign exchange is excessive and consequently it has made the treasury authorities perform a careful revision regarding deals with civil engineering works exported. The wide treatment, however, should be kept for Basic Engineering, Detail Engineering, etc., for these subsidies do generate far more direct benefits. Such subsidies exceed in great measure the fiscal effective lien constituting a contribution from the Federal Government to encourage service exports.

In Mexico, four Secretariats have signed a charter with approximately 20 entities pertaining the Public Sector, which will acquire about 35%

of capital goods required by the country in the next five years. In the charter, it is provided that they must acquire those goods in the country, when the price does not exceed 15% (plus freight) the price offered by the main supplying country, or the U.S.A. The development scheme to manufacture capital goods intends to integrate, while orienting the demand towards the domestic market by means of regulations such as those described, via strong entities pertaining the Public Sector, such as Pemex, C.F.E., Siderurgy, Fertilizer, etc., and while directly supporting fiscally the local production of capital goods and by means of other indirect support through fiscal exemptions to importation of staple inputs (raw materials, components, etc.) not produced in the country but needed to manufacture capital goods.

Due to provisions in the Technology Transfer Law, every action, agreement, or contract that allows to acquire all pertinent information service to Basic and Detail Engineering, both in and out of the country, should be registered in Mexico. This in order to enforce the acquirer's position regarding the terms and conditions the supplier may impose. For instance, acquiring in foreign countries industrial packages of which the Law provides the acquirer should not to be bound to acquire Detail Engineering relative to a Basic Engineering. Neither is he bound to accept the foreign supplier deciding as to what machinery, equipments, parts, etc. are to be purchased. However irrefutable the purposes of the Law and its executive agency, the - Registry, in practice there are circumstances influencing unfavorably to reach a significant reduction in the contents of capital goods - imports. The first circumstance is that major public sector agencies have lacked an adequate planning to make their future machinery, - equipment, spare parts, etc. requirements known to the private sector with enough time in advance. Another negative circumstance, on - behalf of the domestic suppliers is that usually delivery face terms often are considerably longer than those offered by foreign vendors. Furthermore, real delivery terms have been subject to penalties - because there are cases where suppliers had delays of even a year or more.

So, it was necessary to call upon the expediency of imports. Otherwise, the lack of equipment would dangerously delay the performance of works basic to the economic development of the country, such as in the oil and electric industry and so forth. Likewise, one could - mention the factors of quality and price. These often hamper local purchases promotions. In this aspect, the vicious circle between offer and supply of capital goods in Mexico is evidenced on behalf of consumers it is claimed that terms, quality, and domestic prices - should be able to compete internationally or else they must subsidize domestic manufacturers of capital goods, affecting investment -

schedules and works of consumer industries which must adjust their income-outcome budgets and their operating schedules. On the other hand, manufacture claims that user corporations shoud make their - purchasing schedules known beforehand in order to schedule in turn, the production of equipment, machinery, parts, spares, tools, and so forth, in time. In addition, they sould be granted more flexible - terms than those offered by foreign suppliers, lower quality standards, support to obtain promptly productive inputs, at reasonable prices, etc. This because of the lag our developing countries hold as - compared to other industrialized nations.

Some years ago it was established for certain Mexican industries that they were bound to integrate within their production 60% of domestic parts. This measure, however, has not proven its effectiveness - since, for example, the automotive industry 15 years after the respective decree still hold automotive brands not covering even 50% of the vehicle with locally manufactured parts. As regards to production of capital goods it would be very hazardous to apply such measures, so flexible regulations may be set so that if the choice is between a 20% integrated product and a fully imported one, we must support the one partially produced in the country to the extent of not having - considered -if necessary- foreign inputs for domestic and foreign - contents purposes, as regards the output.

Specifically, it must be acknowledged that applying such fiscal measures per-se would contribute no integrated, lasting solution. Previous - records in Mexico show that fully tax exempted sectors or activities, in force, never contributed, at least decisively to its growth and - development (Cf. production cooperatives) and it would be perhaps - wise to look for other instruments such as direct public expenditure measures, implying a review on conditions, activities, operating - modes, etc., of institutions, research centers, professional curriculae designs (specially in metals and mechanics) etc., looking for serious and lasting mechanisms that may stop today's most common procedure human resources training, the creation of brains needed in domestic specific economic needs and their unfortunate spreading because of - the lack of an integrated schedule to develop Project Engineering as a sine-qua-non condition for the ultimate development of an authentic domestic capital goods industry.

A fact already recognized in Mexico as a significant national precedent is that of the Mexican Oil Institute whose success -it is claimed- is the result of a perfect or intimate relationship between the productive apparatus (Pemex as user) and the apparatus generating scientific and technological knowledge (IMP). This model production-research, - with separate entities but close links could be the form to generate constant demand flows related to engineering services, at least to -

productive corporations in the public sector, in branches such as Siderurgy, Electricity, Fertilizers, etc. In addition to Oil and this kind of utilizing services rendered by their own research centers and those of private companies in engineering, in terms of their operating experiences. Perhaps it would be a good idea to increase the scopes of fiscal measures such as those in Decree 101-165 (3-III-78 S.H.C.P.) supporting accelerated depreciation or income taxes in such a way that in order to correspond, the corporation would pledge to reinvest the moneys left by the treasury. If not via profits or quantitative productive increase, via a technological development. In areas where difference with foreign inputs should be excessive, it would not be worthwhile to spend money in this kind of research. In summary, difficulties to instrument incentives for technological development have not been yet overcome and therefore it is still not possible to visualize articulating such fiscal measures with financial measures, human resources training, etc. At present, an adequate planning of investment schedules in productive corporations, especially those in the public sector and, consequently, an efficient and prompt schedule for future purchases of major corporations (Pemex, C.F.E., etc.) are much more effective than fiscal incentives themselves. Making in advance programs to purchase, adjusted to consistent investment schedules, known in time to real or potential capital goods producers, prepared to stay in the market -and not efimerously, because of passing circumstances- is a real instrument of the Federal Government to promote development of the capital goods industry. Thus, it is imperative that the Federal Government defines clear and specific - criteria on modes, mechanisms, procedures, etc. to submit, in - hiring Project Engineering services on behalf of public corporations in order to deplete local possibilities before turning to foreign - suppliers.

One of the most important Mexican engineering firms submited a - paper (*) synthethizing clearly the private sector's point of view with regards to this question. We feel we should present here some of their arguments:

"... Dynamic relations between research and development, machinery and equipment manufacturing, and industrial training should exist.

Naturally all these demand and only develop, if they have highly - qualified human material. This brings about the need to structure training programs both theoretical and practical from the first stages in the educational process. Keeping in mind that it is necessary to

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(*) "La ingeniería de Proyecto como Instrumento de Capitalización - para los Países en Desarrollo" (Project Engineering as an - Instrument of Capitalization for Developing Countries) a paper - presented by Eng. Jose Mendoza, Executive Chairman of Bufete Industrial.

have qualified human material, with a long experience and a thorough knowledge of the subject matters, characteristics achieved by - performing similar tasks, it must be stated clearly what the objectives and methodological procedures to be implemented are, so that Project Engineering becomes a source of accrued capital.

... Whatever the alternatives chosen (developing domestic organizations in Project Engineering or hiring services from foreign firms) - developing Project Engineering is conditioned to market demand - factors on these services.

In Mexico's case, there are innumerable areas where Project - Engineering has been developed by Mexican firms, in the country. - Both within private enterprises and state corporations. It has been of great impact both as generator and accruer of capital. An example of the above are the Chemical, Petrochemicals, Food, Paper, Sugar, Beer, Automotive, Mining and Metallurgic and Extractive Industries.

... As regards to the Oil Industry, "Project Engineering" in - Mexico has developed rapidly and at present is able to render - highly qualified services to this industry in all its aspects, from planning, designs and manufacturing of equipment to assembly and operating the corresponding units.

To this aspect one may quote the following figures in the oil industry:

In 1965, 87% of projects developed by Petroleos Mexicanos were foreging and 13% of domestic origin. In 1974, 40% of projects handled by Petroleos Mexicanos were of foreign origin and the remaining 60% - corresponded to processes adapted and improved in the country.

Integrating Engineering services has not been easy. It has required - careful planning of the economic and human resources incorporations - and companies engaged in this kind of activities. The quality of the - services rendered is the result of wide personnel training programs - and performing similar projects jointly with foreign companies where, - naturally, the bases and expertise for these activities is claimed. - Apart from this, it would be fair to recognize that it was Petroleos - Mexicanos who most encouraged this development, who has granted the necessary trust to make the expertise come true as projects in regards to engineering. This has brought about the creation of research - institutions and corporations engaged in machinery construction. This in turn has required implementing new concepts in the "Project - Engineering" field with its consequent capital and expertise accrual.

With regards to the activities development performed with "Project - Engineering" in Mexico, it would be pertinent to mention a few examples - to illustrate the above.

As to state owned firms, the Instituto Mexicano del Petróleo (IMP) has been involved significantly in developing process such as DEMEX, which - has been sold in South America. Also, MPI has developed several - phases in "Project Engineering" to service the State owned company Petroleos Mexicanos. These services have also been sold in foreign countries.

Related to domestic firms, pertaining private enterprise, we would - like to point out the case of Grupo Bufete Industrial. This company - together with other Mexican engineers has promoted the development of processes such as "Proceso Marino" (Sea Process) to produce ammonium sulfate and "Proceso Cusi" (Cussi Process) in the paper industry, as - well as the Processing Engineering in Chemical and Oil Industry such - as ammonium sulfate production and combined crude distillation plants - design. As to the Cussi Process it may be interesting to point out - that it has already been sold in South America and Mexico and the - Sea Process is being implemented in a Mexican project.

Finally, it should be noted that operating corporations, through their - Engineering Departments have also contributed in Mexico to this kind - of development. An example of the above is the HYLSA (Hojalata y Lámina, S. A.) process in the steel industry.

We feel the pattern followed by our country, susceptible of improvement, is the most suitable to achieve integration of "Project Engineering" responding the objetive to accrue capital. Any other scheme, as posed herein, depending significantly upon foreign aid, will need to be limited with regard to capacity for its major ends to accrue capital".

VII.3 FINANCIAL SUPPORT

Against the background of the above set of ideas, it was established that beginning the time when capital goods user corporations determine technologies to be used in corresponding processes and specially their origin, the Project Engineering required is also established thereby. Likewise, the origin of project financing often conditions the starting of engineering.

On the other hand, engineering firms with the capacity to develop projects for certain corporations on a Basic, Detail, or Design Engineering basis, have serious limitations to compete in certain industrial competitions because of a lack of financial support.

Finally, you have the case of most capital goods producers facing traditionally financial problems or else the projects being developed, themselves, are limited by low to financed and a shortage of financial sources for manufacturers. This influence the interest rates, amortization terms, financial terms, times of delay allowed, etc.

One of the instruments Mexico already has to support financially the development of capital goods producers and their previous stages, is the Fondo de Equipamiento Industrial (FONEI) (Industrial Equipment Supplying Fund) authorized to finance, on a very wide preinvestment concept, projects such as adapting, integrating and developing technologies, capital good oriented. This involves Project Engineering in its various phases. This supporting mechanism will become true through preferential interest rates, wide amortization terms (10 years at least), the possible adoption of guarantees to improve the Engineering Firms' position as credit subjects, among others. As an example, it may be claimed that the Fund is financing up to 80% of technology development expenses as well as prototype construction.

On the other hand, the Fondo Nacional de Estudios de Preinversion (FONEP) (National Preinvestment Studies Fund) is a financial mechanism for particular projects or overall surveys to determine particular projects. It works mainly through specialized consultant firms and is made by two possible well known factors -the public and private sectors. Also, consultant firms presenting technical and economical proposals to well known agencies to be selected. This agency finances significantly what is known as "supplementary surveys' which in turn refer mainly to Basic Engineering and Detail Engineering. In such cases where specific applications for industrial projects were submitted, where Basic and Detail Engineering would be supplied by a foreign consultant, FONEP did not grant the credit since the entire experience remains with the foreign vendor and this, of course, implies foreign exchange drain without the domestic consultant being able to profit from the "know-how".

Important industrial projects have already been financed in which Design Engineering, mainly within the Secondary Petrochemicals field, was required. For example, corporations such as Cloro de Tehuantepec, Percalatos Mexicanos, Glicoles Mexicanos, Poliestirenos y Derivados and others, such as Mexpapel, Mexicana de Papel Periódico, etc. However, no experience has been derived from financing capital good projects. FONEP is opening another very important window to directly finance Consultant Firms willing to increase their personnel, to increase their working capital required in important projects, to acquire computers, equipment, subcontract qualified personnel, organize technical files, and otherwise.

An additional agency to support economic activities is the Fondo para el Fomento de las Exportaciones de Productos Manufacturados (FOMEX) (Fund to Encourage the Exportation of Manufactured Products) which has modified a part of its operation regulations to support further manufacture or sales of machinery and equipment useful to produce goods and generate services, including parts and components and special tools, fixtures, matrices and patterns. Also the need to compete or bid internationally has disappeared. This considerably limited finances to capital goods. Furthermore a possibility to guarantee the first purchaser of a capital good design and manufactured in Mexico is open, against risking the loss of equipment price, liable to happen during the initial financial period. Also, a guarantee in favor of credit institutions is generated, against failure to pay when granting credits to domestic producers manufacturing capital goods to substitute imports.

In relation to eliminating the international bids, it means a colateral supporting credit of intermediate financial institutions, used by FOMEX, is granted to finance corporations requiring it. Financing capital goods is on a preferential rate basis semi-annually reviewed by the Central Bank and obviously lower than those in the market. This Fund is dealing to finance the Metal-Mechanical Industry and the Comisión Federal de Electricidad (Federal Electricity Commission) subject to certain requirements such as Mexican outputs, with a 60% domestic integration, although special concession may be applied (calculations related to domestic inputs exclusively or some other necessary survey). Also, the corporation is required to have a 51% Mexican capital, at least.

In spite of these financial instruments (FONEI, FONEP, FOMEX, etc.) one of the most obvious conclusions drawn in relation to this subject is that scientific and technological research is difficult to finance with-banking resources due to their liability in payment and the uncertainty in the expected successful results. This financing must be performed, consequently, with current expenses -the possibility to sell achievements. Anyway, the action surrounding the specific financial problems to - develop capital goods industries undoubtedly is materializing around - questions such as:

- investment financing
- Operation financing
- sales financing
- basic and applied research financing related to Capital Goods Industry (technology development).
- financing exports or sales to foreign countries,

out of which the most critical are financing sales, operation, and - technology development (research and basic engineering, detail engineering, prototype manufacturing, etc.). These have only been lightly - supported, especially technology development which requires specialized supports different from those offered by the other economic sectors. - It would be true to state that the Federal Government's financial mechanisms have been supporting slowly but consistently, through the - introduction of new operating regulations, the channeling of resources - in these three critical environments and gradually they have neutralized the dormant obstacles. The application phase for those regulations -

will begin generating new elements to judge their application effectiveness and the functionality of the bionomial second floor banking -first floor banking which, in the first place, is the one to recognize credit solvency and other features of potential credit users for capital goods and technological development. The above phase not only will demand sensitizing the financial sources but also their counterpart; i.e. entrepreneurial media, consultant firms, etc. to correct and enrich the - application of new operating regulations.

It is important to establish that a condition for success accompanying - the financial support mechanism for capital goods in other countries, - has inevitably been linked to three requirements:

a) Selectivity
b) Activity
c) Integrity

In a period with wide prosperity prospects it would only be natural to - show trends to diversify efforts in a wide range of activities; precisely due to this, it will be of particular importance to concentrate efforts in certain priority and basic areas by giving the financial support mechanisms (together with fiscal measures and human resources training) - their selective character.

The Active function condition is expressed by the degree of actual and permanent contact between the vendor agents of financial resources - (second floor banking) and users, through intermediate agents (first - floor banking). If, for instance, a generous scheme to finance sales should be granted, it would support manufacturers of equipment - - -Brazilian model- to indirectly develop the capital goods industry. - Situations as the above give the financial mechanism a status of Active, "direct contact" financial source -intermediate agent- user. This - articulation's funcionality will be the one to approve or reject the - operating regulations' effectiveness implemented today.

Finally, the integrated status will be given according to the fluency - the financial agencies FONEP, FONEI, FOMEX, FOGAIN, NAFINSA, - etc., may grant expeditely and promptly -through a common speaker-- to capital goods producers or engineering firms, or research and - technology development centers within the selective and active framework. This common speaker could be the coordinator of existing - mechanisms -somewhat spread out at present- or any other institutional mode deemed adequate within the public sector.

For coordination purposes in the regulating administrative area of - fiscal and financial incentives, a paramount problem is posed, referring to hierarchization of industrial projects - -

requiring such support. This is important for it also affects the tariff duties definition of manufacturing programs for public sector domestic priorities, the public sector's purchases, etc. inasmuch as it is not accurate yet as to what a priority is and it is not, in an overall framework of capital goods. As an example, one may point out a regulation imposing a good produced for the second time, since it is not an imports substitute. But in withdrawing the subsidy or support, importing the foreign good, will be renewed. So, in Mexico, obviously changes will occur in the modes to grant fiscal and financial incentives.

Specifically, when speaking, for instance, of backing Engineering, carried in a more or less long maturity process, the solution via current expenses - previously mentioned -- which may be useful in institutions such as IMP or otherwise, are supported. But if support goes to private institutions, certain difficulties arise, both from the fiscal and financial point of view, with not too predictible effects.

The accrued amount of money resources that may be channeled through the above Funds is considered, at present, enough to support manufacturing Capital Goods and Technology Development.

Credit terms are, in general, nine year amortization terms plus a year and a half or more to delay payment; interest rates range from 5 -

to 7%, etc.

In projects related to capital goods or petrochemicals, FONEI, for instance, is able to finance amounts over one hundred million pesos.- In the inmediate future, beginning 1981-1982 as unknown phenomenon may occur in Mexico. The surplus of cash (derived from foreing sales of oil and gas). Facing it, we would have to rapidly develop a design and performance capacity for priority industrial projects, to compensate for the so called "lack of entrepreneurial capacity" felt in the failure to use fully current available financial resources.

What should be today's capital good manufacturers attitude be, facing- the inmediate future prospects? With regards specifically to purchases on behalf of Petróleos Mexicanos, and to support domestic manufacturers, orders (parts, components, minor equipment, etc.) - for a plant or industrial complex have been placed with domestic vendors while capital goods with complex technology are purchased from foreign vendors. This caused a control and coordination spread for Pemex when disposing promptly of entire rigs. Thus, Pemex decided to make domestic manufacturers generally responsible for the entire package.

Then, domestic vendors devoted themselves to get the foreign concessioners to grant them the know-how to be able to assume responsibility for integrating the technology package. The result was that the licensor would not give up his "know-how" facing the possibility to lose control in handling rigs he traditionally had supplied. This situation exposes the hard work and ordeal to be faced in developing an industry to produce capital goods in Mexico.

Thus, capital goods production can be supported by three main elements:

a) Engineering hired with foreign firms.

b) Engineering developed by domestic manufacturers themselves.

c) Engineering developed in research centers related to the user corporation (IMP-Pemex) and able to negotiate supplying agreements for engineering in particular areas.

Obviously, the degree of dependence on capital goods supplies is directly proportional to the degree in which a country such as Mexico will be subject to foreign engineering and its lack of capacity to self-supply through local domestic engineering sources. However, developing local production of capital goods involves adopting strict measures to reach quality levels, precise production schedules to fulfill delivery terms required by users, wide technical aid, etc., so that the stigma heavy on today's domestic products will be translated-into, from untrust, to trust in the equipments working.

As regards to capital goods users (Pemex), we feel it is necessary to device a mechanism to allow for the test of new domestically manufactured equipment. Especially simple equipment, those called "easy technology". Today various equipments are being teste, both at IMP and working centers. But in general this involves excessive expenditures charged on Petroleos Mexicanos.

Today in Pemex (also in the Comision Federal de Electricidad, Ferrocarriles Nacionales and other productive public agencies) there is a Mixed Supplying Commission made by representatives of Pemex, the Government and manufacturers. They support in various ways -although with not too well defined policies domestic manufactured capital goods. It has proven, however, that it is possible to improve the three-part relationship benefiting every one involved, provided the manufacturers of equipment, parts, components, etc., guarantee (especially through their own operative tests) Pemex it will not undergo serious breakdowns in its production programs due to forseeable failures in its capital goods. This lack of guarantee has impelled the oil industry technicians not to risk future operating plants. It has contributed to a degree to the "vice" of calling to imports from well known foreign vendors. To coadjuvate promoting locally produced capital goods, Pemex created and supports a Domestic Manufacturing Promotion to hold a close link with manufacturers on firm production bases for equipment and otherwise, with the quality required, competitive prices or prices reasonably higher, certainty in delivery terms so that it may not need a 75%

indemnity on the respective recovery price, which does not help - significantly the breakdown causing a shutdown in production, due to - defficient equipments. Due to the aforementioned, changes to operating regulations should positively and more or less inmediately affect, - with the above measures as guaranteee in favor of the first purchaser of capital goods manufactured in Mexico, against the risk of loss in - the equipment price during the initial working period. This guarantee may cover 75% of a definite loss, subject to certain requirements. - To implement this kind of operations, meetings are convened to involve support agencies, both on behalf of buyers and sellers.

Based on such experience, with certain domestic manufacturers, we - may glimpse at how active support instruments function, among financing agencies for industrial development of capital goods, manufacturers - of these goods and users representing more of the public sector, as - to what may be called the crucial phase in the formal structurization- of capital goods manufactured in Mexico.

VII. 4 HUMAN RESOURCES TRAINING

To have a full grasp of the problem as it stands today, with regards to human training in the Projection Engineering area, it would be - advisable to ask some general questions:

What are the higher level educational institutions doing to increase the quality and offer as regards to specialists in Projection Engineering?

and related to it, what are agencies such as Consejo Nacional de - Ciencia y Tecnología (CONACYT) (National Science and Technology - Board) to encourage this kind of specialists to acquire the necessary-knowledge? What training systems are being generated both in the - public and private sectors with regards to training medium and low - spheres? What is being done with regards to training within the - selection and introduction to a position process and training in the - position itself in order to encourage efficiency and productivity from - available human resources?

What is the demand from Engineering Firms as regards to specialized human resources in Projection Engineering and what is the situation - derived from problems existing in this area?

And what is being done specifically by Engineering Firms to integrate their Projection Engineering charts? In what specific areas is it - being done? what are the results obtained? What negative effects has the lack of insufficiency of qualified human resource brought about?

Experience in high level educational centers, with regards to - Projection Engineering is still negligible. The impotant thing is the graduate curricula are being created in Mexico, under the economic - patronage of user corporations such as Petroleos Mexicanos, research centers such as Instituto Mexicano del Petroleo and CONACYT. Also-Mexican Engineering Firms have contributed in order to train human-resources in Projection Engineering and every branch deriving from - it. Tending mainly, the fields of Civil Engineering, Mechanical - Engineering, and Chemical Engineering as well as specific aspects in productive corporations using Projection Engineering, manufacturers - of capital goods, Engineering Firms, etc. A case exemplifying this - situation is the renewed boom in the Mexican Oil industry influencing- at present the chemical and petrochemical plants mushrooming and - causing a "jump" in Projection Engineering demand.

In analyzing the current situation of Projection Engineering in Mexico, it is noteworthy that, the fact the required processes for progranmed plants and the Processing Engineering Needs are known in advance, - due to economic planning by sectors, however, the corresponding - "technology packages" are undesignable because the country does not- have enough Processing Engineering capacity. This is the "Achilles' tendon" to the Mexican.

Projection Engineering, which has been oriented to cover more or - less satisfactorily the economic need for Detail Engineering.

A survey conducted in 1975 concluded that 4,880 employees were - performing Projection Engineering tasks in various modes and it was estimated that by 1980, 11,420 technicians in this matter would be - needed; i.e. 2.3 times as much as those existing in the base year.

Some state the average wages paid in Mexico to a technician in -

Projection Engineering, for his first year of service, are allocated as follows. 50% correspond to training and only 5 or 6 years later he - actually earns his income. In implementing master's degree programs in Projection Engineering the trend has been to incorporate faculty, - technicians and specialists of corporations using engineering skills and capital goods, consultant engineers pertaining certain firms, etc. so - that learning is separated from real day-to-day problems in the - economic activity.

Even if a Master's degree in Projection Engineering originally stems - from an express petition from the oil industry in Mexico, we are aware of the need to give it a balanced vision to adapt it pragmatically to - various basic sectors in the economy. To that end, programs and - proposals are submitted for approval by specialists in various - economical-productive agencies. Thus we try to recognize the specific needs in the main sectors and corporations in the country, to shape - the curricula within the most objective and concrete framework - possible.

The School of Engineering at the National Autonomous University of - Mexico submited a Training Program for Professors, to the - Scientific Research Coordination Division, to train human rosources - in capital goods production, with special reference to Machine Tools. - This project is based upon the fact that industrial output of goods -

(easy and/or complex technology) requires a wide range of cut processes and metal shaping. To this end, the use of various machines - such as lathes, millingmachines, planes, drillers, presses, and unfolders is necessary.

The objectives of this Program are:

i) To train human resources to meet the faculty demand from higher - level education institutions, offering a BS in Mechanical Engineering.

ii) To train human resources to meet the demand for research - personnel in national centers of scientific research and technology.

iii) To train human resources, with a high specialization level from- those staying at industrialized countries producing capital goods, to - produce such goods with the quality and cost require to compete on an international basis in this market.

The proposed strategy to perform this program - considering - specialized engineers in using and designing machine tools should have a BS in Mechanical Engineering to follow a specialization at a graduate level. It would include - a) Courses in basic training; b) Experimenting; and c) Research, including in turn the following areas:

1. Technology in metal machining.
2. Technology in metal shaping.
3. Material Technology.
4. Machine Tools Design.

5. Organization of Production.

To train professor candidates (one for each area, especially 1, 2 and 5) - a series of agreements between universities (well known in machine tools technology) is proposed, in order to train them in the laboratories of - those institutions.

To select candidates, an oposition contest would be called upon and a total of six scholarships for areas 1, 2 and 5 would be offered. In mechanical design, a maximum 2-year leave of absence granted is proposed for post-doctoral research to some of the available professors in the mentioned - institutions.

A Ph. D. schedule involving this Program may be started beginning late - 1982. Since four years make a reasonable period of time for a Ph. D. - schedule. Before it, another Ph.D. schedule in Mechanical Engineering may be initiated in specific mechanical design and thermosciences areas. As you may see from the Program proposed by the Higher Level Studies - Division at the School of Engineering, high level human resources are - scarse at present and training others requires for a certain number of - years. This by no means diminishes the proposal although it does establish clearly the precarious status the scientific and technological support, in - machine tools in particular, is. This within the entire capital goods - industry range.

Another fact to be stressed, because of the implications represented by -

disfunctionalty, it is suggest expressly the scholarships mentioned should- be granted by UNAM itself, through its Academic Personnel Training and - not against the background of CONACYT'S program "to avoid interfering - with this board's policies to select scholarship students".

The National Science and Technology Board was created in late 1970, - since"...there was no mechanism (available) on a national basis to - (allow) formulating and performing that policy. There are - it was pointed out in the whereas section different agencies doing research.

Others train human resources at various levels. And last, others - coordinate, encourage, or support in a partial and deficient way, these - activities.

... Therefore, within a functional system, interrelating the various agen- cies that perform, promote and use scientific or technological research, - or train researchers, there must be a high level governmental agency..." (*)

Out of the 9,385 scholarships granted by CONACYT, for the 1971-1976 - period, 31.2% approximately have been engineering science oriented. -

The Board has four training programs for human resources:

(i) Academic scholarship to support BS level students, for a graduate - level.

(*) Quoted from "La Transferencia Internacional de Tecnología El Caso - de México" (International Technology Transfer - Mexico's Case-)- by Wionczek, Bueno, Navarrete, F.C.E. 1974, México.

ii) Up dating schedule to support provincial students to write a thesis on production aspects in their home State.

iii) Technical training Schedule to train medium level technicians and teach specifically to handle correctly and practically machinery, and.

iv) Exchange schedules underwritten by Mexico to which CONACYT has given the highest priority when dealing with engineering.

Therefore, it has signed specific human resources training agreements with Instituto Mexicano del Petroleo, Instituto Mexicano de Investigaciones Electricas (Mexican Institute for Electrical Research) Instituto Politecnico Nacional (National Politechnicum Institute) - The School of Mechanical and Electrical Engineering -, etc... Especially the trend is to take advantage from exchange programs to train specialized technicians and in relation to production, especially with countries such as Japan, Canada, or Germany.

CONACYT, through its adjoint Human Resources Training Bureau is aware of the need for Mexican scholarship students going out to learn their graduate curricula, must have a very specific relationship towards the needs in our country. Thus, letters of commitment are written whereby high level educational institutions or the productive sector are pledged to support those professionals required in the engineering areas.

Likewise, the General Management of CONACYT recognizes it is not enough to support scholarships or financial backing as those it grants. The success of the human resources training program will also depend on the quality the high level educational institutions are going to give these graduate programs and their consistency with domestic needs. One of the actions to be performed at once by CONACYT to assess those programs is to integrate an institution catalog and domestic and international programs, based on points of view in the scientific community, the productive sector and public institutions.

The point of view in Private Firms Engaged in Projection Engineering is of particular interest and may be summarized as follows:

Domestic Engineering Firms, aware of the enormous responsibility they have with regards to the country's requirements in this respect and with regards to their function to meet future demands as to a technical personnel training, to be required in order to carry out the industrial implementation in Mexico.

For the first time, since some 25 years ago, thanks to the joint efforts of IMP, CONACYT, the National Association of Engineering Firms and some other agencies, it is possible to achieve a projection on the actual needs of the country as to technical services for the 1978 1982 period.

According to scheduled investments, in various industrial branches, for the rest of six year presidential period (1977-1982) an average million Men-Hours/year will be required to meet the industrial development scheduled. (See Graphs 8 and 9). If we compare them to a - production forecasted capacity for engineering projects (from - established Mexican firms*) they show a preoccupying deficit (white bars or total investment by sector or branch in the economy vs. striped - bars or total amount of projection engineering required to be spent to- implement those investments). This was the basis to project the M-H demand for Engineering. These calculated at an average sales or - purchasing price (for each M-H established) total an investment in - industrial projects of $220,000 MM in the next five years, at an annual average of $44,000 MM out of which 8.7% (about $4,000 MM/Year) - will derive from Projection Engineering.

To evaluate the difference forseen between the demand and the - availability of engineers, medium technicians, and managers, there - are (in all the registered firms in the country and those studied in - this analysis) 356 project managers against a future demand of 724; - 1,355 available engineers in every subject, against an estimated demand of 2,752 and 1,856 medium technicians (designers and sketchers) vs. - 3,766. This poses a foreseeable deficit of 3,675 people in these three categories.

(*) I is estimated that this forecasted capacity has an 80% reliability - range. It refers to knowm data from firms subject to a control by an - Official Association or Agency.

Increase of human resources availability is estimated on a 9% per annum - rate. At this growth rate, 10 years will be necessary to meet the demand for the next five years. This means we must import engineering with an- approximate cost of $2,000 MM/Year.

RESOURCES	AVAILABILITY	DEMAND	DEFICIT
Managers	356	724	368
Engineers	1,355	2,752	1,397
Technicians	1,856	3,766	1,910
TOTAL	3,567	7,242	3,675

SOURCE: "Evaluación de las Necesidades de Recursos Humanos en - Ingeniería de Proyecto durante los próximos cinco años" - (An evaluation of the Human Resources Needs in Projection- Engineering for the next years). A paper by Eng. Juan - Alberto Zepeda Novelo, Chairman of Ingenieria Panamericana, S.A. May, 1978.

Only 10% of Basic Engineering is to be imported. Based on the - capacity to adopt technologies which is one of the areas where the - country has more experience. This brings about abundant development in Basic Engineering or its adaptation, derived from advanced - technologies to be adequated to situations such as that of Mexico.

The most important deficiencies, by Projection Engineering branches - will be in Mechanical Engineering and Processing Engineering.

It Will be reflected on the 1,297 figure under "Deficit" in the - following rations: Chemical Engineers - 350 (25%), Mechanical - Engineers - 490 (35%), Civil Engineers - 280 (20%) and Electrical -

Engineers - 277 (20%).

On the other hand, the deficiency of medium technical personnel is very important at the level of sketchers, projectionists, and designers. They deserve the greatest attention on behalf of college and university institutions. This could be in terms of short curricula, with a close involvement of engineering firms so that learning programs would be adapted to the market's needs and after a short training period they may be employed in firms or corporations. For example The National Association of Engineering Firms has an agreement with the Industrial Technical Training Centers of the Public Education Secretariat to incorporate in sketchers and designers curricula, courses in industrial design oriented to specific needs of the engineering firms. Personnel trained in these courses is registered in a labor exchange handled by the Association committed to employ graduate students trained by instructors supplied by the Association itself.

On another approach, the National Association of Engineering Firms through the Regional Technological Institutes has promoted a scholarship system the corresponding minimum wage, to use one month per year as minimum average, non graduate chemical engineering students in Projection Engineering Firms so that they may train potentially usefull personnel.

This not only intends to meet the needs of the Firms but also to control an artificial inflationary situation in costs, coused in the market by a sensitive difference between offer and supply.

Should this excessive costs trend not be controled, Mexico would have an embarrassing "pride to have one of the most expensive engineering corporations in the world".

From a survey conducted by the much mentioned Association, it was concluded that, averagely, in 5 years, $50 thousand are invested in each person entering a Firm, because of training.

This figure is modest in absolut terms but great for companies normally not having a considerable capital. This is a risky investment due to a relatively insecure situation in the market causing often "discharges" of idle personnel, as two years ago occurred.

Finally, Engineering Firms in the private sector feel it is useful and advisable to act as receivers or licensors of foreign know-how, through a system allowing them to grasp the technology to manufacture capital-goods, since most of those Firms have the capacity to adequate and up date knowledge to the local market features, different substantially from that of the country originating it.

... That is not the case in Petrochemicals. There, a very narrow coverage exists and expansion will still require several more years.

Change in engineering (expressed as M-II) to be carried aut to incorporate any modification in Processing Engineering is most sensitive to have an echo in Detail Engineering. Consequently, Processing Enginering should be performed by highly specialized personnel very efficient and with very specific features. This is equivalent to great attributes in the quality of their job.

Another priority area at present is that of pipe design, in detail Engineering, since this activity consumes about 30% of M-H required in an overall project. Thus, it is advisable to be at the front to pass, for example, from traditional plant desing and elevations to designing miniature models, to isometrics through computers, and so-on.

Management and Control areas also are an important priority in Projection Engineering at IMP. Due to the that the Engineering market, as narrow as it is has the peculiarity of being very competitive so it is necessary to watch very carefully the project's performance as to time and cost, delays in starting a plant could, for example, cost additional out of the ordinary expenses.

Al present, Projection Engineering at IMP handles about 45 projects per year. It proves the personnel trained in the first -

stage (where projects were joined between IMP and foreign Firms) is - today a diffusing nucleus of knowledge and continues properly developing Projection Engineering.

Another specific point in the human resource training program at IMP a refers to allowing students in engineering to be graduated perform - their social service (a requisite to graduate at higher level educational institutions in Mexico) within a six months to one year period and then, if they prove valuable, they will be hired. This mechanism shortens - in fact the training period and the future adaptation of the specialist.

Finally, training courses taught by engineers from IMP (Piping, -- Instrumentation, Systems, etc.) and as to professional medium levels are helped to attend seminars, conventions, simposia, etc. proveded - they teach this knowledge within their work location.

VII.5 CONCLUSIONS AND RECOMMENDATIONS.

I. Conclusions

- Three of the main instruments able to contribute in Mexico to - developing Projection Engineering in its branches - Basic, Detail, - Design Engineering - are: a) Fiscal Measures; b) Public and -- Private Financial Support; and c) Human Resources Training.
- As a country, Mexico tends to develop a capital goods industry - sound and relatively autonomous. It must supplement, as soon as -

possible, quantitative existing guidelines (production programs, - demand projections, etc.) around industrial projects jointly with - those qualitiative guidelines or aspects (technology development) - constituting the necessary measures entirely in order to increase - the domestic design capacity.

- The instrument package to be designed to develop the Engineering domestic capacity will be based upon:

I) The interrelationship Demand-Supply in Projection Engineering.

II) Identifying those Agents involved in this relationship.

III) Destinguishing from various kinds of Engineering involving - - Projection Engineering.

IV) Defining and selecting the specific instruments able to articulately act in developing the Engineering domestic capacity. More recent fiscal measures, relative to capital goods and basic inputs are - oriented to reduce machinery and non priority equipment imports to indispensable levels and allow to import those intended to - manufacture capital goods in the country, through incentives such - as -duty tax exemptions, overall income tax exemptions, - - accelerated depreciation rates, etc. For the first time, incentives are specific product oriented as supplement to traditional criteria referring rather to a geographical factor.

- Four Secretariats and twenty entities, pertaining the public Sector, demanding 35% of capital goods, have signed in Mexico an agreement whereby they commit themselves to buy local capital goods when the corresponding price does not exceed 15% the price offered by the main supplier, or the U.S.A.

- Mexico has a technology Transfer Law, recognized by major countries supplying technology and capital goods. It is a legislation consistent and adequate to protection purposes in developing domestic capital goods and Mexican technology.

- The public sector's major productive agencies (Pemex, CFE, Siderurgy, Fertilizers, etc.) have no adequate planning to make, their future machinery, equipment, components, spare parts, etc. purchases, known well in advance and promptly, to capital goods producers and neither do they let their engineering needs be known to domestic firms.

- The main obstacles for major public or state owned corporations to increase substantially their local purchases of equipment, machinery, spare parts, etc. are:

I) Quality deficiencies.

II) Excessive sales prices due to high production costs.

III) Uncertainty or excessively long delivery terms.

IV) Lack of own or external financing resources for capital goods -

Manufacturers to insure their production schedules.

- Any development scheme in Engineering domestic capacity, -- depending significantly on foreign assistence and technology will be necessarily limited in its main purposes; e.g. capital inner accrual.
- Scientific and technological research is difficult to finance on -- banking resources since they are risky projects, due to uncertainty in payments sources, uncertainty in results, etc. Perhaps, -- financing via current expenditures may be more effective; especially if achievements are sold.
- If the origin of any kind of engineering conditions, determines -- substantially the origin of capital goods, the origin of financing to purchase goods and technology also influences this aspect.
- There is a dissociation between human resources requirements and characteristics in Engineering Firms and the rate and effectiveness of curricula in higher level educational centers as well as graduate level curricula.
- Mexican industrialists generally do not believe, at present in the - quality of a domestic projection engineering.
- An industry is big and important as the oil industry in Mexico is - often forced to call upon purchasing foreign capital goods due to the fact it must maintain more rigorous quality standards than other - corporations since a failure might cause operational and security -

problems. This causes the rejection numbers in local products to be high. Pemex, however, will continue supporting increasingly - both the domestic capital goods and technology developments, via - IMP.

II. Recommendations

- Due to the importance of Projection Engineering on the demand -- and production of Capital Goods it is necessary to define and -- establish a setting for Projection Engineering Promotion and -- Development Policies to enforce encouragement bases to produce - capital goods.
- It is necessary to create a nucleus for higher decisión making. - Representatives of public and private corporations using all kinds of engineering, engineering firms research centers, schools, etc. to integrate and implement specific engineering programs, consistent - with the national projects to produce capital goods.
- It is necesary, for entities (such as the Mexican Oil Institute-IMP - and other Mexican Engineering Private firms) to exist in Mexico as institutions receiving foreign technology, capable of convenient - negotiations, to insure transfers and publication in the country.
- It is not advisable to try the development of every kind of - - Projection Engineering in Mexico. Only Basic Engineering, Detail Engineering, and Design Engineering in its various modes when -

able to assimilate and master rapidly and for specific purposes in developing industrial proyects. This without diminishing encouragement, in ad-hoc centers, to purely scientific research.

- Modes in hiring technology, followed by IMP when buying only technology for the first time and then signing coparticipation and growing supervision agreements, might be a sound and advisable practice in this subject.

- There must exist dynamic relationships between research and development, machinery and equipment manufacturing, and industrial training.

- It is necessary to coordinate the function of different existing financial instruments to support development in the domestic capital goods industry and extend its scope to encouraging projects in Basic Engineering, Detail Engineering, Design Engineering and Human Resources Training, etc.

- The condition to success accompaying the financial support mechanism to capital goods manufacturing should be associated in countries such as Mexico to the following requirements:

I) Selectivity in areas or basic projects.

II) Activity or actual and efficient contact between financial sources and users (equipment manufacturers, engineering firms, etc).

III) Integrity or fluency with financial agencies to support through a common speaker (integrator and planner) the corporations and firms.

- Curricula in Projection Engineering should be on a pragmatic basis by means of direct mechanisms school-industry, or school-engineering firm to add to employment sources.
- Pemex will systematically, promptly and in advance, make known to domestic vendors of capital goods its future purchasing schedules.

METHODOLOGICAL ADENDUM TO ITEM VI.2.

ANNUAL COST ESTIMATE FOR MATERIALS AND ENGINEERING IN PETROCHEMICAL PLANTS AND REFINERIES: 1977-1986.

Cost estimates for materials and engineering in petrochemical plants and refineries, under construction and scheduled for 1986 by PEMEX, was made as follows: First, from the investment schedule for this sector (given by the Petrochemicals and Refining Division, Submanagement for Economic Studies and Industrial Planning, IMP) were derived total amounts to invest by Plant and Working Center for the 1977-1986 period. Then, construction advance reports supplied for each plant by the Projects and Construction Management, were consulted. From these reports, components of costs by concept and origin for each project were obtained and a first approximation for this concept was achieved. Once the amounts of investment in materials and engineering were determined, their annual allocation was made according to total and annual scheduled investment ratios for each plant. Thus a total for each center, wheather petrochemical or refinery, was obtained and consequently a total for each sector was also obtained. Expenditures for the above concepts were estimated by using cost averages, for plants in the petrochemical center, programmed on long terms of under construction, which had no advance sheet. For instance Cactus, Chis., where: a) at the Cryogenic fractioned plant, the expenditure ratio was obtained as a cost average observed in other Cryogenic and Fractioned plants, considered individually. b) at the Hydrocarbons Sweetening and Stabilizer Plant it was calculated according to the respective crude sweetening and stabilizing plants from another working center. For the following plants, cost porcentages correspond average estimates keeping in their construction, chemical plants with regard to fixed capital. They were given by "Chemical Engineering" quoted from Plant Design and Economics for Chemical Engineers, Peters, M., P. 104. McGraw-Hill, Chemical Engineering Series.

Allende	Propylene
	Propylene oxide
	Polypropylene
	Butadiene
San Martín Texmelucan, Puebla	Tetramer
	Acrylic Acid
	Dodecyl-tolbene
Tula, Hidalgo	Acrylonitrile II
	Acetonitrile

Undefined	**Butadiene** **Acrylonitrile III** **Cyclohexane** **Propilene Oxide II**

For the other plants, from both sectors, cost breakdown was considered according to similar plants in other centers. And last, where no data were available to calculate the costs by origin (for example plants with average cost ratios in chemical plant) a porcentage average was used from the other plants making up that center or another one if they referred to similar plants or works (auxiliary services and/or integrations). A greater precision in estimates meant desintegration by families of Equipment and Materials. It was made as follows. A statistical* average by type of plant was established which applied to the total amount of materials and equipment estimated allowed to divide this amount in two for each of the above concepts. At the same time, from both concepts and by means of another statistical factor, components were determined as equipment families (furnaces, pumps, etc.), and the like for materials.

Next to reviewing the purchasing schedules for those goods, their separation in families was made. This, together with payment terms practiced by Pemex, allowed their allocation in time according to scheduled investments for each product. Exceptionally if the formed distribution resulted in a yearly amount over the figure in the scheduled investment, an adjustment in equipment was made. From

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* The result from observations in 53 plants.

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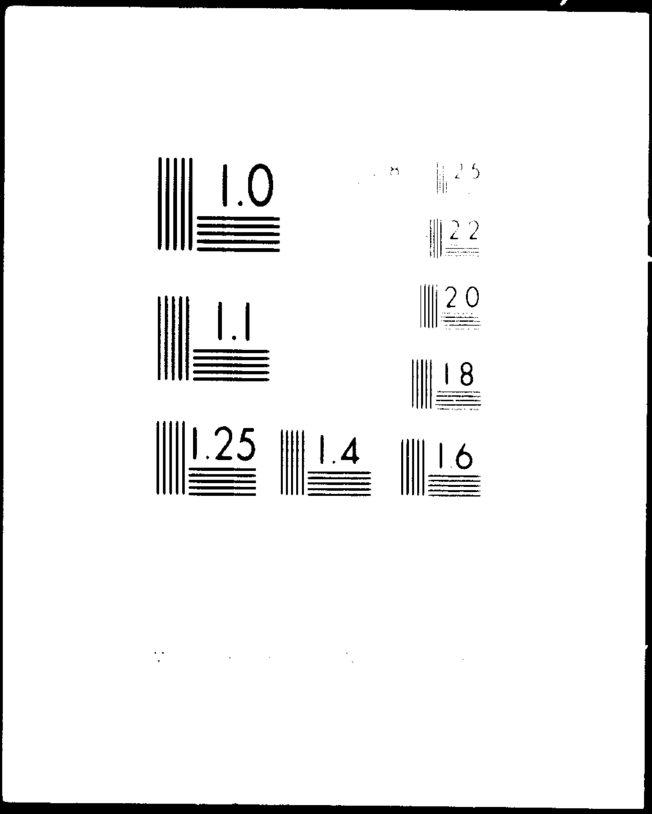

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experience they present greater delays in delivery terms (pumps, heat exchangers and towers, in this order of significance). That is, even in redistributing expenditures for pumps, when the amount per year - exceeded that in the scheduled investment for that year.

The figures for heat exchangers were adjusted and so on. When necessary, the same was done with materials. Their adjustment item was - - "Miscellaneous".

As to Engineering, its expenditure was distributed for the sake of this desintegration, according to typical curves, considering the number of years scheduled for each project.

CLARIFYING NOTE RELATED TO DIFFERENCES IN QUANTITIES AND TOTALS ESTIMATED FOR MATERIALS, EQUIPMENT AND ENGINEERING IN REFINING AND PETROCHEMICALS.

The results obtained in the form mentioned in the methodological note - Tables VI.2.4. and VI.2.6 - that is, estimation of expenditures to be - allocated to purchases of materials and equipment, plus that of -- engineering itself, undergo changes in their total amount and yearly - distribution as a result of a greater precisión in desintegrating by - families equipment and materials, done in each plant to be constructed in various working centers and for each year according to scheduled - projects. Therefore the amounts to be allocated to those concepts - offer differences with the equivalents in Tables VI.2.10 and VI.2.11, - considered as definite and carried to their ultimate desintegration. It should be mentioned that these differences refer basically to yearly - distributions and also, they are not substantially considerable.

Discrepancies observed in the total amount for the 1977-1986 period - are not caused precisely by the changes mentioned. They are due to - the exclusion of certain originally scheduled works (Tables VI.2.4 and - VI.2.6) and were not included in definite figures broken down by type - of equipment and materials. Another cause in this concept is due to - increases or decreases, conveniently applied by certain works in -- desintegrating for the above sectors.

The following are the detailed differences involving plants in each -- sector, for the reader's benefit:

Working Center	Plant/Work	Mat. and Equip. $ 000	Engineering $ 000
REFINING			
Minatitlán, Ver.	Lubr. Hydrog.	- 2,952	- 300
Azcapotzalco, D.F.	Rehabilitation	- 3,275	- 7
Salina Cruz I. Oax.	Bitter Water Treat.	-26,735	- 1,069
Salamanca, Gto.	Storage Tanks	- 300	--
Salina Cruz II and III, Oax.	2 Int. Dist. Hydr.	--	+21,548
TOTAL		-33,262	+20,172
PETROCHEMICALS			
Allende, Ver.	Polyethilene A.D.	-30,000	--
Allende, Ver.	Propilene	--	-29,800
TOTAL		-30,000	-29,800

The above amounts, negative signed, mean for both sectors their -- deletion in the originally handled data. Otherwise, amounts positive -- signed imply the fact that these amounts overestimate the total -- mentioned.

TABLE T. V1.2.

WORKS STARTED AND TERMINATED IN THE 1977 - 1982 PERIOD

EXTENSION FOR EXISTING PLANTS

SALAMANCA:

Additions to plants to increase lubrs. production by 2,000 B/D.

NEW REFINING CENTERS

SALINA CRUZ II:

Second atage to increase processing capacity by 200,000 B/D with the - following plants:

200,000 B/D Primary Distillation

100,000 B/D Vacuum Distillation

40,000 B/D Catalytic Desintegration

36,000 B/D Naphtha Hydrodesulphurer

25,000 B/D Naphtha Reformers

Two 25,000 B/D Intermediate Distillate Hydrodesulphurers

Treatment and Fractioning

Sulphur Recoverer, 85 Ton/Day.

TULA II:

Second stage to increase processing capacity by 200,000 B/D with the - following plants:

200,000 B/D Primary Distillation

100,000 B/D Vacuum Distillation

40,000 B/D Catalytic Desintegration

36,000 B/D Naphtha Hydrodesulphurer

25,000 B/D Naphtha Reformer

Two 25,000 B/D Intermediate Distillate Hydrodesulphurers

Sulphur Recoverer, 85 Ton/Day.

DUCTS TO CARRY PRODUCTS

Cadereyta - Monterrey products line.

(San Jeronimo) Chih.

Cadereyta - San Rafael Products line

Mexico - Toluca Products line

Mexico - Cuernavaca Products line

Aguascalientes - Zacatecas

Mazatlan - Culiacan

Rosarito - Mexicali

TABLE T. VI.3

WORKS TO BE STARTED IN THE 1977-1982 PERIOD AND TERMINATED IN THE NEXT SIX YEAR PERIOD

NEW REFINING CENTERS

SALINA CRUZ III:

Third stage to increase processing capacity by 200,000 B/D, with the - following plants:

200,000 B/D Primary Distillation

100,000 B/D Vacuum Distillation

40,000 B/D Catalytic Desintegration

36,000 B/D Naphtha Hydrodesulphurer

25,000 B/D Naphtha Reformer

Two 25,000 B/D Intermediate Distillate Hydrodesulphurers

Treatment and Fractioning

Sulphur Recoverer, 85 Ton/Day.

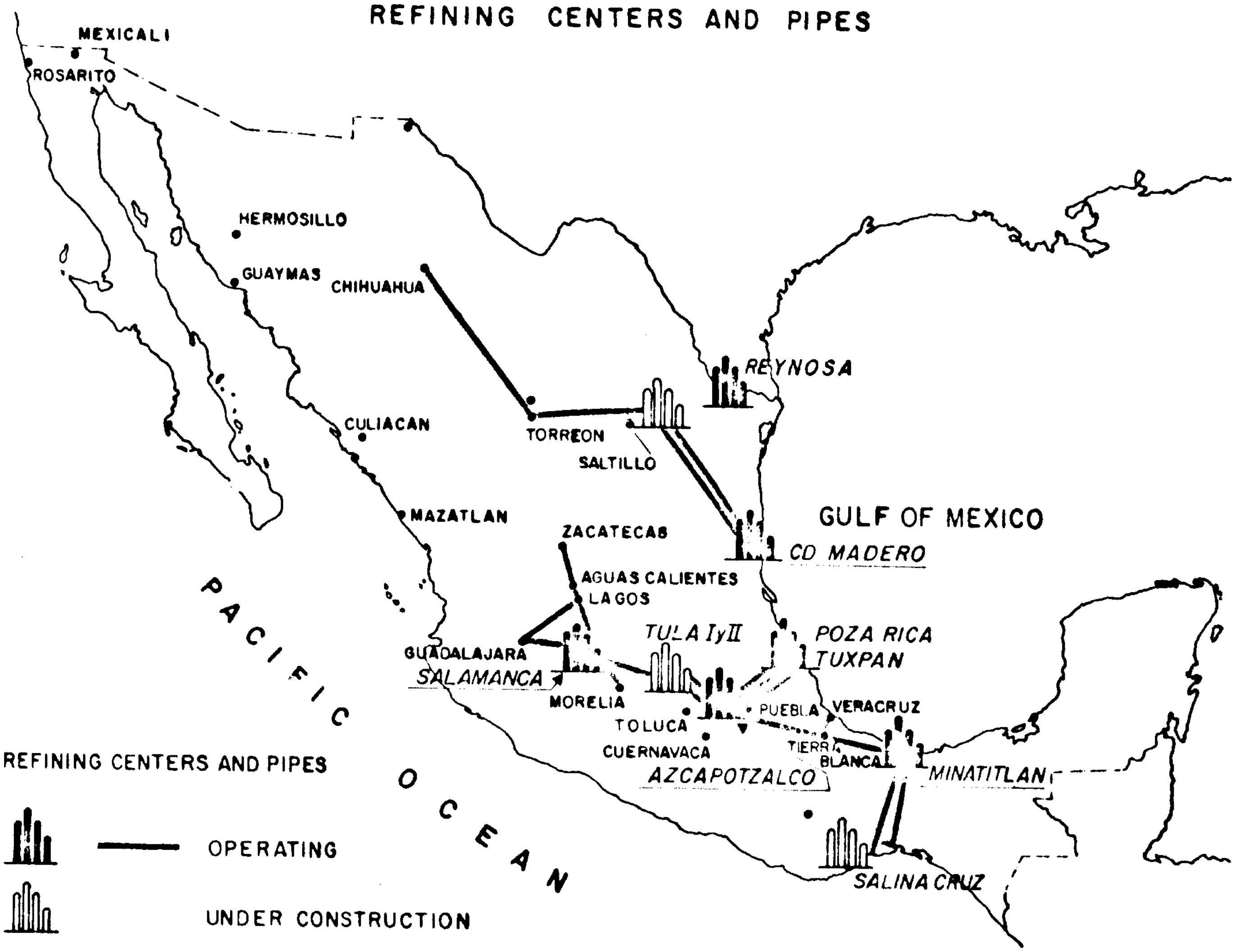
CADEREYTA II:

Second stage to increase processing capacity by 200,000 B/D with the - following plantas:

FIG. F. VI. 2

PETROLEOS MEXICANOS

REFINING CENTERS AND PIPES

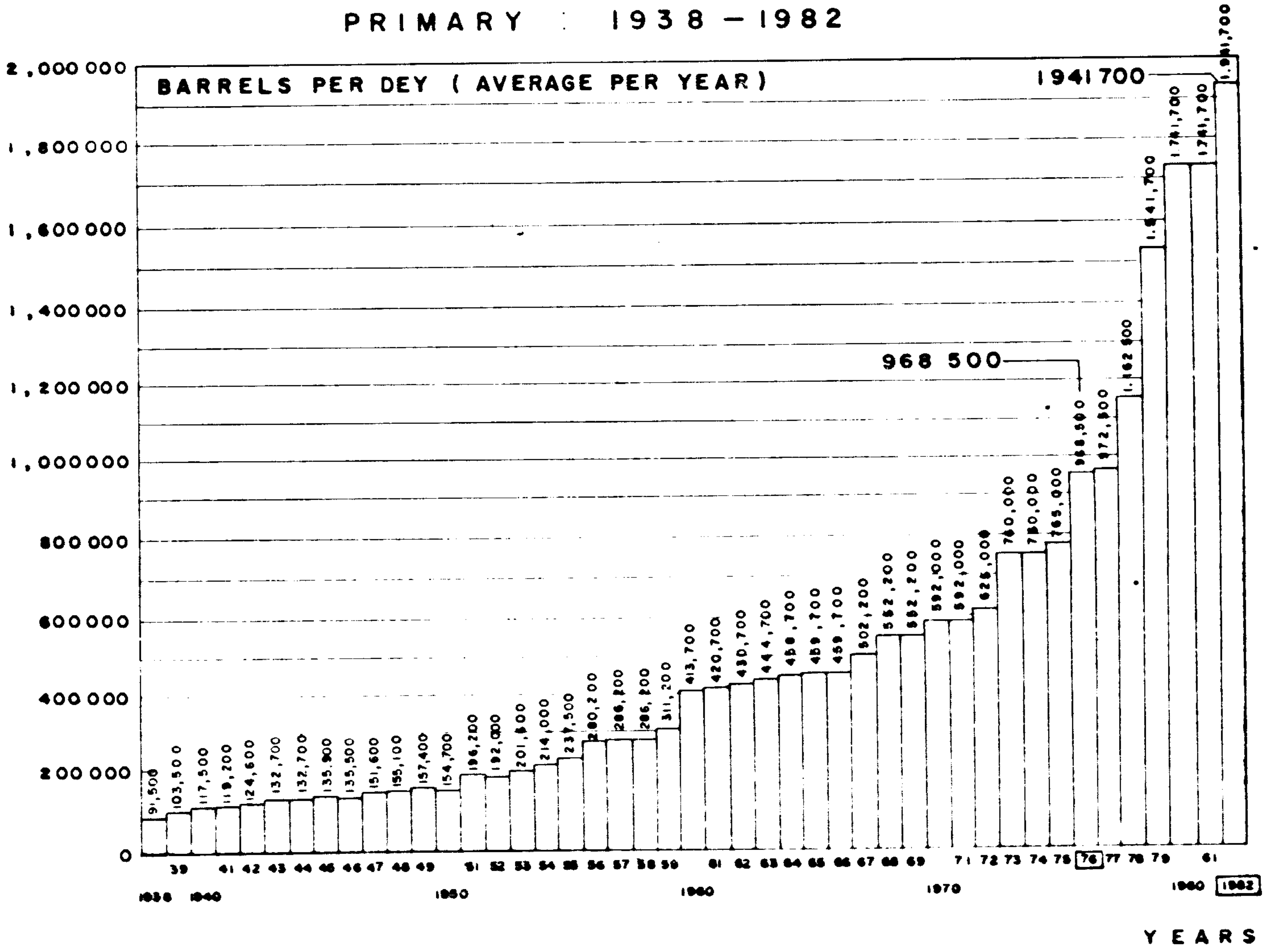


GRAPH G. VI. 2

REFINING CAPACITY

DESTILLATION FACE CAPACITY

PRIMARY : 1938 – 1982



GRAPH G. VI. 3

PETROLEOS MEXICANOS
TOTAL PRODUCTION CAPACITY OF OUTPUTS
BASIC PETROCHEMICALS

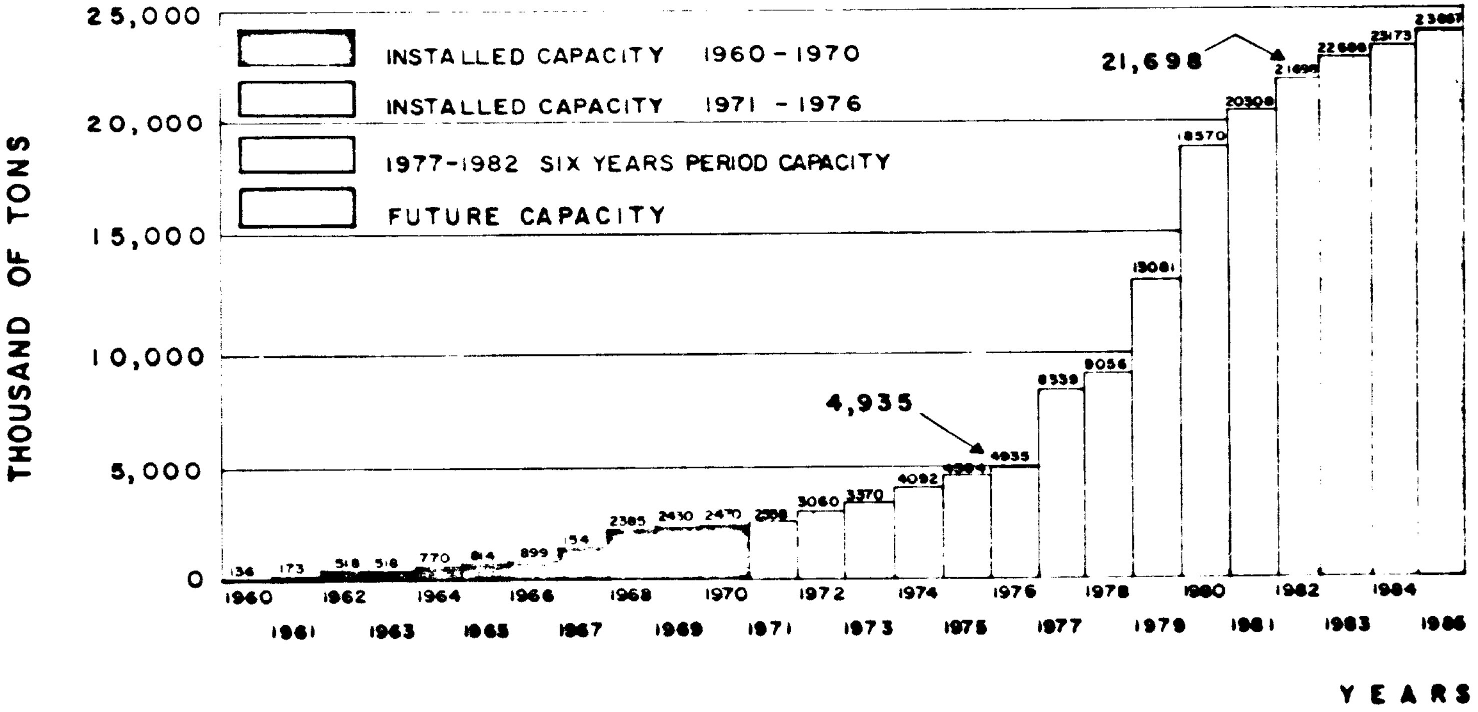
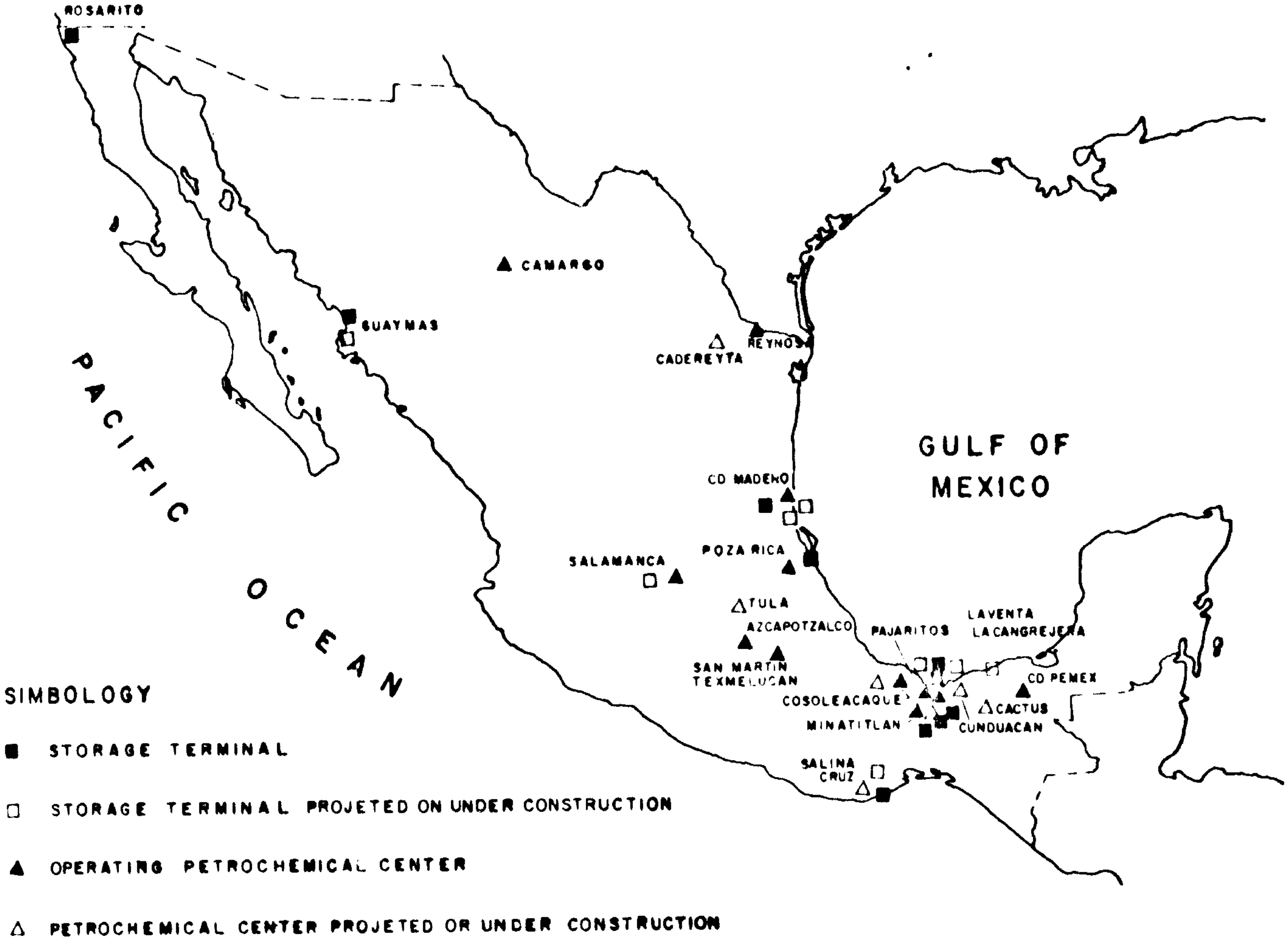
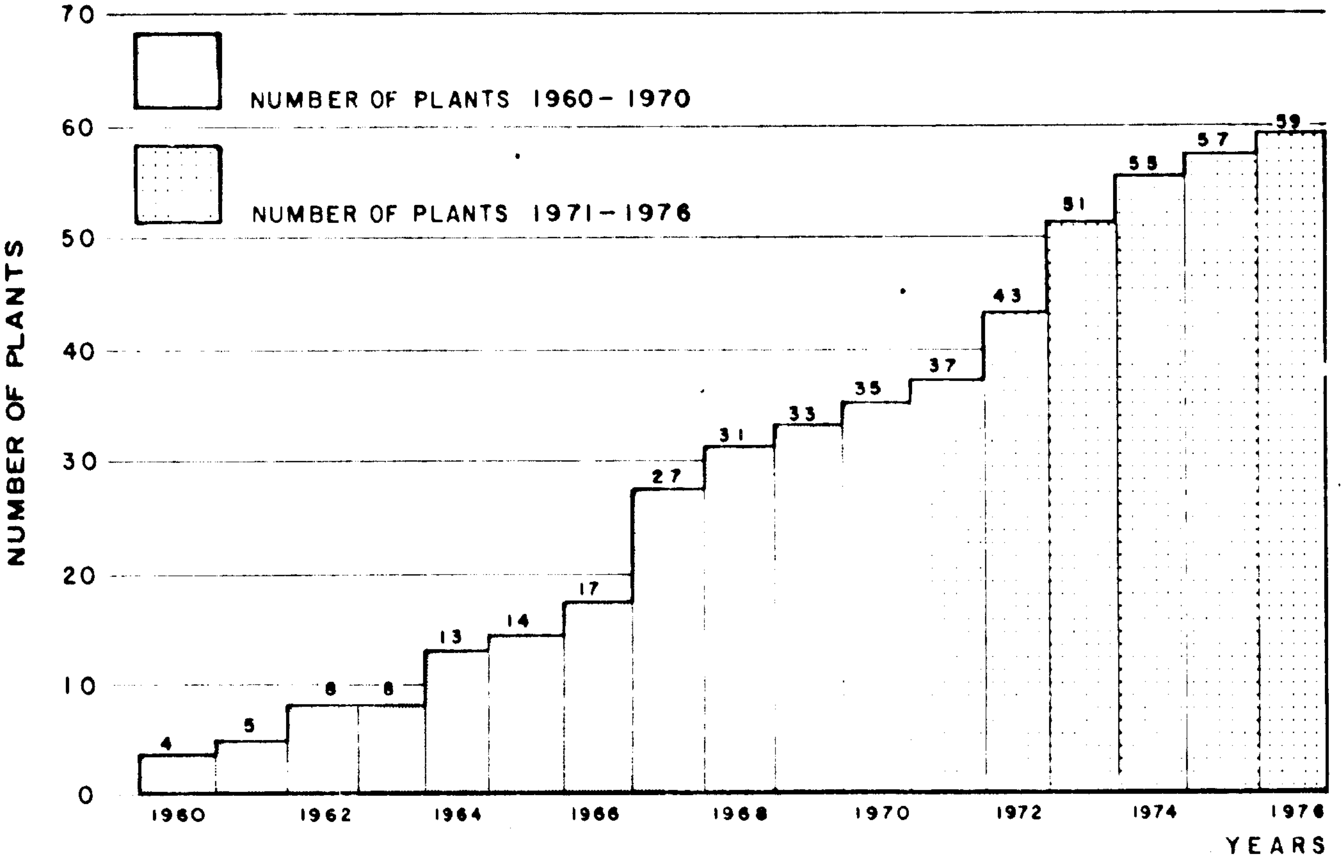


FIG. F. VI. 3

PETROLEOS MEXICANOS
PRODUCING CENTERS AND PETROCHEMICAL TERMINALS



NUMBER OF BASIC PETROCHEMICAL PLANTS INSTALLED FROM 1960 TO 1976



GRAPH G.VI.5

NUMBER OF BASIC PETROCHEMICAL PLANTS TO BE INSTALLED FROM 1977 TO 1985

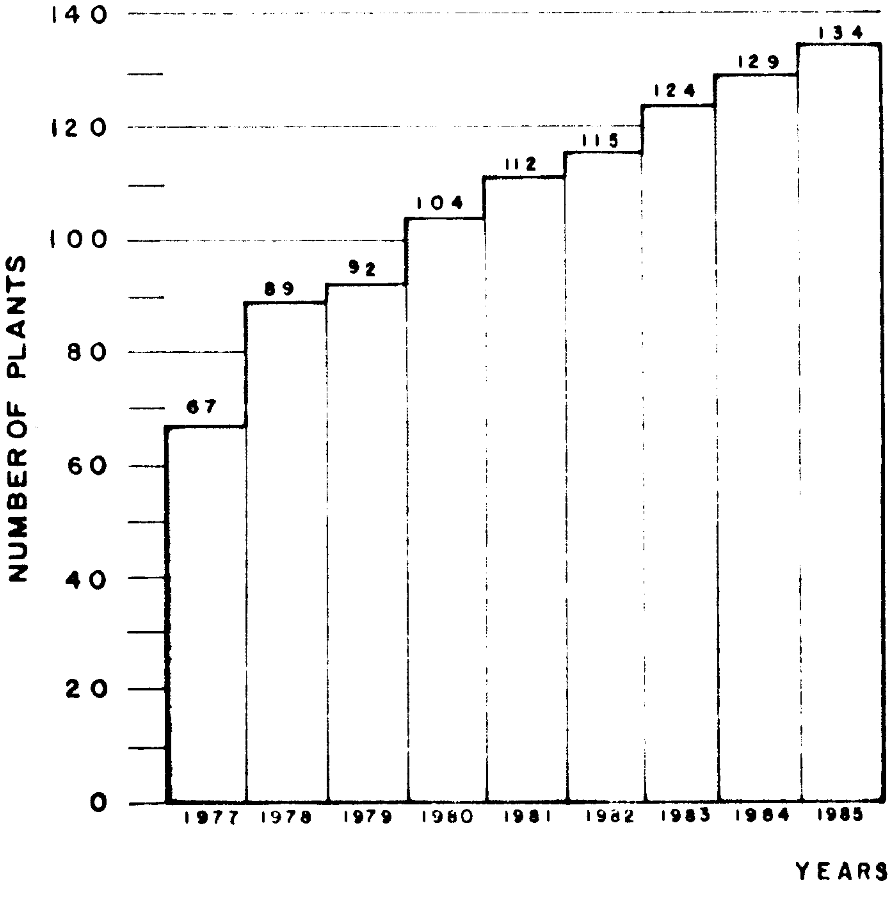


FIG. F. VI. 4

PETROLEOS MEXICANOS
NATIONAL OIL PIPELINES SYSTEM

FIG. F. VI. 5

PETROLEOS MEXICANOS

NATIONAL NATURAL GAS TRUNK SISTEM

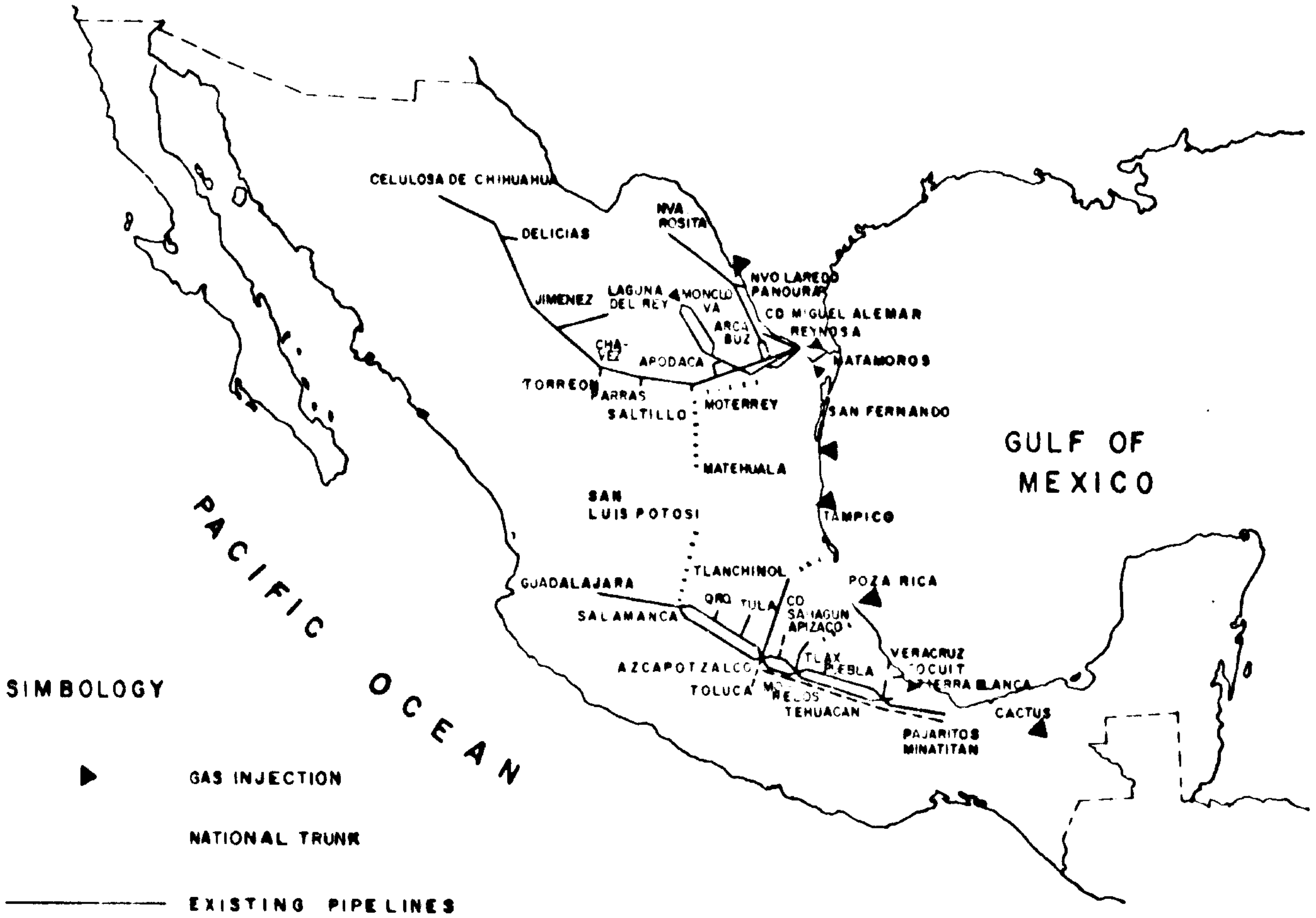


FIGURE F.VI.6
PETROLEOS MEXICANOS
NATIONAL GAS TRUNK SYSTEM
BID AND PENDING ORDERS FOR MATERIALS AND EQUIPMENT REQUISITIONS

MATERIALS AND EQUIPMENT	PLANTS FROM VARIOUS COUNTRIES INVITED TO BID:												TOTALS:		PROBABLE VENDING COUNTRIES
	GERMANY,	BELGIUM,	CANADA,	SPAIN,	U.S.A.,	FRANCE,	HOLLAND,	ENGLAND,	ITALY,	JAPAN,	MEXICO,	SWITZERLAND.	COUNTRIES	PLANTS	
I. GAS TRUNK PIPELINE															
Pipes - Major Diameters	4	-	1	1	3	1	1	-	1	6	1	-	9	19	6
Valves and Major Connections	2	-	-	3	12	3	1	1	2	8	2	-	9	34	3
Traps at Inlets and Outlets	-	-	-	-	6	2	-	5	-	1	1	-	5	15	2
Pipes, Valves and Minor Connections	1	1	1	1	4	2	-	3	1	6	2	-	10	22	6
Gaskets and Pins	-	-	-	-	1	-	-	-	-	-	3	-	2	4	1
Totals:	7	1	2	5	26	8	2	9	4	21	9	-	35	94	18
II.- COMPRESOR STATIONS															
Pipes - Major Diameters	-	1	1	-	2	1	-	-	2	2	1	-	7	10	2
Valves and Major Connections	1	-	-	1	10	2	1	1	1	4	4	-	9	25	3
Fluid Separators	-	-	-	-	9	1	-	-	-	4	2	-	4	16	2
Pipes, Valves and Minor Connections	1	-	-	1	5	1	-	1	-	4	3	-	7	16	6
Turbines	3	-	3	-	5	1	1	3	1	4	-	1	9	22	3
Compressors	1	-	-	-	5	-	1	1	1	3	-	1	7	13	3
Instrumentation	-	-	-	-	15	-	-	-	-	-	7	-	2	22	2
Gaskets and Pins	-	-	-	-	1	-	-	-	-	-	3	-	2	4	1
Totals:	6	1	4	2	52	6	3	6	5	21	29	2	47	128	22

200,000 B/D Primary Distillation

100,000 B/D Vacuum Distillation

40,000 B/D Catalitic Desintegration

36,000 B/D Naphtha Hydrodesulphurer

25,000 B/D Naphtha Reformer

Two 25,000 B/D Intermediate Distillate Hydrodesulphurers

Treatment and Fractioning

Sulphur Recoverer, 85 Ton/Day.

A complete train to manufacture lubrs., with a 10,000 B/D capacity.

DUCTS TO CARRY PRODUCTS

Distribution network to handle increase in production corresponing TULA II.

VI.2 DEMAND FOR CAPITAL GOODS REQUIRED BY THE OIL AND BASIC PETROCHEMICAL INDUSTRY 1977-1986 (1)

I. Total Material and Equipment Rquirements.

Total estimated investment in Materials and Equipment for the Oil - Industry (exploitation, Refining, Petrochemical, and Traffic and - Distribution) will be $ 154,736 millions current pesos during the 1977 - 1986 period. In the 1977-1982 period, e.i., during this administration, out of $ 333,186 millions total investment 31.2% or $ 103,933 millions will be - allocated to purchase equipment and materials.

Out of a total purchasing schedule for the 10 year 1977 - 1986 - period for the four main oil branches, the Exploitation Sector and - Petrochemicals will require almost 70% of capital goods and -

---

(1) See statistical annexes.

GRAPH G.VI. 6

SCHEDULED INVESTMENTS TO ACQUIRE MATERIALS AND EQUIPMENT FOR THE OIL AND BASIC PETROCHEMICAL INDUSTRY

%

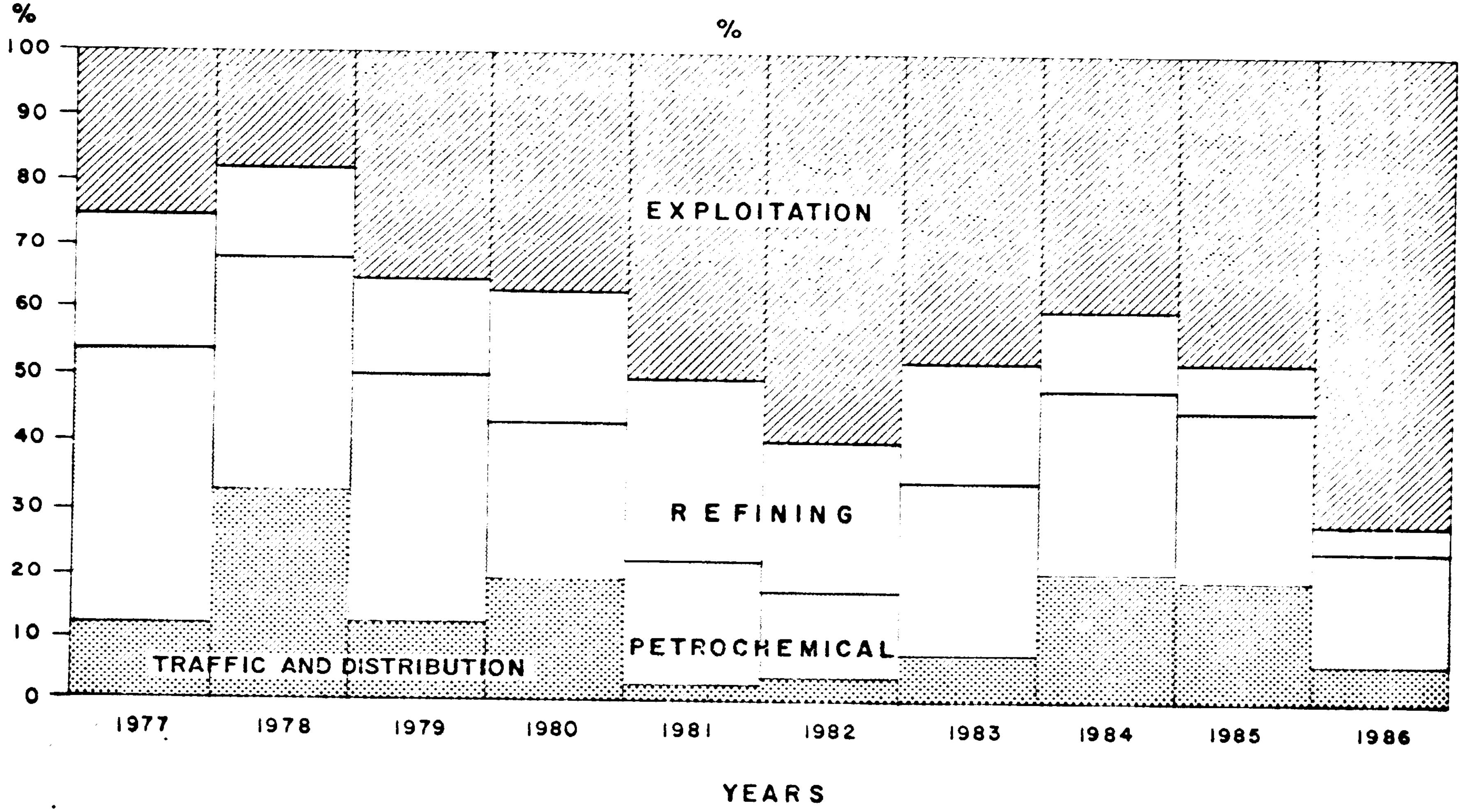
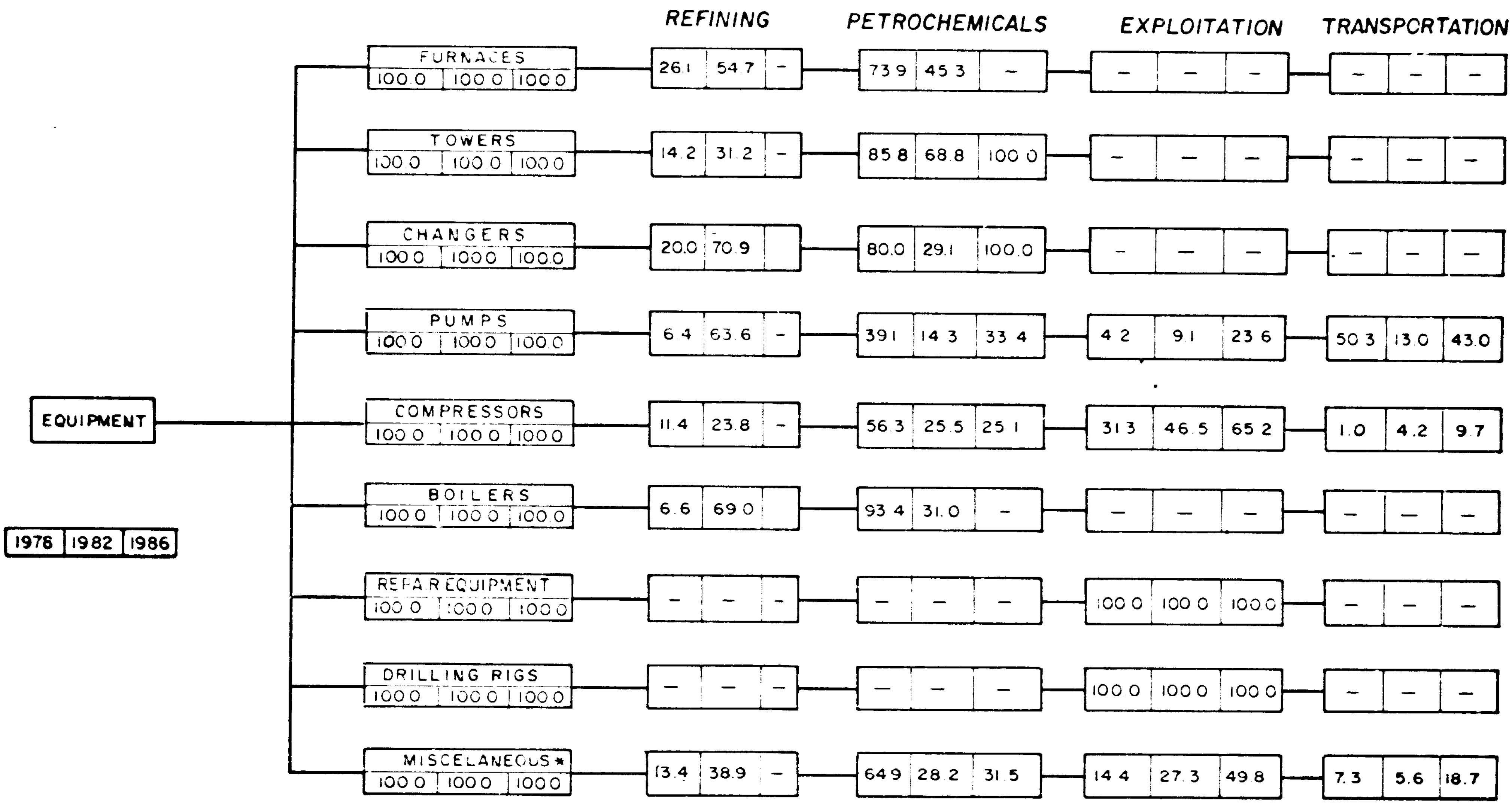


FIG. F. VI. 7

EQUIPMENT DISTRIBUTION BY OIL INDUSTRY SECTORS
(PERCENTAGES)

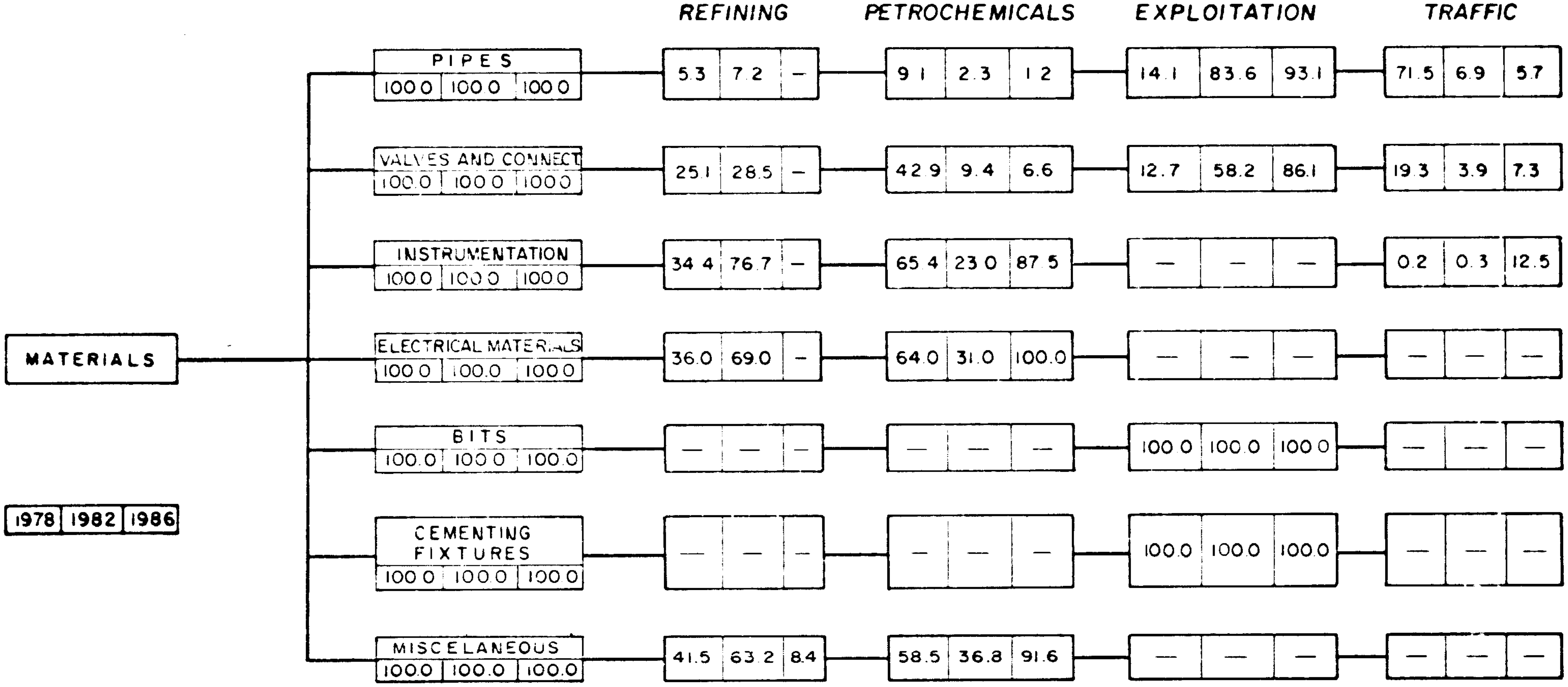


				REFINING			PETROCHEMICALS			EXPLOITATION			TRANSPORTATION		
FURNACES	100.0	100.0	100.0	26.1	54.7	-	73.9	45.3	-	-	-	-	-	-	-
TOWERS	100.0	100.0	100.0	14.2	31.2	-	85.8	68.8	100.0	-	-	-	-	-	-
CHANGERS	100.0	100.0	100.0	20.0	70.9		80.0	29.1	100.0	-	-	-	-	-	-
PUMPS	100.0	100.0	100.0	6.4	63.6	-	39.1	14.3	33.4	4.2	9.1	23.6	50.3	13.0	43.0
COMPRESSORS	100.0	100.0	100.0	11.4	23.8	-	56.3	25.5	25.1	31.3	46.5	65.2	1.0	4.2	9.7
BOILERS	100.0	100.0	100.0	6.6	69.0		93.4	31.0	-	-	-	-	-	-	-
REPAIR EQUIPMENT	100.0	100.0	100.0	-	-	-	-	-	-	100.0	100.0	100.0	-	-	-
DRILLING RIGS	100.0	100.0	100.0	-	-	-	-	-	-	100.0	100.0	100.0	-	-	-
MISCELANEOUS*	100.0	100.0	100.0	13.4	38.9	-	64.9	28.2	31.5	14.4	27.3	49.8	7.3	5.6	18.7

* INCLUDING: TOWER INTERNS, REACTORS, SOLOAIRS, EJECTORS, PROCESSING CONTAINERS, STORAGE TANKS, ETC.

FIG. F. VI. 8

MATERIAL DISTRIBUTION BY OIL INDUSTRY SECTORS
(PERCENTAGES)



				REFINING			PETROCHEMICALS			EXPLOITATION			TRAFFIC		
PIPES	100.0	100.0	100.0	5.3	7.2	—	9.1	2.3	1.2	14.1	83.6	93.1	71.5	6.9	5.7
VALVES AND CONNECT	100.0	100.0	100.0	25.1	28.5	—	42.9	9.4	6.6	12.7	58.2	86.1	19.3	3.9	7.3
INSTRUMENTATION	100.0	100.0	100.0	34.4	76.7	—	65.4	23.0	87.5	—	—	—	0.2	0.3	12.5
ELECTRICAL MATERIALS	100.0	100.0	100.0	36.0	69.0	—	64.0	31.0	100.0	—	—	—	—	—	—
BITS	100.0	100.0	100.0	—	—	—	—	—	—	100.0	100.0	100.0	—	—	—
CEMENTING FIXTURES	100.0	100.0	100.0	—	—	—	—	—	—	100.0	100.0	100.0	—	—	—
MISCELANEOUS	100.0	100.0	100.0	41.5	63.2	8.4	58.5	36.8	91.6	—	—	—	—	—	—

TABLE C.VI.3
MATERIAL AND EQUIPMENT TOTAL INVESTMENT PROGRAM FOR THE 1977-1982 SIX YEAR PERIOD

(Millions of Pesos)

SCOPES / YEARS	1977		1978		1979		1980		1981		1982		1977/1982	
	$	%	$	%	$	%	$	%	$	%	$	%	$	%
PEMEX														
Total Investment	39,710.6	100.0	87,124.3	100.0	58,974.1	100.0	49,580.4	100.0	47,033.3	100.0	50,763.6	100.0	333,186.3	100.0
Material and Equipment	13,869.1	34.9	28,331.6	32.5	19,618.2	33.3	16,085.8	32.4	12,615.6	26.8	13,412.5	26.4	103,932.8	31.2
EXPLOITATION														
Total Investment	14,045.8	100.0	28,005.8	100.0	24,824.6	100.0	25,092.1	100.0	26,192.3	100.0	28,443.3	100.0	146,603.9	100.0
Materials and Equipment	3,455.5	24.6	5,022.5	17.9	6,990.5	28.2	6,050.0	24.1	6,342.6	24.2	8,089.7	28.4	35,950.8	24.5
REFINING														
Total Investment	8,184.1	100.0	14.722.6	100.0	6,382.4	100.0	6,031.6	100.0	4,792.8	100.0	6,026.9	100.0	46,590.4	100.0
Materials and Equipment	2,867.1	35.0	4,122.8	28.0	2,690.6	42.2	3,092.9	51.2	3.537.4	73.8	3,031.1	50,3	19,341.9	41.5
PETROCHEMICALS														
Total Investment	9,079.2	100.0	15,228.9	100.0	12,342.5	100.0	5,870.8	100.0	3,412.9	100.0	3,195.9	100.0	49,130.2	100.0
Materials and Equipment	5,946.9	65.5	9,703.9	63.7	7,525.0	61.0	3,796.7	64.7	2,482.7	72.7	1,866.9	58.4	31,322.1	63.3
TRAFFIC AND DISTRIBUTION														
Total Investment	5,990.4	100.0	24,865.3	100.0	11,253.8	100.0	8,046.2	100.0	6,997.1	100.0	6,372.4	100.0	63,525.2	100.0
Materials and Equipment	1,599.6	26.7	9,482.4	38.1	2,412.1	21.4	3,146.2	39.1	252.9	3.6	424.3	6.6	17,318.0	27.3

intermediate goods. This evidences the Mexican Government's intention to maintain an accelerated rate in oil production, based on the growing availability of reserves. Also its intention to diversify the domestic industry. On the other hand, Refining progresses towards a definite consolidation in programming plants whose access and technology will be among the most advanced in the world and wich will supplement the existing refining plants to meet the inner consumption and will gradually produce distillates with a high aggregate value for exports.

Purchases in this sector will represent 15.9% of a total for the 10 year period.

The Traffic and Distribution sector will be receiving extraordinary support in investments for the 1978-1980 three year period due, mainly to works in the National Gas Trunk System backing up the industrial development for domestic service in various regions in the country. This sector will demand 15.7% of the materials and equipment value, for the 10 year period.

EXPLOITATION

In analyzing the materials and equipment requirements, by branches in the state oil industry, the fact that 39.7% of estimated cost for capital and intermediate goods required between 1977 and 1968 will be originated by the Exploitation sector, is stressed. Among materials and equipment demanded by this branch, the most important are those - necessary to Drill and Repair Wells. They will be 86.0% of the total-amount, for the ten year period. The remaining 14.0% will be allocated to Surface Exploitation Facilities.

The order of importance of these materials and equipment in the - - Exploitation Sector will be as follows, according to required investments for the above 10 year period:

MATERIALS AND EQUIPMENT	ESTIMATED VALUE ($MM)	%
A. TOTAL EXPLOITATION	61,463.3	100.0
B. WELL DRILLING AND REPAIR	52,827.6	86.0
1. Strut Pipe	24,154.7	39.3
2. Drilling Rigs	13,384.7	21.8
3. Bits	5,636.0	9.2
4. Valve Shaft	4,666.1	7.6
5. Repair Equipment	2,840.0	4.6
6. Cementing Fixtures	1,610.3	2.6
7. Drilling Pipes	535.8	0.9
C. SURFACE FACILITIES	8,635.7	14.0
1. Collection	480.7	0.8
1.1 Piping	426.0	0.7
1.2 Special Rigs	30.4	
1.3 Valves and Connections	24.3	

2.	Separation and Gauging	1,422.2	2.3
2.1	Separators	1,095.5	1.8
2.2	Special containers	182.6	0.3
2.3	Sp. Gauge and Control Equipment	91.1	0.1
2.3	Valves and Connections	73.0	0.1
3.	Storage	961.2	1.5
3.1	Tanks	730.1	1.2
3.2	Vapor Recovery	121.7	0.2
3.3	Special Rigs	60.8	
3.4	Valves and Connections	48.6	
4.	Oil Pumping	420.3	0.7
4.1	Motor Pumps	372.5	0.6
4.2	Special Sec. and Control Equipment	26.5	
4.3	Valves and Connections	21.3	
5.	Gas Compression	5,331.3	8.7
5.1	Motor Compressors	4,723.9	7.7
5.2	Sp. Sec. and Control Equipment	337.6	0.6
5.3	Valves and Connections	269.8	0.4

DIAGRAM G. VI. 7

SCHEDULED INVESTMENTS FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE EXPLOITATION SECTOR, 1977-1986

(*PERCENTAGES*)

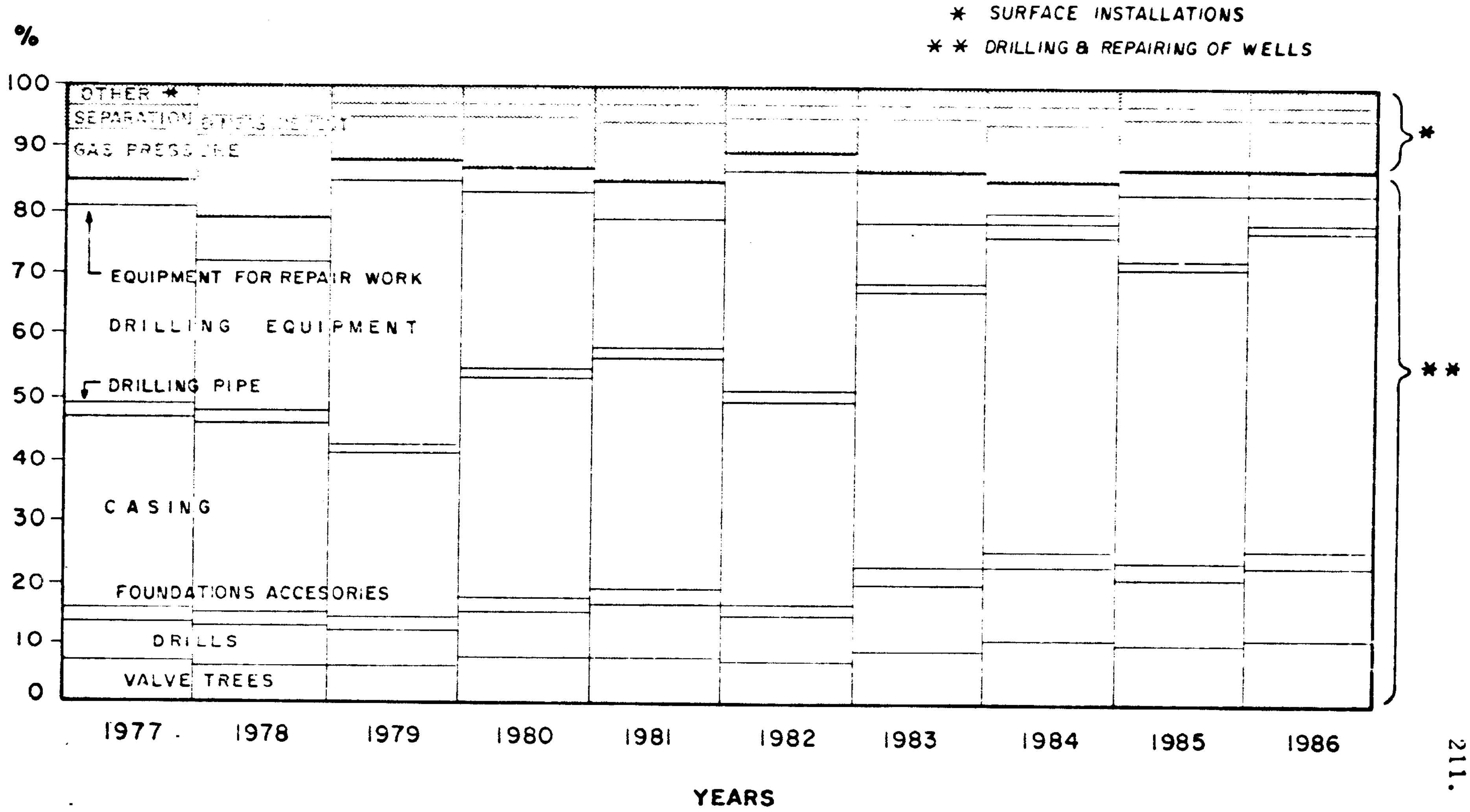
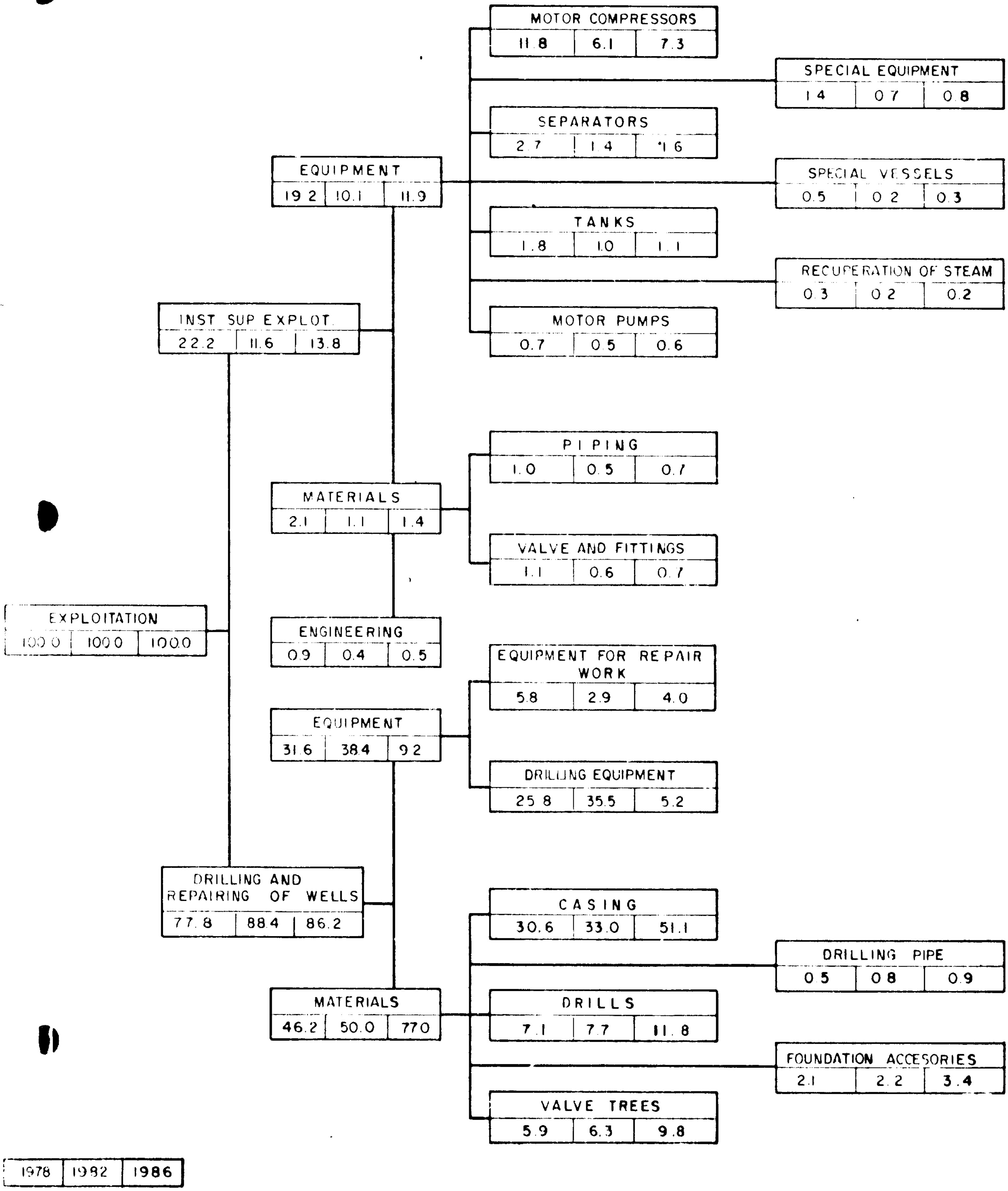


FIG. F. VI. 9

DISTRIBUTION OF EQUIPMENT, MATERIALS AND ENGINEERING FOR THE EXPLOITATION SECTOR

(PERCENTAGES)



During the recent years, the tendency has been directed towards the intensification of hydrocarbon exploitation. This accounts for the privileged leading position that this sector occupies within the industry as far as scheduled resources is concerned. Thus, the nature of its activities demands that its equipment and supplies requirements are particularly signficant. The drilling equipment and the casing used for this purpose accounts for more than 60% of the estimated acquisitions volume. Secondly, valves and drills used in drilling works have also been assigned considerable sums, and with regard to the surface exploitation installations, the most important equipment is composed of motor compressors as number one priority, then comes the separators and tanks with a less significant participation, but this last segment of the industry is more fully representative than the rest of the equipment which acquires only complementary characteristics as shown by its estimated investment.

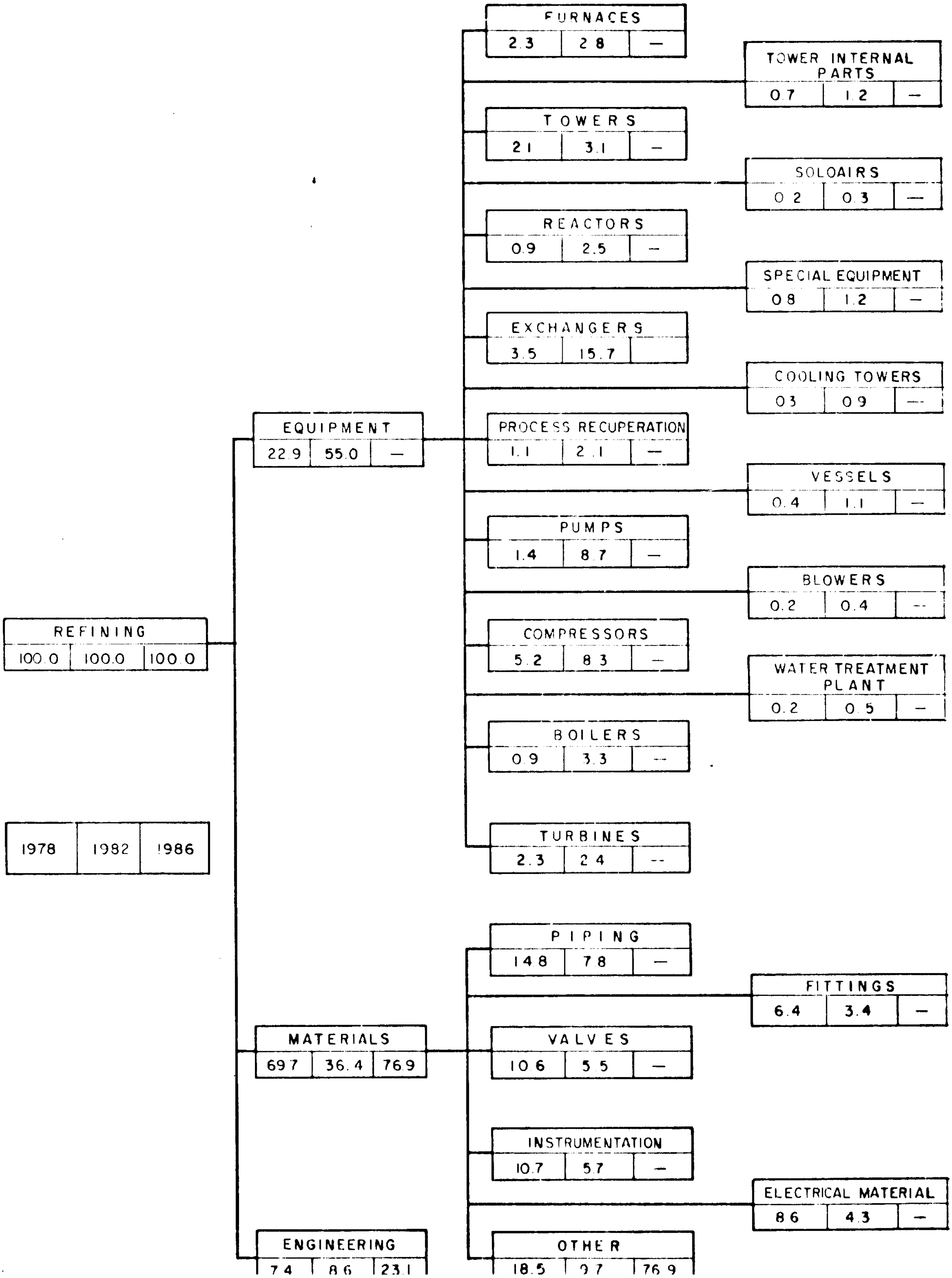
REFINING

The requirements of the Refining division with respect to the total estimated value of equipment and supplies required by the oil industry- are of the order of 15.9% ($24,562MM), and places this sector jointly with Transportation, in the lowest level, as far as equipment and supplies requirements are concerned, as revealed by data covering a ten year survey.

FIG. F VI. 10

DISTRIBUTION OF THE EQUIPMENT, MATERIALS AND ENGINEERING FOR THE REFINING SECTOR

(PERCENTAGES)



The above is a true indication that this segment of the oil industry is consolidating its refining processing facilities, and new refineries are being scheduled for construction in the country.

The enlargement of the existing plants, including refineries under construction and others that have not as yet been initiated, will continue to be a source of demand for a wide range of capital goods.

The most important equipment during the period 1977-1986 will be exchangers (11.1%), compressors (7.5%), pumps (5.4%), Furnaces (4.1%), Boilers (3.8%) and towers (3.5%). The materials that will sustain a continued demand along the years, and which present more favorable assets than other equipment (as indicated by its budgeted expense) are: piping, valves and instrumentation. The electrical material requirements will also be significant during the referenced period.

The participation of the equipment and materials in the refining division will be as follows:

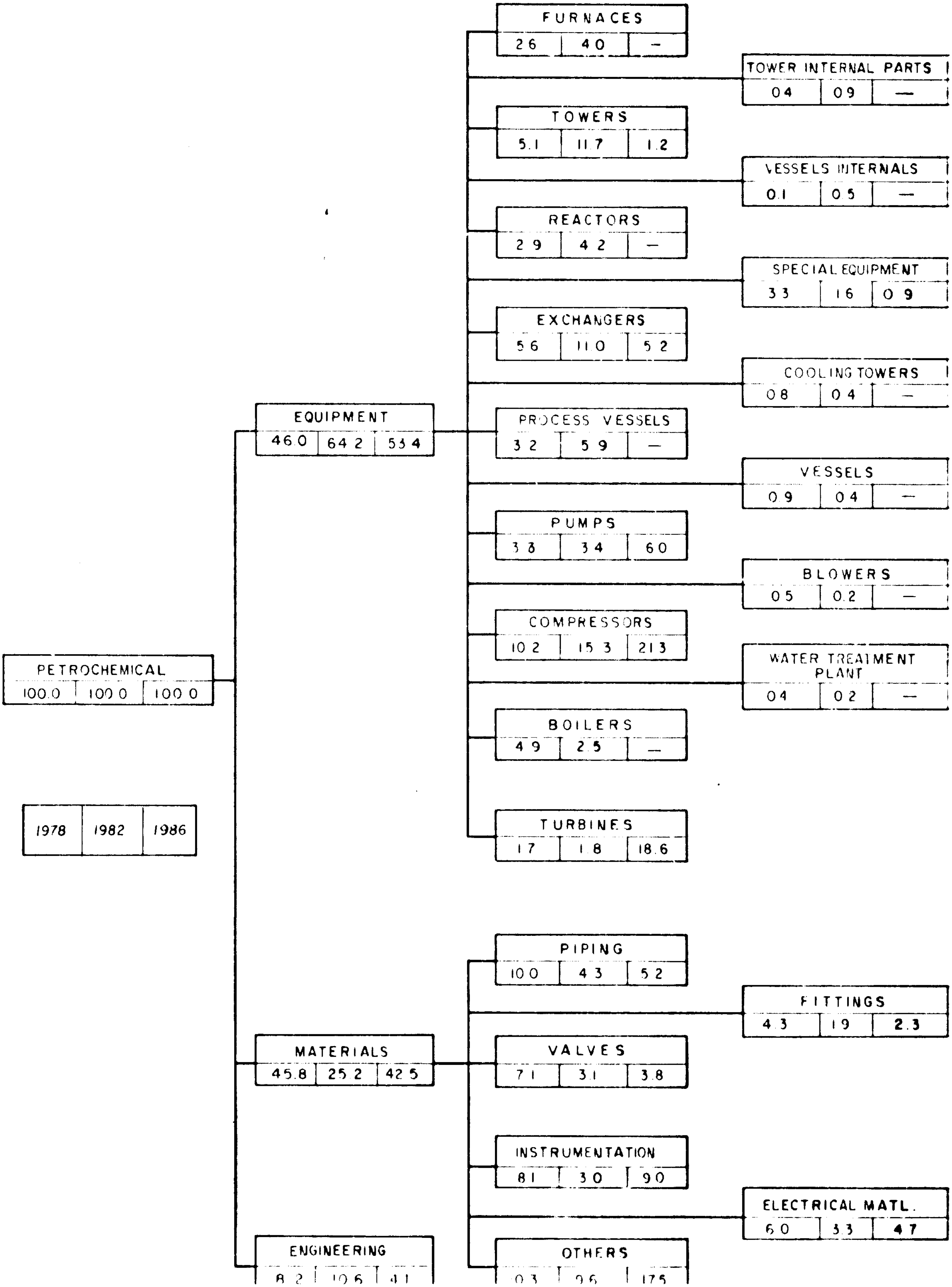
MATERIALS & EQUIPMENT	ESTIMATED VALUE ($ MM)	PERCENTAGE
TOTAL REFINING	$24,562,129°	100.0
Exchangers	2,723,331	11.1
Compressors	1,849,392	7.5

MATERIALS & EQUIPMENT	ESTIMATED VALUE ($ MM)	PERCENTAGE
Pumps	1,322,179	5.4
Furnaces	1,001,953	4.1
Boilers	934,594	3.8
Towers	853,651	3.5
Turbines	671,691	2.7
Reactors	668,280	2.7
Process Vessels	642,173	2.6
Special Equipment	298,184	1.2
Tower Internal Parts	265,883	1.1
Vessels	145,797	0.6
Cooling Towers	118,140	0.5
Soloairs	89,891	0.4
Blowers	57,704	0.2
TOTAL REFINING: (CONTINUED)	24,562,129.	100.0
Water Treatment Plants	60,435	0.2
Storage Tanks	35,589	0.1
Internal Combustion Engines	13,658	0.1
Ejectors	12,291	0.1
Vessel internal parts	2,473	
Superheaters	727	-
Total Equipment	11,768,016	47.9
Piping	2,886,397	11.8
Valves	2,067,865	8.4
Instrumentation	2,037,260	8.3
Electrical Material	1,604,980	6.5
Fittings	1,243,754	5.1
Other	2,953,857	12.0
Total Materials	12,794,113	52.1

SOURCE: Subdirection of Economical Studies and Industrial Planning, - based on the disintegration of capital goods per families, -- realized by the Subdirection of Project Engineering IMP.

DISTRIBUTION OF THE EQUIPMENTS, MATERIALS AND ENGINEERING FOR THE PETROCHEMICAL SECTOR

(PERCENTAGES)



• - This figure does not agree with the Resumé of Scheduled Investments for the acquisition of materials and equipment (See metodological Note).

PETROCHEMICAL

Of the total investment scheduled between 1977 and 1986 the petrochemical division will be allotted 28.7% ($44,346MM) converting itself in the second most important activity within the Mexican petroleum -- industry. The years between 1977 and 1980 will be crucial for the - consolidation of the national Basic Petrochemical and, therefore, during those four years 61% of the mentioned investment will be applied, -- namely, $26,973 MM; and the capital goods (equipment which will be - outstanding within the purchases to be made during the period will be - compressors (11.9%), exchangers (11.4%), towers (5.8%), pumps (4.0%), furnaces (3.5%), boilers (3.5%), vessels (3.3%), turbines (2.5%). With respect to the materials, there will be a remarkable demand for the - items covering piping (10.7%), valves (7.8%), instrumentation (7.4%) - and electrical material (6.2%), as can be attested in the following listing:

MATERIALS & EQUIPMENT	ESTIMATED VALUE ($ MM)	PERCENTAGE
TOTAL PETROCHEMICAL	42,990,200•	100.0

MATERIALS & EQUIPMENT	ESTIMATED VALUE ($ MM)	PERCENTAGE
Compressors	5,104,371	11.9
Exchangers	4,891,732	11.4
Towers	2,489,804	5.8
Pumps	1,704,841	4.0
Furnaces	1,525,225	3.5
Boilers	1,484,580	3.5
Process Vessels	1,418,588	3.3
Turbines	1,086,375	2.5
Reactors	971,944	2.3
Special Equipment	825,327	1.9
Vessels	313,363	0.7
Cooling Towers	203,512	0.5
Tower Internal Parts	182,441	0.4
Water Treatment Plant	104,159	0.2
Blowers	100,908	0.2
Vessel Internal Parts	55,206	0.1
Internal Combustion Engines	33,120	0.1
Superheaters	7,628	-
Storage Tanks	2,475	-
Soloairs	192	-

MATERIALS & EQUIPMENT	ESTIMATED VALUE ($ MM)	PERCENTAGE
Ejectors	135	-
TOTAL EQUIPMENT	22,505,926	52.3
Piping	4,583,059	10.7
Valves	3,333,707	7.8
Instrumentation	3,193,228	7.4
Electrical Material	2,686,512	6.2
Fittings	1,974,573	4.6
Other	4,713,195	11.0
TOTAL MATERIALS	20,484,274	47.7

SOURCE: Subdirection of Economical Studies and Industrial Planning, - based on the desintegration of capital goods, realized by the Subdirection of Project Engineering. IMP.

o - This figure does not agree with the Resumé of Scheduled Investments for the acquisition of materials and equipment (see methodological - Note).

TRANSPORTATION AND DISTRIBUTION

This division will absorb 15.7% of the value of the materials and - equipment that the oil industry will require during the decennial. In-

DIAGRAM G .VI.8

SHEDULED INVESTMENTS FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE TRANSPORTATION SYSTEMS, 1977-1986

(*PERCENTAGES*)

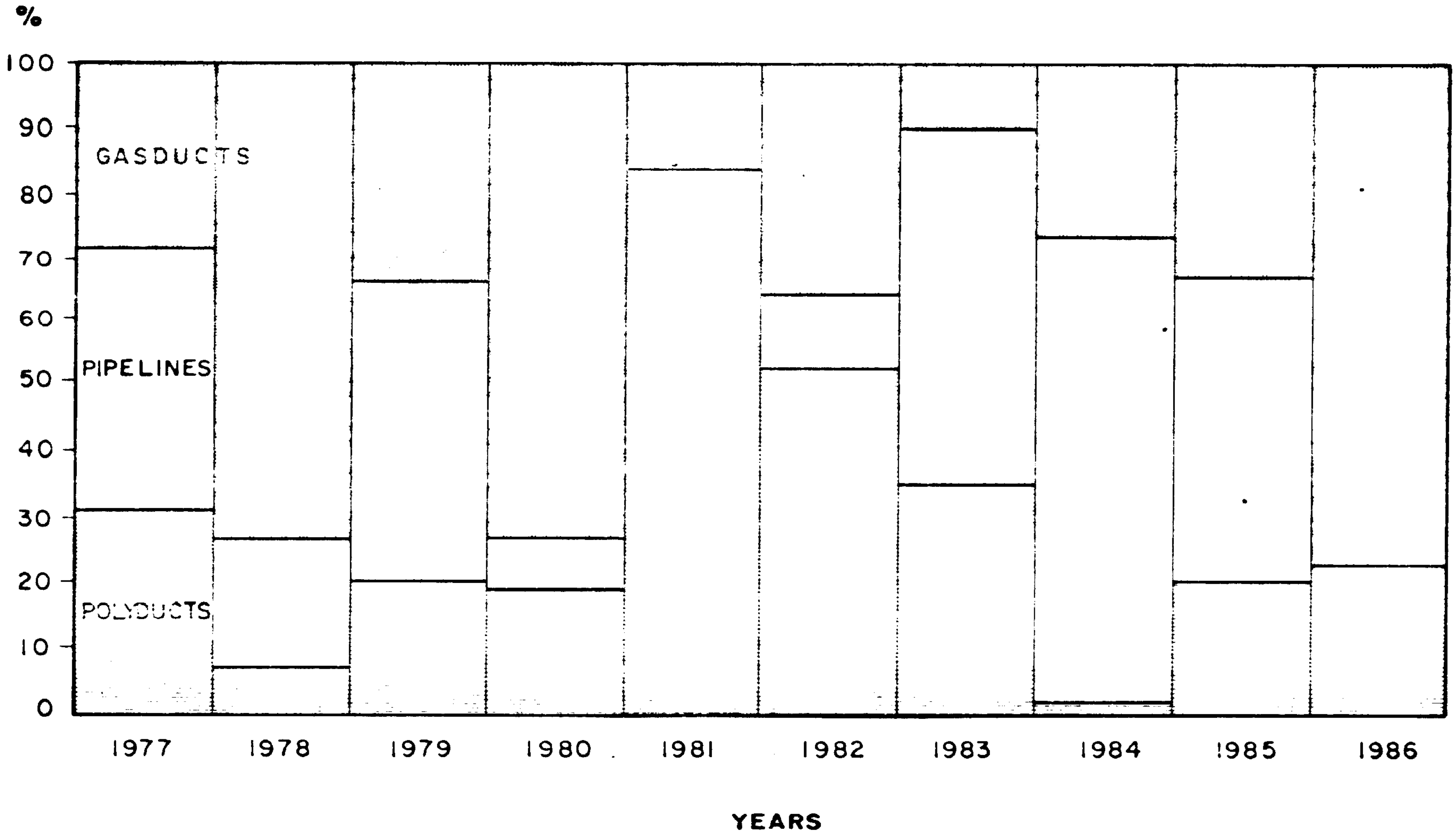


DIAGRAM G. VI. 9

SCHEDULED INVESTMENTS FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE POLYDUCT TRANSPORTATION SYSTEM, 1977-1986

(PERCENTAGES)

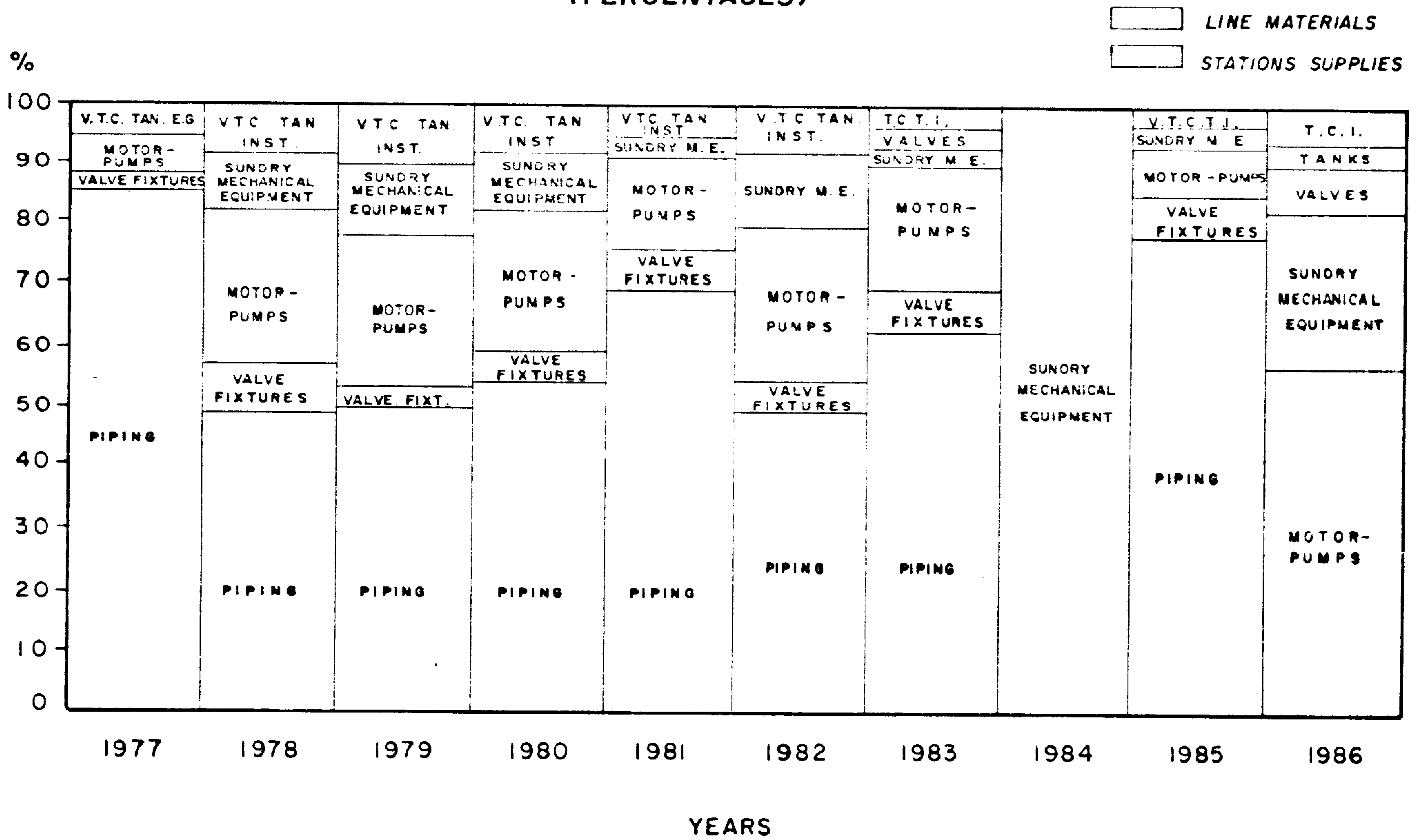


DIAGRAM G. VI. 10

SCHEDULED INVESTMENTS FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE GASODUCT TRANSPORTATION SYSTEM, 1977-1986

(PERCENTAGE)

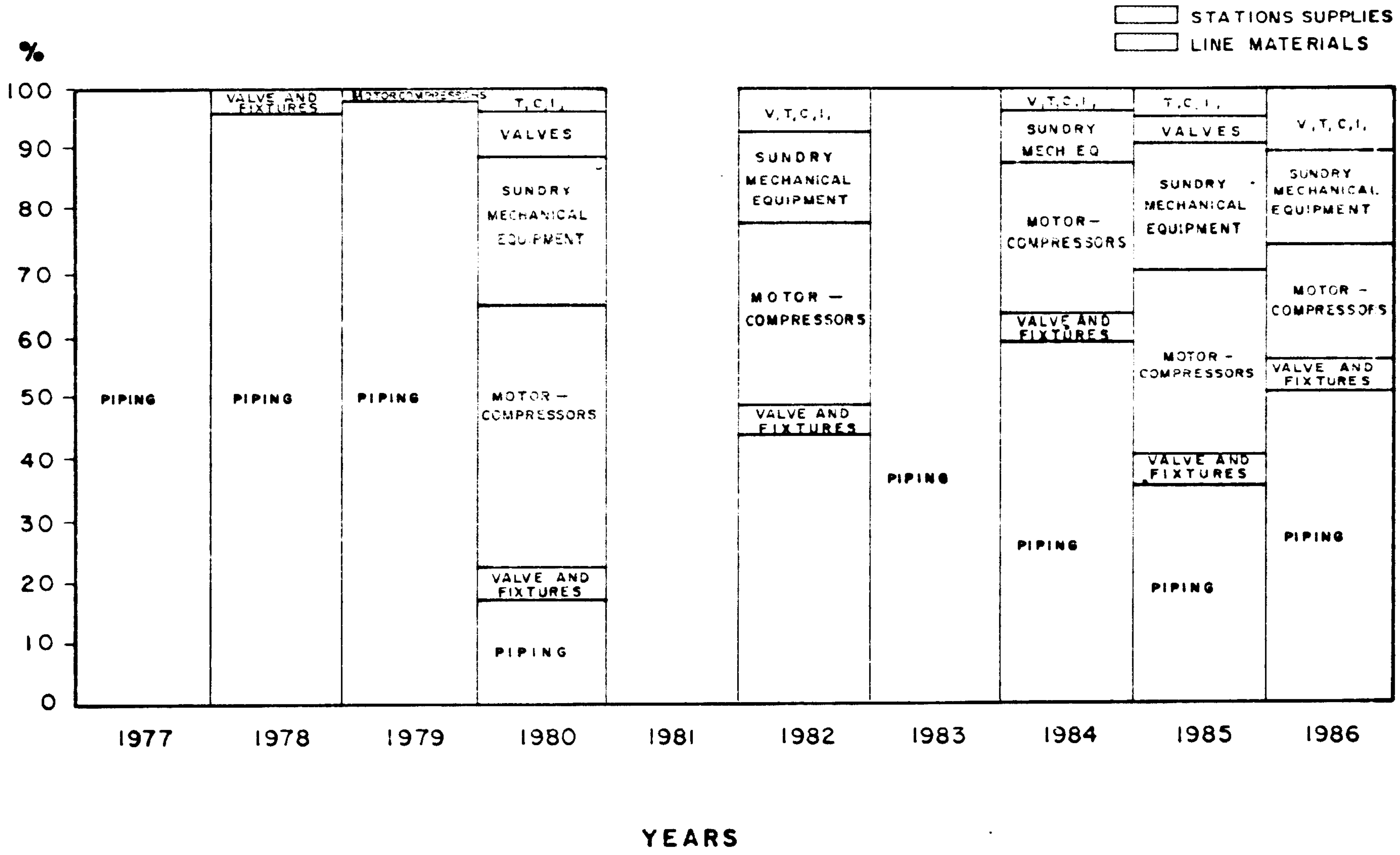


DIAGRAM G. VI. II

SCHEDULED INVESTMENTS FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE PIPELINE TRANSPORTATION SYSTEM, 1977-1986

(*PERCENTAGE*)

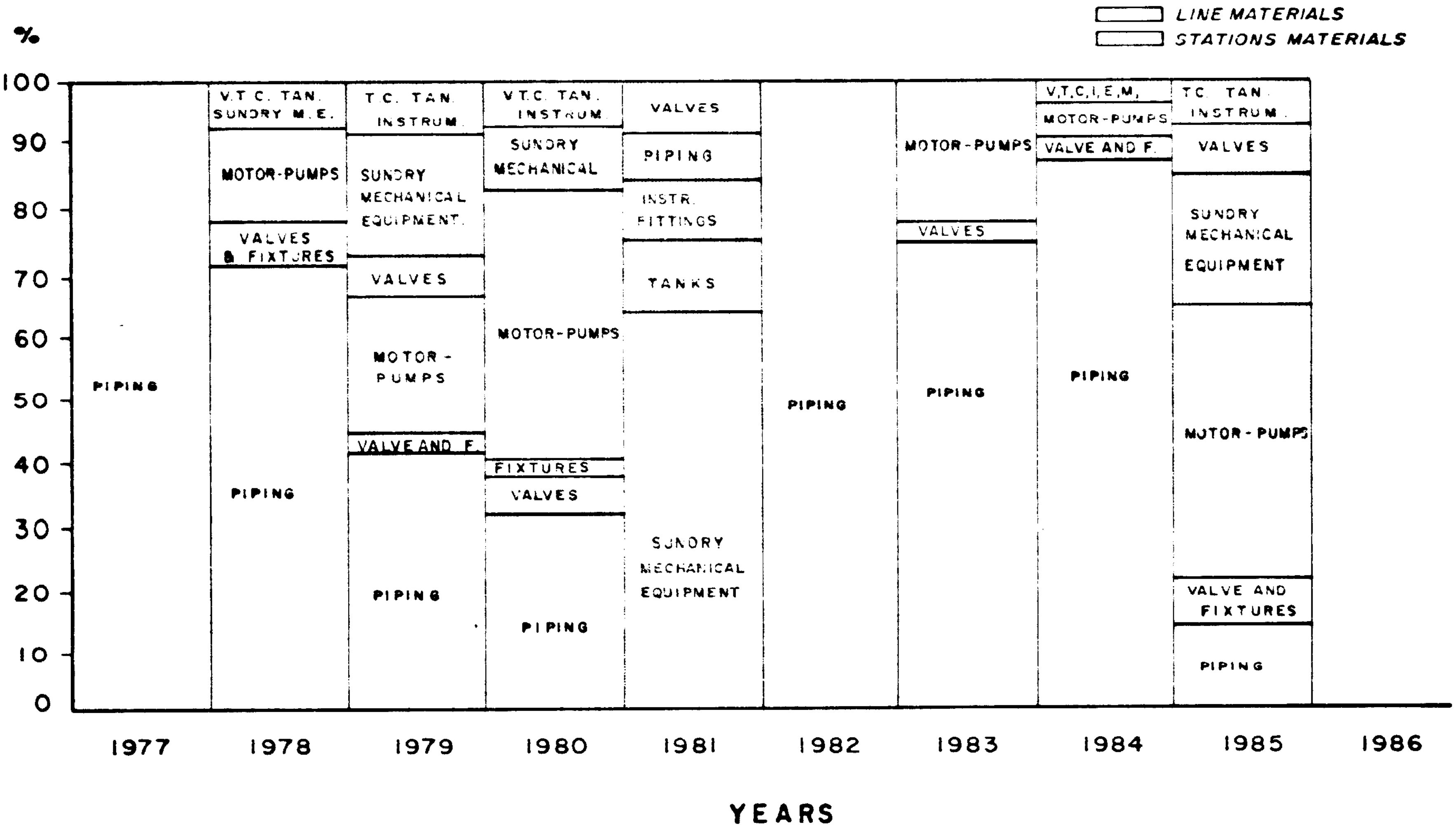
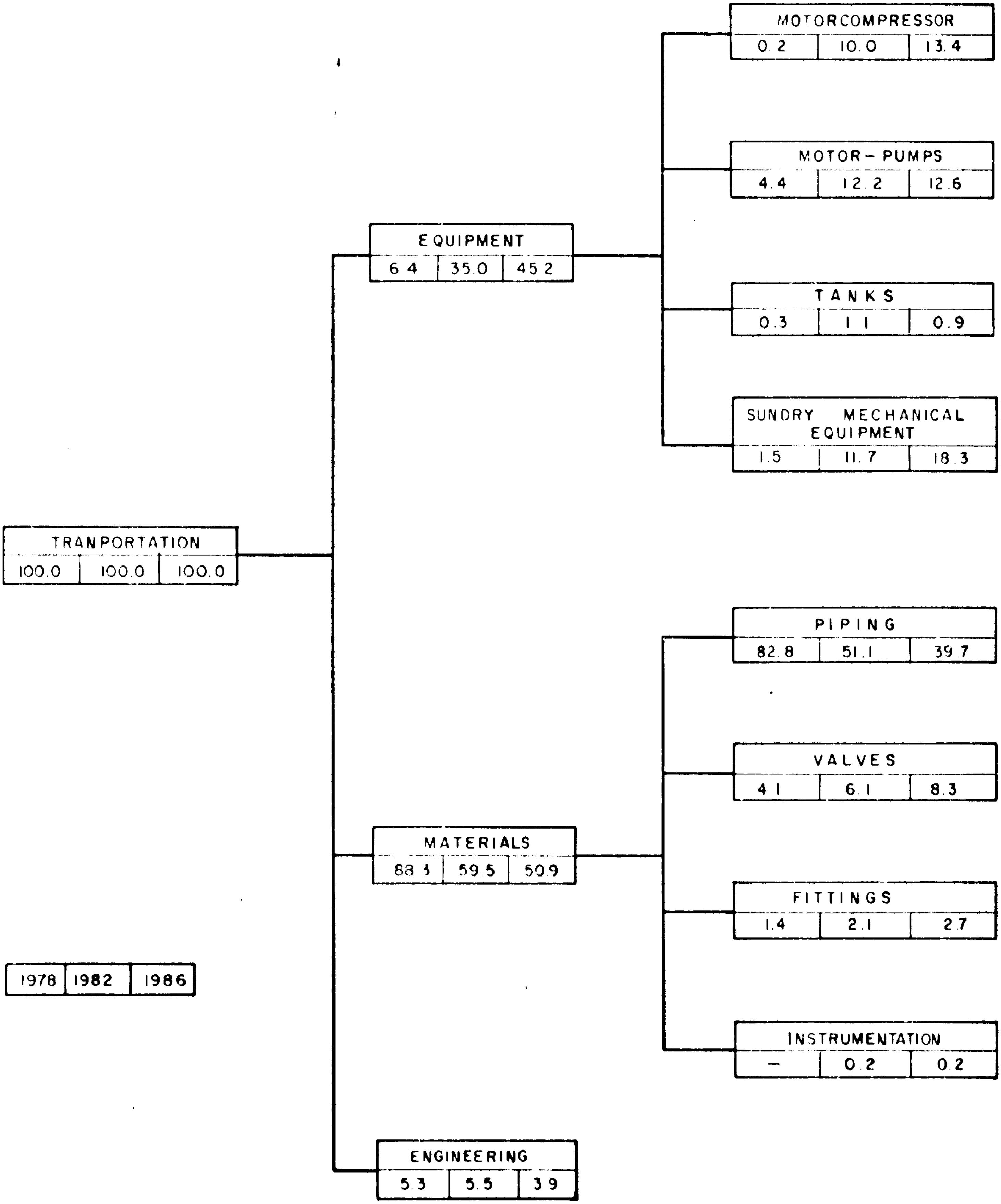


FIG. F. VI. 12

DISTRIBUTION OF THE EQUIPMENT, MATERIALS AND ENGINEERING FOR THE TRANSPORTATION SECTOR

(PERCENTAGES)



analyzing the estimated value of the materials and equipment that will be required for all pipeline systems, the most outstanding requirements correspond to gas pipelines ($13,284.9 MM) which means 52.4% of the total. However, this priority is determined by the National Trunk Gas System, which has been proyected from Cactus, Chiapas, to San Fernando,Tamps., in the coast of the Gulf of Mexico, and went to full swing during the - year of 1978. For this reason, the gas pipelines investments percentage variations run from 72.9% maximum in 1978 to 9.8% as minimum in 1983.

In second term is the investment in pipelines with an investment of - ($8,289.6 MM) representing 32.7% of the ten-year period investment, - with a yearly investment participation which goes from a minimum of 9.2% in 1980, to a maximum of 73.5% in 1984. Finally, the polyducts will represent 14.9% of the total expenditures for materials and equipment, and will participate in 1981 with 84.0% of the total investment, - and its minimum participation will be in 1984 with 0.7%.

In the ten-year analyzed period from 1977-1986, following is a resumé of the most important materials and equipment which will be required- by the Transportation and Distribution systems:

MATERIALS & EQUIPMENT	ESTIMATED VALUE ($ MM)	PERCENTAGE
A. TOTAL TRANSPORTATION AND DISTRIBUTION	24,330.8	100.0
B. GAS PIPELINES	12,635.8	51.9
1. Line Materials	9,754.2	40.1
a) Piping	9,244.2	38.0
b) Valves	384.9	1.6
c) Fittings	125.1	0.5
2. Stations Supplies	2,881.6	11.8
a) Motor-Compressors	1,584.6	6.5
b) Valves	246.4	0.9
c) Piping	86.5	0.4
d) Fittings	86.5	0.4
e) Instrumentation	8.9	-
f) Sundry Mechanical Equipment	868.7	3.6
C. OIL	8,103.6	33.3
1. Line Materials	5,538.6	22.8
a) Piping	5,212.6	21.5
b) Valves	255.2	1.0
c) Fittings	70.8	0.3
2. Stations Supplies	2,565.0	10.5

MATERIALS & EQUIPMENT	ESTIMATED VALUE ($ MM)	PERCENTAGE
a) Motor-Pumps	1,465.9	6.1
b) Valves	211.2	0.9
c) Piping	74.4	0.2
d) Fittings	74.4	0.2
e) Tanks	109.6	0.4
f) Instrumentation	7.5	-
g) Sundry Mechanical Equipment	622.0	2.7
D. PRODUCT PIPELINES	3,591.4	14.8
1. Line Materials	2,331.1	9.6
a) Piping	2,141.0	8.8
b) Valves	149.8	0.6
c) Fittings	40.3	0.2
2. Stations Materials	1,260.3	5.2
a) Motor-Pumps	719.2	3.1
b) Valves	104.2	0.4
c) Piping	36.4	0.1
d) Fittings	36.4	0.1
c) Tanks	53.8	0.2
f) Instrumentation	3.8	-
g) Sundry Mechanical Equipment	306.5	1.3

The scheduled investments for the acquisition of materials and equipment for the transportation systems during the period 1977-1986, clearly reveal that the estimated amounts for piping is one of the most outstanding items, and imply about an average of 70% for the items in question. During - this period, the highest figure corresponds to the year of 1978, due to- the investments allotted to National Trunk Gas System which constitutes one of the most important achievements accomplished by this division.- Second to piping, are the expenditures estimated for motor-pumps, - motor-compressors and valves and, in their respective order, are the most significant items covering the referred acquisitions.

Consequently, the fulfilment of these requirements represents for basic steel and metal-mechanical industries in general, a sizeable volume of business in the order of 24 thousand millions of pesos, which is the - sum estimated for the total acquisition of materials and equipment for this division which, next to the Exploitation Division, is the one to - whom has been assigned the largest scheduled investment during the -- present sixyear term (19.1%).

Following are attached a series of tabulations which show a resumé of the Total Investments for the Oil Industry and for each integrated division. Also shown are tabulations covering Invesments for Work Centers, Plants and for other types of lines. Finally, there are other - tabulations itemizing capital goods by familes, for each of the analized divisions.

VI.3 ENGINEERING REQUIREMENTS FOR PEMEX PROJECTS FOR THE PERIOD 1977-1986

The expansion programmed for the Mexican petroleum industry will - require during the period 1977-1986 an engineering expenditure totalling $7,356 millions of pesos, at prices which prevailed during 1977. - During that period, the engineering expenses will represent more or - less about 5% of the total investment in materials and equipment, and a noteworthy fact reveals that the engineering requirements are larger - during the first years for the period under study (56.6% of the total) - than in the rest of the years, this is due to the intense programmation of works for the Explotation, Refining, Petrochemical and Transportation and Distribution Divisions, considering that this program will signify - during those four years the 50% ($77,905 MM) of the total - scheduled investment for materials and equipment, namely, $154,736 - millions of pesos during the ten year period under study.

In analyzing the engineering services requirements, with regard to the various sections of the petroleum industry, there are some very interesting facts which occur during these ten years that are being analyzed.

The Petrochemical division is absorbing the largest portion for engineering expenditure, since it is demanding an average of 55.4 of the total, wich is equivalent to 4,079 millions of pesos, even though, there are some annual variations which oscillate between 43.4% and the 70.2% of the total engineering requirements for each year. The engineering expenditures represent the 2.6% of the total scheduled equipment and materials investment for the ten year period.

In second place we find the Refining Division with an average of 26.4% for the ten years period with (1.964 MM), and with variations which range from 12.4% to 48.8% annually. These expenditures expressed in terms of equipment and materials budget for the ten year period, will represent about 1.3%.

The Transportation and Distribution Systems will also absorb an average of 13.7% of the total engineering expenditure during the ten years, namely, $1,007 millions of pesos, which represent 0.7% in comparison with the estimated value of the equipment and materials.

It is interesting to note that the annual variations for Engineering expenditures run from 31.3% in 1978 to 2.9% in 1979 with respect to the total for each year, the reason is because in the year it comprises the construction of most of the National Trunk Gas System (From Cactus, in the State of Chiapas to San Fernando, in the State of Tamaulipas), while during the next year there are no important works scheduled. (1)

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(1) Unless it was decided to start the construction in 1978 of the section between San Fernando-Reynosa for the exportation of gas.

Finally, the Explotation Division will absorb 4.5% of the average Engineering expenditure during the period, wich is equivalent to $328 millions of pesos, which scarcely represent 0.2% of the accumulated value for equipment and materials.

1. MEASURES ADOPTED BY PEMEX-IMP WITH RESPECT TO PROJECT ENGINEERING.

It is indeed very important to note that in the concrete case of the Mexican Petroleum Industry, it possesses an 80% to 85% of the "know-how" requirements of detailed engineering; and that not withstanding the fact that there are still some deficiencies in their own technology -due to the rapid development of the public and private investment programs- it would not be advisable to try to develop all type of basic engineering parallel to the execution of the most urgent investments, considering that it is a well known fact that no country on earth is, -- or tries to be, totally self-sufficient and, in exchange, it is convenient to acquire a certain percentage of foreign "know-how", not only because it would be a rather expensive venture to try to internally develop this technology, but would also be detrimental for the progress of the works scheduled, and also because it permits us an actual knowledge with respect to new fundamental "know-how" techniques.

The Mexican Petroleum Institute (IMP) is a good example for this procedure, since it has deemed convenient to cotract the services of national and foreign engineering firms (of which, the Mexican Petroleum Institute will continue exert a more closely supervision) in view of the ever increasing number of projects that have been assigned to this institution.

The Mexican Petroleum Industry as of the year 1966, -when the Mexican Petroleum Institute was founded- has concentrated all its efforts to the development of its own technology as vouched by the processes covering primary vacuum refining, cryogenics, viscosity reduction, hydrodesulphuration, etc., and others like the Demex process, Ethylene process, isomerization process, reforming process, chemical treatment process, etc., and in the very near future Mexican technology for ammonia plants, and some process engineering required for offshore oil production.

As a general policy, a system has been adopted whereby it has been deemed advisable to acquire integral equipment for one single time, and eventually to be supplemented with partial spare parts purchases (until practically none), and finally, they will buy only those foreign items which cannot be profitably substituted, or wich are not produced within the country. As a corroboration of the above stated case, we can cite the polyethylene which has compelled Mexico to totally import the detailed engineering, since the "know-how" is not transferible. In accordance with this policy, Petroleos Mexicanos has been gradually increasing its access to foreign technology, and in a supplementary manner the Instituto Mexicano del Petróleo has augmented and substantially enhanced its basic technology, and leads the Mexican engineering firms whom, will be receiving a continued support from IMP, in order to nationally develop procedures and techniques required by the oil industry and the country in general.

México recognizes that the requirements for developing the Basic Engineering are in accordance of the ownership of the "know-how" and of the complexity of processes and three very clear situations are evident, namely:

a) Commonly known processes and whose calculations of procedures - can be developed by any group of specialists upon acquiring the -- Engineering Process "know-how" and designing the Basic Engineering required for such a process, taken from the ample and accessible existing literature.

b) Commonly known processes whose Basic Engineering can be elaborated by an engineering firm and which, consequently, can negotiate with licencing firms, in order to be able to design basic engineering owned by these firms.

c) Commonly known processes owned by third parties and that can be designed by capable firms, and besides, have established engineering groups for the development of Basic Engineering processes -- derived from their own technology.

Petróleos Mexicanos and the Instituto Mexicano del Petróleo have developed the "know-how' of several processes included in clause a), namely, fractional of liquefiables, absorption plants, cryogenic plants, distillation plants, atmospheric and vacuum plants, etc. In general terms, it is considered that the Instituto Mexicano del Petróleo is covering most of the commonly known and will be in condition of developing, in the very near future, other processes such as the sulphur plants, which will be of particular importance within a few years.

The "PEMEX-IMP MODEL" illustrates in a very clear manner, the relationship that should exist between the production company and the engineering firm, and could serve as example for the stablishment of similar production-research models for other national industrial activities -- such as Utilities, Steel, Fertilizers, Paper, Sugar, etc.

With reference to the second case, contained in clause (b), it might --- happen that the licencer of the process could be a company or a production enterprise who was able to develop this "know-how", and is willing to commercialize it, by transferring this technology to some other firm. It is also feasible that the ownership of the process is in the possession of a research and development firm, in which instance, the transferring of technology is seldom complete, since the licencer prefers to do the - Basic Engineering and leaves to the licencee the Detail Engineering. Notwithstanding the above fact, it is estimated that the Instituto Mexicano - del Petróleo (and other Mexican firms), will be in position to elaborate the Basic Engineering of certain processes, thereby transferring "know-how" to other companies.

Finally, the Instituto Mexicano del Petróleo covers in México such situations as described in clause (c), since it not only develops the technology, but also elaborates the Basic Engineering, as has been the case in - the DEMEX process (dismetallization of residuals), hydrodesuphuration -- of napthas, hydrodesulphurator of intermediate distillates, isomerization, etc.

Under the actual circumstances, the Instituto Mexicano del Petróleo will continue to augment the development of technologies, and based on this -- "know-how" will design, in close collaboration with its own experienced research and development and engineering groups; unfortunately, very -- little can be expected from other engineering firms, as long as this technological duality is absent.

Of the total Man/hours (H-H) dedicated to Project Engineering in México, the major amount corresponds to Detail Engineering who will be responsible, therefore, of the success or failure of the projects, as far as duration, cost and technical quality is concerned.

The other aspects which have a brilliant future in Detail Engineering for the oil industry, are the following:

- Priority will be given to piping design in scale models since, in - comparison with the traditional method (drawing of plans, in plant and elevation), has advantages such as the fact that it requires a smaller working area, less H-H, it facilitates the interpretation of engineering and construction phases, and facilitates the customer, the capacitation and training of its operators.

- The bibliography of computed programming will be enhanced for the calculation and designing of the various Detail Engineering disciplines, such as special foundations, equipment supporting structures, or offshore platforms, calculations for heat exchangers and its optimization, simulation of the behaviour of plants under operation, etc.

- In the area of Mechanization and Computation we will extend during the next few years, the design specialty by means of graphicators adapted to computers, especially for vessels, heat exachengers, -- foundations, structures, flow diagrams, localization plans, etc. In this form we will substantially reduce the drawing Man Hours.

- The general administration of the projects will be improved due to the accurateness of the information media relayed through critical paths, actualized Man Hour Reports, expenditures, engineering -- progress reports for each specialty, controls for the acquisition of materials and equipment, etc.

The Project Engineering field of action will be extended and diver sified to cover exploitation fertilizer and basic and secondary petrochemical projects, etc.

Through the Instituto Mexicano del Petróleo, México has increased its participation in international projects, especially in Latin América, by providing Mexican Technological Engineering and, in most cases, with the Instituto Mexicano del Petróleo own licence, such as the cryogenic processes, DEMEX, ammonia, etc.; we could offer complete engineering, construction and financing packages, upon contact with other firms or organizations.

- Priority will also be given to modulated plants since there is a considerable saving of engineering time, and also facilitates the acquisition of equipment and construction work. Such is the case of gas treatment plants, hydrodesulphurators, reformers and cryogenics.

- The technological interchange will be promoted with other domestic and foreign enterprises, in the area of Administration and Detail Engineering, in order to jointly acquire or realize new technologies, or jointly participate in project engineering works.

- The selling of technical services will be promoted for such areas as stress analyses, heat exchangers design, calculation of equipment, etc., which includes technical assistance up to the termination of the job and/or in some instance, the sale of computer programmation developed for calculation or drawing (isometric case).

- Methods and procedures will be established for the efficient coordination and administration of large projects, or multiprojects in various areas of the industry, as a result of the priority given by the Instituto Mexicano del Petróleo to Project Engineering.

- It is also expected that the IMP will, in a brief time, develop -- additional engineering for the fabrication of equipment, and will ask for bids for its fabrication, preferably, with national enterprises. This combination of engineering and domestic fabrication represents a considerable saving of project times since practically all the information will not have to depend from foreign fabricators, with the - exception in cases which are strictly indispensable.

- Another of the objectives of the Instituto Mexicano del Petróleo, is to accomplish the standardization in the construction of elements - such as piping arrangements, tank platforms and towers, piping supports, etc., in order to fabricate them within the country. In the same manner, it is estimated that the development of Project Engineering by the IMP will contribute to encourage the domestic fabrication of vessels and electrical equipment, as it will increase the use of automatic methods for the selection of head types and cla-- sses of materials, and also, through the selection of electrical --

equipment with a more significant degree of domestic integration.

- Depending on some external factors, the Instituto Mexicano del Petróleo will play a very important role in the normalization and standardization of electrical equipment, in order to diminish the great number of different spare parts and accesories, and will increase the volume to more profitable levels. For example, a careful examination of standards for the classification of areas, would increase the utilization of domestic made engines.

II. PROJECTS AND PROCESSES TO BE REALIZED BY PEMEX, AND ITS RELATIONSHIP WITH NATIONAL AND FOREIGN ENGINEERING.

WORKING LOCATION.	PROJECTS & PROCESSES.	COMPANY	ORIGIN:
Cadereyta, N. L.	Combined plant.	Atlas-Foster-Wheeler.	Foreign
	Merox plant.	Procesos de México.	Mexican.
	Auxiliar & Integral Services.	Bufete Industrial.	Mexican.
	Hydrodesulphuration of Naphthas.	I M P	Mexican
	Reformer of Naphthas.	I M P	Mexican
	Hydrodesulphurator of Intermediate Distillates.	I M P	Mexican

II. PROJECTS AND PROCESSES TO BE REALIZED BY PEMEX, AND ITS RELATIONSHIP WITH NATIONAL AND FOREIGN - ENGINEERING.

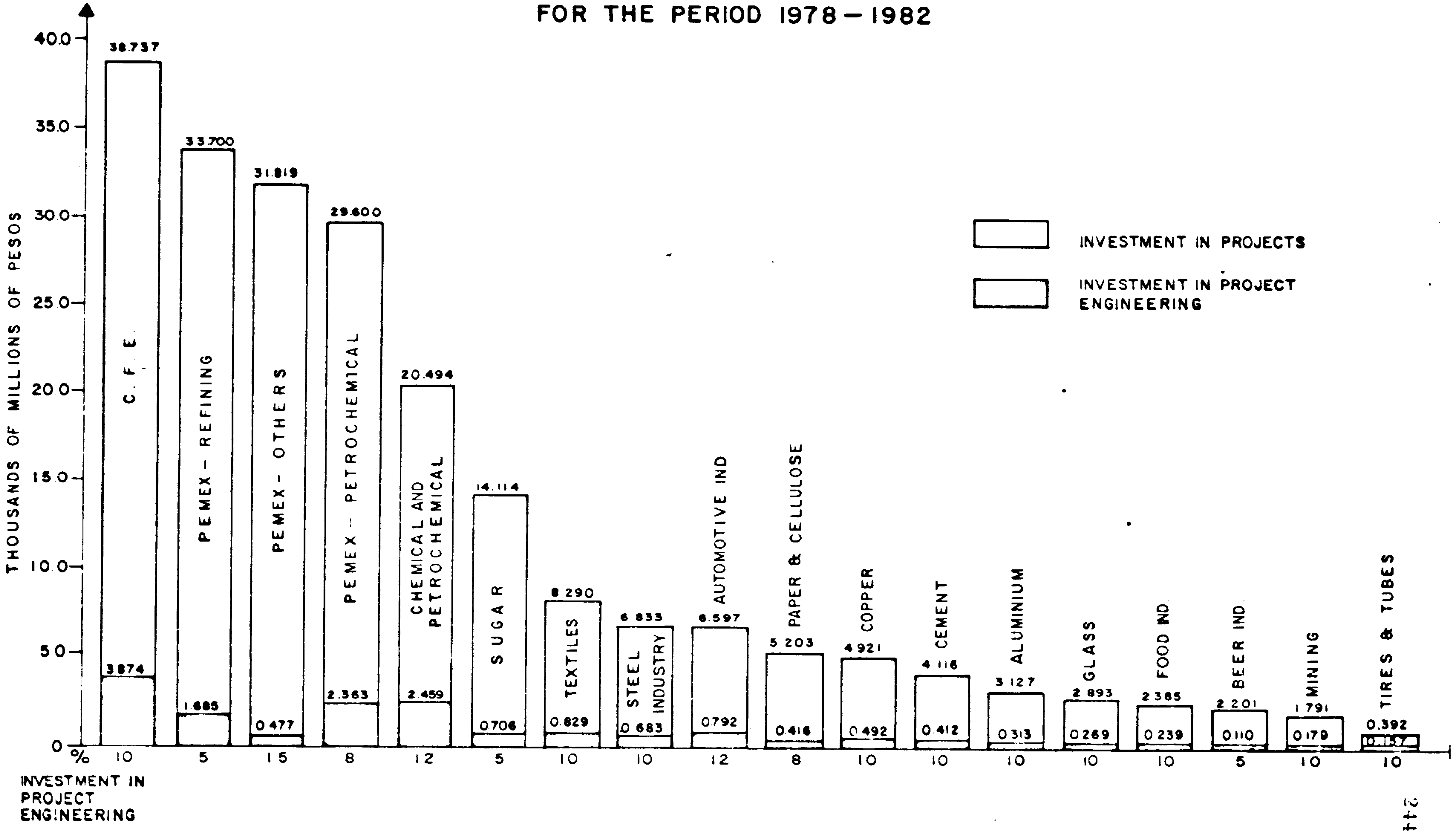
WORKING LOCATION.	PROJECTS & PROCESSES.	COMPANY	ORIGIN:
	Fractionation of Liquefiables	IMP	Mexican
	Common Area.	IMP	Mexican
	Combined Plant.	Procesos de México.	Mexican
	Catalytic FCC	Bufete Industrial.	Mexican
Cd. Madero, Tamps.	Hydrodesulphurator of Intermediate Prod. Pl.	IMP	Mexican
	Demex Process	IMP	Mexican
	Dismineraliz. Water Pl	IMP	Mexican
Salamanca, Gto.	Mod. Isopropanol Pl.	IMP	Mexican
	Hydrodesulf. Naphthas Plant.	IMP	Mexican
	Reformer Plant	IMP	Mexican
	Aux. Serv. (Power Plant)	IMP-PEMEX	Mexican
Tula, Hgo.	Acrilonitrile Pl.	NIIGATA	Ext.
	Acrilonitrile Purif.	IMP	IMP
Salina Cruz, Oax.	(Identical to Cadereyta, With the exception combined Pl., Instead Gasoline Treatment Pl. (Foreign - Technology) IMP occupies first place).		

II. PROJECTS AND PROCESSES TO BE REALIZED BY PEMEX, AND ITS RELATIONSHIP WITH NATIONAL AND FOREIGN - ENGINEERING.

WORKING LOCATION.	PROJECTS & PROCESSES.	COMPANY	ORIGIN:
Cangrejera, Ver.	Polyethyelene Plant.	(Indefinite)	Ext.
	Aromatics	Fluor	Ext.
	H. C. Fractional.	IMP	Mexican
	Ethylene Plant.	IMP	Mexican
	Hydrodesulf. Naphthas.	IMP	Mexican
	BTX Reformer.	IMP	Mexican
	Styrene, Ethylbence Pl.	IMP	Mexican
	Recup. of Hydrocarb. Liq.	IMP	Mexican
	Effluent Treatment.	IMP	Mexican

GRAPH. 6. VI. 12

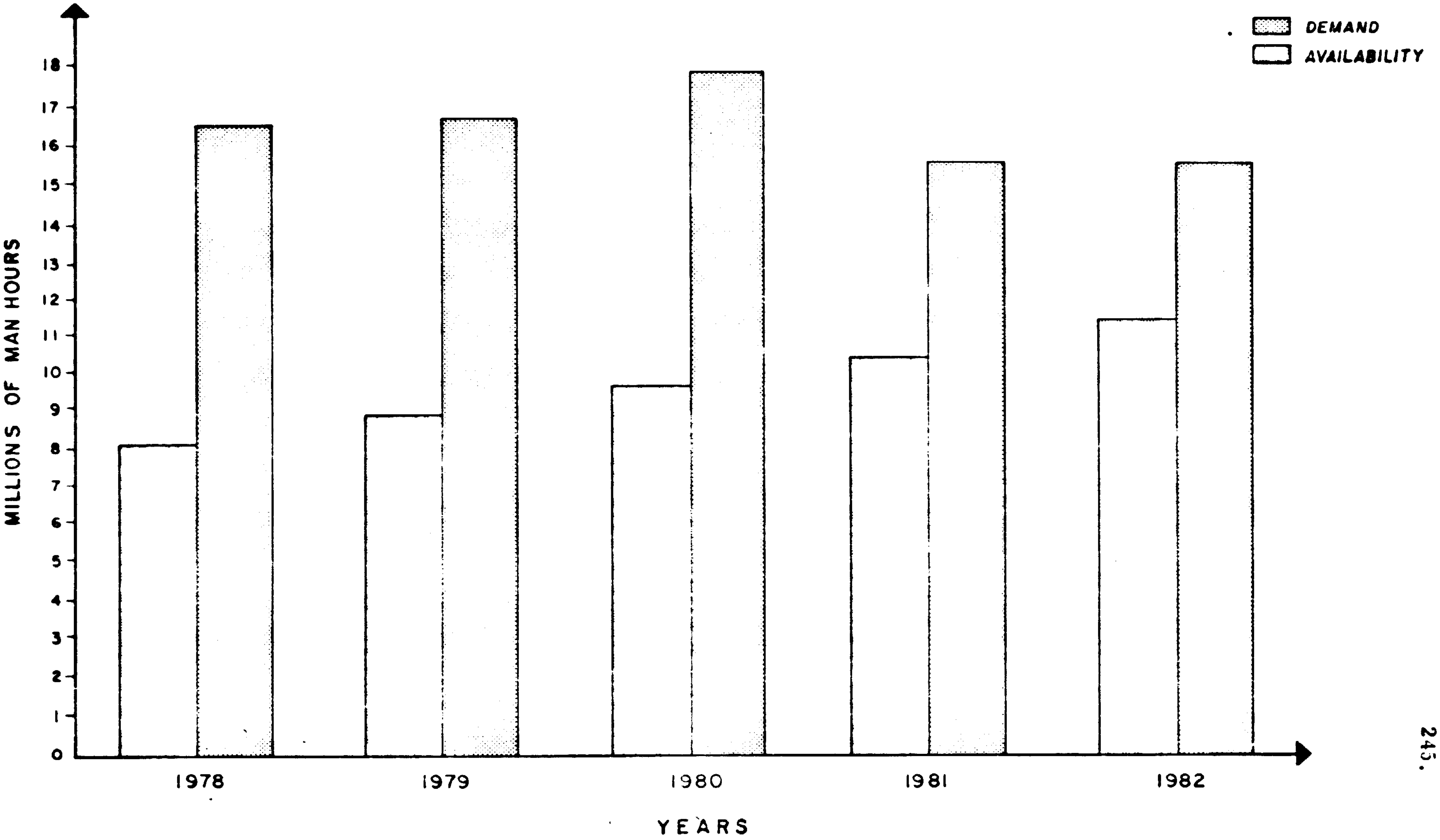
ESTIMATE OF INVESTMENT IN INDUSTP'AL PROJECTS FOR THE PERIOD 1978 – 1982



NOTA : SOME DATA COULD BE SUBJECT TO VARIATIONS IN 1978, DUE TO MODIFICATIONS IN OFFICIAL AND/OR PRIVATE SCHEDULING, BUT GENERALLY SPEAKING IT IS CONSIDERDED VALID.

GRAPH. 6 VI. 13

DEMAND AND AVAILABILITY OF MAN HOURS OF PROJECT ENGINEERING FOR THE INDUSTRIAL SECTOR, 1978-1982.



VI.4 DEVELOPMENT OF THE AUXILIARY INDUSTRIES TO THE OIL INDUSTRY.

One of the conditions for developing the industry of capital goods is the recognition of the prioritary sector of investments. In support of this statement is the fact that the capital goods consumed in México are channeled to the public sector and, consequently, by following a comprehensive acquisitions policy, we could build-up an efficient promotion for the internal production of these goods.

The basical oil and petrochemical industry covers one of the most important sectors, and dependant on the efficient and timely scheduling of its acquisition of materials and equipment, as well as the - permanent communication with manufacturing sources, it is deemed necessary to give a considerable impetus to the internal fabrication of such vital elements. Therefore, it is up to this sector to outline a pilot program promoting the internal fabrication of capital --- goods, by programming acquisitions, and this model could be followed by the rest of the public sector industries.

In view of the close relationship existing between the investment and the demand of capital goods, the itemized schedule of investments by Pemex for estimated acquisitions is a basical document that enables manufacturers to schedule their production, and constitutes an important asset in achieving the rationalization of the demand requi red for the public sector through its policy for acquisitions.

The timely demand of materials and equipment is a significant purchasing asset which will become a true guiding instrument for developing the capital goods industry, provided the institutional agencies can work out, in close cooperation with the fabricators, production agreements based on the magnitude of the estimated investments for all kinds of equipment and materials, this would contribute to a more extensive participation of the fabricators with the industry, and consequently, would improve their efficiency, not only in terms of quality but price as well; delivery terms, and even more, in diversifying production.

It is interesting to note the relation that exists between capital -- goods (or of investment) with goods produced by the metalmechanical industry in general, and for this reason, there is a close and direct relationship with project investments for the corresponding sectors. The estimated period of investment of the oil industry for a ten-year period is of the order of 154,735.7 millions of pesos, for materials and equipment and, in general terms, are representative of the metal-mechanical contribution to this industry, with a few -- exceptions[1]. Said investment includes the amounts assigned to

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[1] The value of the purchases for piping constitutes one of the exceptions, since these are provided by the basical steel industries (group 35, CMAE).

the various branches of the basical oil and petrochemical industries. After understanding the important role played by the metalmechanical industry within the national problematic of capital goods, its contribution to diminish the commercial deficit is most significant, in view of the heavy importations that have been made in order to meet the local requirements.

In essence, the effective support to the auxiliary industries of Pemex, this is accomplished after the calendarization of capital goods and intermediate estimates for the oil industry in future years, as correlated in the present study, and after the selection of equipment and materials which in consideration to its importance and requirements during the period being surveyed, can be qualified as authentic needs that must be taken care by the domestic industry.

In the itemization which follows, we offer a recapitulation of the calculated requirements during the ten-year period under study for the industry, and which are covered in the break-downs for each one - of the four sectors of the industry, which are the matter of this -- study. After a careful examination, your first observation will be that the estimated investment for materials exceeds the one corresponding to equipment: 58.3% against 41.7% respectively; also, you will note the notorious participation of the piping in the listings of total acquisitions, followed by valves and fittings, compressors, -

drilling equipment and heat exchangers.

Supplementing the aforementioned statements, and as per the data contained in the graphics listing acquisitions, the equipment and materials were classified in industrial groups and as per their origin, with the primary intention of identifying the requirements with the corresponding specific manufacturing activity, and it was discovered that in most of the cases, the equipment and the materials that will be required during the next few years, are classified under Groups 34 and 36; in other words, the basical metallic industry and the - fabrication of non-electrical machinery, averaging 34 and 57% respectively, or the equivalent of $ 132,478.4 millions of pesos.

The Mexican Catalogue of Economical Activities (CMAE) classifies the industrial activities in the following manner:

GROUP 34 - BASICAL METALLIC
GROUP 35 - METALLIC PRODUCTS
GROUP 36 - NON-ELECTRICAL MACHINERY
GROUP 37 - ELECTRICAL MACHINERY

I. SCHEDULED INVESTMENTS FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE PETROLEUM INDUSTRY, 1977-1986.

(MILLIONS OF PESOS OF 1977)

ITEM	1977-1986	%
DRILLING EQUIPMENT.	13,334.7	8.7
COMPRESSORS. (°) (1)	13,262.3	8.7
HEAT EXCHANGERS. (°) (2)	7,615.0	5.0
PUMPS. (°) (3)	5,584.5	3.7
TOWERS.	3,343.4	2.2
EQUIPMENT FOR REPAIRS.	2,840.0	1.9
FURNACES.	2,527.1	1.6
BOILERS.	2,419.2	1.6
PROCESS VESSELS.	2,060.8	1.4
SUNDRY MECHANICAL EQUIPMENT.	1,797.2	1.1
TURBINES.	1,758.1	1.1
SPECIAL EQUIPMENTS.	1,669.9	1.1
REACTORS.	1,640.2	1.1
SEPARATORS.	1,095.5	0.7
STORAGE TANKS.	931.6	0.6
VESSELS.	459.2	0.3
TOWER INTERNAL PARTS.	448.3	0.3
COOLING TOWERS.	321.6	0.2
SPECIAL VESSELS	182.6	0.1
WATER TREATMENT PLANTS.	164.5	0.1
BLOWERS.	158.6	0.1
STEAM RECOVERY.	121.7	0.1
SOLOAIRES.	90.1	---
VESSELS INTERNAL PARTS.	57.7	---
INTERNAL COMBUSTION ENGINES.	46.7	---
EJECTORS.	12.4	---
SUPER-HEATERS.	8.3	---
TOTAL EQUIPMENT.	64,001.2	41.7
PIPING. (4)	49,381.0	32.2
VALVES AND FITTINGS. (4)	15,508.2	10.1
DRILLS.	5,636.0	3.7
INSTRUMENTATION.	5,250.7	3.4
ELECTRICAL MATERIAL.	4,291.4	2.8
CONCRETE WORK.	1,610.3	1.1

I. SCHEDULED INVESTMENTS FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE PETROLEUM INDUSTRY, 1977-1986.

(MILLIONS OF PESOS OF 1977)
(Continued)

ITEM	1977-1986	%
OTHERS	7,667.6	5.0
TOTAL MATERIALS.	89,345.2	53.3
GRAND TOTAL.	153,346.4	100.0

(°) (1) - Includes motor-compressors.
(2) - Includes auxiliary services equipment.
(3) - Includes motor-pumps.
(4) - Includes Exploitation, Drilling and Casing Piping.

II. DISTRIBUTION OF THE ESTIMATED INVESTMENT IN ACQUISITIONS OF EQUIPMENT AND MATERIALS PER BRANCH OF ACTIVITY, --- 1977-1986.

(MILLIONS OF PESOS OF 1977)

ITEM	GROUP 35	GROUP 36	GROUP 37	TOTAL:
DRILLING EQUIPMENT.		13,384.7	---	13,384.7
COMPRESSORS.	---	13,262.3	---	13,262.3
HEAT EXCHANGERS.	---	7,615.0	---	7,615.0
PUMPS.	---	5,584.5	---	5,584.5
TOWERS.	3,343.4	---	---	3,343.4
EQUIPMENT FOR REPAIRS.	---	2,840.0	---	2,840.0
FURNACES.	---	2,527.1	---	2,527.1
BOILERS.	---	2,419.2	---	2,419.2
PROCESS VESSELS.	2,060.8	---	---	2,060.8
SUNDRY MECHANICAL EQUIPMENT.	---	1,797.2	---	1,797.2
TURBINES.	---	1,758.1	---	1,758.1
SPECIAL EQUIPMENTS.	---	1,669.9	---	1,669.9
REACTORS.	---	1,640.2	---	1,640.2
SEPARATORS.	1,095.5	---	---	1,095.5
STORAGE TANKS.	931.6	---	---	931.6
VESSELS.	459.2	---	---	459.2
TOWERS INTERNAL PARTS.	448.3	---	---	448.3
COOLING TOWERS.	321.6	---	---	321.6
SPECIAL VESSELS.	182.6	---	---	182.6
WATER TREAT--MENT PLANT.	---	164.5	---	164.5
BLOWERS.	---	158.6	---	158.6
STEAM RECOVERY.	---	121.7	---	121.7
SOLOAIRES.	---	90.1	---	90.1
VESSELS INTERNAL PARTS.	57.7	---	---	57.7
INTERNAL COMBUSTION ENGINES.	---	46.7	---	46.7
EJECTORS.	---	12.4	---	12.4
SUPERHEATERS.	8.3	---	---	8.3
TOTAL EQUIPMENT.	8,909.0	55,092.2	---	64,001.2

II. DISTRIBUTION OF THE ESTIMATED INVESTMENT IN ACQUISITIONS OF EQUIPMENT AND MATERIALS PER BRANCH OF ACTIVITY, --- 1977-1936.

(MILLIONS OF PESOS OF 1977)
(Continued)

ITEM	GROUP 34	GROUP 35	GROUP 36	GROUP 37	TOTAL
PIPING.	49,381.0	---	---	---	49,381.0
VALVES & FITTINGS.	---	---	15,508.2	---	15,508.2
DRILLS.	---	---	5,636.0	---	5,636.0
INSTRUMENTATION.	---	---	5,250.7	---	5,250.7
ELECTRICAL MATERIAL.	---	---	---	4,291.4	4,291.4
CONCRETE WORK.	---	---	1,610.3	---	1,610.3
TOTAL MATERIALS.	49,381.0	---	28,005.2	4,291.4	81,677.6
GRAND TOTAL.	49,381.0	8,909.0	83,097.4	4,291.4	145,678.8

SOURCE: SUBDIRECTION OF ECONOMICAL STUDIES AND INDUSTRIAL PLANNING, BASED ON THE DISINTEGRATION OF CAPITAL GOODS PER FAMILIES PERFORMED BY THE SUBDIRECTION OF PROJECT ENGINEERING. IMP.

NOTE: THE ITEM "OTHERS" IS NOT INCLUDED IN VIEW THAT IT REFERS TO MATERIALS THAT DO NOT AFFECT THE CORRESPONDING ACTIVITIES OF CAPITAL GOODS INDUSTRY.

VI.5 CONCLUSIONS AND RECOMMENDATIONS.-

I. CONCLUSIONS.

- The most important aspects of the oil policy during the next few years are the following:

a) The drilling activities will be intensified to such an extent, that the Exploitation Division will absorb, during the six-year term, the largest scheduled investment for the period;

b) The duplication of the petrochemical production capacity, will permit this sector of the oil industry to -- effect some exportations, once the internal demand - has been sufficed;

c) Maintaining self sufficiency of refined products, in view of the expansion of installed capacity and based in efficient and profit-wise considerations signifies - the capitalization of good procedures and systems; - and

d) The unusual increase of the scheduled investments - for basical transportations such as the Trunk Line - of the National Gas System which is the most impor tant project developed by the sector.

- The petroleum industry is of vital importance due to the -- amount of capital goods and intermediate purchases which it realizes in the domestic as well as foreign markets; for this reason, the calendarization of the demand of estimated --- equipment and materials during the coming years, will be - instrumental towards the development of the local supplying of these items. The demand of capital goods and intermediates (equipment and materials) for the petroleum industry is of the order of 153,346.1 millions of pesos during the period 1977-1986. The most important sectors which form - part of this industry are Exploitation, Petrochemical, Refining and Basical Transportation, which is reflective of the design tendency to be followed during the present decennial.

— The petroleum industry will realize exceedingly high purchases of capital and intermediate goods; its annual acquisitions vary between 7,921 and 28,055 thousands of millions of pesos, and the equipments and materials whose outlook is most significant for the national industry as far as value and regular demand is concerned are the following: Drilling equipment; Equipment for repair work, motor-compressors, -- heat exchangers, furnaces, turbines, towers, boilers, pumps among other equipments, and with respect to materials the following items stand-out as most important: Piping for all sectors; particularly the casing used in exploitation, next - are drills, valves and fittings and instrumentation.

- The engineering expenditures estimated for the ten year period which is the matter of this study, amount to $ 7,356 -- millions of pesos. This covers the total projects scheduled; for this reason, the Petrochemical and Refining Divisions -- absorb more than 80% of the total dedicated for this purpose. It is very interesting to note that the engineering expense - not only for the period above, but also, for each year, represent an average of 5% of the equipment and materials investment, with slight variations.

- The most significant aspects of petroleum engineering for the comming years are: a) Special design of materials; b) extensive utilization of computer programming and computational techniques for calculations and designs of the 'different engineering specialties, which will be translated into a considerable saving of man hours; c) More efficiency in the general administration of the projects; d) Diversification and expansion of the project engineering field of work; e) Special attention will be given to the designing of modular plants which, in additon to the savings involved, will lead to the standardization of the equipments, that is a positive factor for the development of capital goods industry.

II - RECOMMENDATIONS

- It is necessary to plan in a permanent manner, the Schedule of Acquisitions for equipments and materials required by the petroleum industry for the completion of the proposed goals for each investment plan. As a matter of fact, this programmation requires a maximum breack-down covering equipments and materials for its proper identification and to being instrumental in controlling the demand, and for the development of domestic fabrication of capital goods.

- The "PEMEX-IMP PATTERN", which is composed of a production enterprise and a research and engineering firm is a highly - recommendable alternative for the rest of the sectors of economical activity, mainly for those with priority A-1.

- The most relevant characteristics that are foreseen in the near future for the petroleum engineering, are the implementation of certain - - advisable measures, such as the disposition to the change in the - - organization of the work, which will result in a more efficient factor. These changes will be motivated by the continued innovation of better techniques in design, in computer methods, technical assistance and participation in international projects where we could offer our own "know-how" or the appliance of techniques that have come our way in technological interchanges, etc.

CHAPTER VII. ACTUATING PROGRAM FOR VIGORIZING THE NATIONAL CAPACITY OF BASICAL, DETAIL AND DESIGN ENGINEERING.

VII.1 INTRODUCTION

In the previous chapters we analyzed the manner in which Project Engineering[o] has been a determining factor of the origin and conditions as to how the required capital goods are acquired by the petroleum industry, as well as the foreseen acquisitions for the decade 1977-1986.

In view of the importance of Project Engineering in the demand of capital goods in the national economy and with special emphasis, in the oil, gas and basical petrochemical sectors, it was deemed necessary to suggest a graphic depicting economical policies in order to promote and develop Project Engineering which would, eventually, set solid bases for favouring the development of the industries producing capital goods.

This third chapter was prepared with the purpose of establishing the bases for the design and implementation of an Actuating Program for vigorizing the National Capacity of Basical, Detail and Design Engineering by means of three principal instruments.

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[o] BY PROJECT ENGINEERING IT IS UNDERSTOOD: BASICAL, DETAIL AND DESIGN ENGINEERING, NOT INCLUDING PROCUREMENT SERVICES NOR THE ENGINEERING ADMINISTRATION.

ECONOMICAL POLICIES (1) FOR DEVELOPING THE BASICAL, DETAIL AND DESIGN ENGINEERING

FISCAL MEASURES

FINANCIAL ASSISTANCE

CAPACITATION OF HUMAN RESOURCES

However, before specifying the importance of each one of these instruments, it is necessary to establish an itemized graphic depicting and analyzing the problem referring to the Development of the National Engineering Capacity.

Until recently, the joint action that the Federal Government had adopted in relation to capital goods, special emphasis was dedicated to the quantitative aspects, in other words, it is convenient to expand the production capacity and schedule the demand, etc., but we also require the diagnosis of the qualitative aspect or the engineering contex required by capital goods.

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(1) The concepts which have been analyzed in this chapter were adopted in three Round Tables organized by IMP-NAFINSA-ONUDI, namely:

I.- "FEDERAL GOVERNMENT SUPPORT FOR THE DEVELOPMENT OF PROJECT ENGINEERING". (28-IV-78);

II.- "FINANCIAL ASSISTANCE FOR THE DEVELOPMENT OF PROJECT ENGINEERING". (8-V-78);

III.- "CAPACITATION POLICIES OF HUMAN RESOURCES FOR VIGORIZING THE NATIONAL CAPACITY OF ENGINEERING" (12-V-78)

There are two fundamental reasons which give to that qualitative aspect or engineering context, its own basical features with regard to the production of capital goods: Firstly, everything that has been expressed in relation to the technical progress in general, for example, the incorporation of fundamental technological innovation in capital goods. Consequently, if a country wishes to fully develop capital goods, but does not jointly adopts the necessary measures in behalf of the increasing of the designing capacity, what then happens is a quantitive development but without any qualitative merits to associate with this sector. The development of the capital goods industry without any parallel development of design capacity is equivalent, to a certain extent, to the development of a customs metallic industry: Metals are melted; casted pieces are machined or dropforged, and boilershop activities are developed: but conception is not characteristic in this development.

The package of features which are designed for developing the engineering capacity will be clearly established in the next four vital assets:

1. The inter-relation of Project Engineering Supply-Demand.
2. The identification of the different aspects which participate in this relation as far as Supply-Demand is concerned.
3. The recognition of the different types of engineering which are involved in Project Engineering, and
4. The aggregated instruments that are essential for vigorizing

those types of engineering which are closely related to Supply-Demand.

With reference to the Supply-Demand, particularly in Latin America, the Supply aspect has been emphasized. Technological Councils are developed, as well as Research Institutions, scholarships are granted for foreign technical capacitation, master degrees are created, etc., in synthesis, great strides are made toward the potential capacitation for developing engineering; unfortunately, shortly afterwards, all these - instrumentation of knowledge becomes silent in the research centers, - many doctors return to their countries to realize activities completely different to their specialty, etc., therby, this potential for the creation of engineering is diluted.

The experience shows, frequently, the demand of the employers of this potential capacity to design they usually turn their eyes towards other countries, for reasons which are evident and comprehensive; therefore it is necessary to exert a strong action in behalf of engineering demand in other words, the concerns who demand this engineering deserve our stimulus in behalf of their internal technical requirements.

This affects the public and private sectors, the international market, etc., and it is imperative to identify the different aspects which - - participate in this relation as far as Supply-Demand is concerned, It is very important to differentiate the behaviour of these aspects in order to develop the adecuate instruments for the specific circumstance pertaining to each one of them. With regard to the offer of technology, there are many reasons why manufacturing concerns prefer to develop their own technology or acquire same in foreign countries. Other specific problems would be the ones referring to engineering firms, research centers and universities, the importation of technology as a source of supplies, thus creating transference regulations problems, etc.

Any general treatment is necessarily limited with regard to practical effects and results, thus anyone of the different problems affecting the aspects related to Supply-Demand, must be discussed on the basis of an interpretative analysis.

With reference to the third aspect, namely, the recognition of the different types of engineering which are involved in Project Engineering, the problem consists in the need of differentiating the typical problems of a Basical Engineering, with regard to those relative to Detail - - Engineering or to one referring to Manufacturing. Finally, in this case of the fabrication techniques in plants producing capital goods, there are enormous differences to the production of consumption goods; - therefore, that separation by types of problems is vital for the - - implementation of supporting elements to favour the development of the national capacity of engineering.

Finally, with reference to the fourth aspect or aggregated instruments, it must be pointed out that the solution does not depend on just one aspect, namely, the fiscal measures, or manufacturing techniques, or financial assistance, or promotion instruments such as the establishments of regulations covering "know-how" transference rights, patents and trade-marks, foreign investment, etc., but the basical articulation of the aggregated instruments involved.

It is under this perspective that we must fully integrate the development of the qualitative phase of the Mexican industry of capital goods.

It is evident that this work is more embrionary than formal, at the present time, and therefore it is not possible to recognize the full terms of the problem that imply capacitating the national engineering and to set the most elemental bases of fiscal, financing and capacitation instruments for the improvement of human resources; however, it will be necessary to count with the assistance of the representatives of the using enterprises of the public and private sector, of engineering firms, research centers, universities, etc., to form a paramount decision group, for the integration and implementation of a concrete program covering Engineering in its different aspects, and in accordance with the national project for favouring the production of capital goods.

VII.2 FISCAL MEASURES

One of the most critical problems for Mexico as of the next four years, which coincides with the extraordinary growth of the petroleum and petrochemical industries and it accompanying surplus of monetary resources derived from the exportation of petroleum and gas, consists in the imperative need of establishing a series of fiscal measures which will support, in an effective manner, not only the general aspects of the market and marketing to which capital goods and its spare parts will be subjected in their transactions, but also raw materials, supplies and components, that will favour the development of productive processes containing national growth aggregates, especially in terms of project engineering.

Reduce, in a continued effort, the importation of equipment and materials required by the petroleum industry, has been a constant preocupation; however, due to the accelerated increase of the investments of Petroleos Mexicanos, and of the urgent construction of some plants during the last years, the percentage of importations has increased considerably; therefore, it is necessary take whatever measures are deemed necessary to reduce to the minimun all foreign importation of plants and its accesories.

The fiscal measures suggested could create dispositions making it compulsory for the industry to buy equipments, parts and components fabricated in the country, provided the quality and price as well as delivery date were satisfactory; other measures could tend to the - reduction of the budget balance of payments covering engineering for research and fabrication, as well as processing engineering for - investment projects; also, flexible yet strict fiscal steps are required which will permit the elimination of the Mexican acquisitions of the foreign purchases of packaged plants.

In the specific field covering the capital goods purchases, an attempt could be made to realize a selection of different rates of - - - - "accelerated depreciation" to be granted to enterprises who acquire capital goods produced within the country. Another possibility would be a special fiscal treatment, even though, in general we are aware of the fact that the importation tariffs for capital goods is extremely low, and, additionaly a subsidy up to 75% can be obtained of - - importation duties. However, the handling of this policy has often been a serious handicap for the development of national capital goods industry, due to the real market reduction of the Mexican fabricators, and sometimes the users of equipments argue that "certain changes" in the technological characteristics make the equipment "radically - different" to the one produced locally, thus their preference to import the equipment. Another supporting element for the development of the industrial production of capital goods, via fiscal stimulus, are the

Decrees on Industrial Descentralization and Stimulus, Assistance and Facilities (23-XI-71 and 19-VII-72 SIC) as well as the Decree of Fiscal Stimulus to the Fabrication of Capital Goods (3-III-78. SHCP).

One of the conditions which require immediate attention, is the one which refers to the differentiation between a public and a private project, since the treatment which both received are different; such is the case of private concerns who find it practically impossible to obtain importation permits for capital goods whose fabrication does not exist in the country. Many examples similar to the ones stated above are very common within the processing industries where margins of 80 to 90% of local fabrication exist. In contrast, the mining industry and the paper are exceedingly variable in the local content of capital goods. In the case of private engineering firms, the action of the CEDIS (CERTIFICATES OF RETURNED TAXES FOR EXPORTATION) has been a good incentive for the exportation of capital goods made by those project engineering firms, thus favouring the expanding production capacity of the industrial plants, and increasing the technological phase, etc.

In recent years there existed a joint venture system between national and foreign enterprises, who were exempted from paying the 42% in the purchase of foreign "know-how". It is evidently impossible to substitute foreign technology completely; therefore, it is very important to define the achievements of the works and the type of participation of the foreign firms; so they could associate themselves with similar national concerns, and in this manner absorb foreign technology and develop it locally.

Another type of fiscal incentives in Mexico, is the one which refers to Resolution 101-165 (3-III-78) of the Treasury Department, who has been granting fiscal stimulus on a trial basis during the year of 1978, for the fabrication of capital goods (machinery, equipment, parts and basical components, including special tools; devices, matrixes and molds). Also, there is a fiscal protection on the importation of capital goods that are not produced in the country, and special incentives are granted to the production of capital goods which are intended for strategic sectors of the national economy. Essentially, the intention is to favour the national fabrication of capital goods and intermediates; as well as fiscally favouring those producing units who acquire capital goods of national origin.

The referred stimulus can be resumed in the following benefits for the fabricators of capital goods:

a) The 75% of the ad valorem quota specified in the General Importation Impost Tariff, originated by machinery and equipment not produced in the country or locally under unacceptable conditions as to price, quality and delivery terms, and which are intended for the productions of capital goods. This subsidy can be up to

100% in the case of enterprises who are fabricating priority capital goods, provided that:

a.1) The favoured enterprise will channel a minimum of 1% of income for net annual sales to research, and technological adaptation and development.

a.2) The enterprise exports significant amounts of its production.

b) Up to 100% of General Imports Taxes imposed on staple raw materials, parts, and components required by capital goods industries, when not produced or insufficiently or inefficiently produced (quality, prices, delivery terms) in the country.

c) Up to 75% of net Federal Gross Receipts Taxes imposed on priority capital goods, manufactured in the country.

d) 15-20% of Overall Corporate Income Tax, imposed on companies manufacturing capital goods and deemed as recently incorporated under the terms of the Industrial Decentralization Act (19-VII-72 S.I.C.) or meeting the needs of strategic economic sectors, (mining, - metallurgics, energy, staple petrochemicals) not met as yet.

e) Autorization to apply accelerated depreciation rates for income tax payment purposes on investments in machinery and equipment - specially when made to manufacture priority capital goods.

On the other hand, incentives to capital goods users will benefit from the following:

a) Users of domestically produced capital goods may depreciate then acceleratedly on preferential rate bases.

TABLE T.V. 1-A

STUDIED PROJECTS SUMMARY

REFINERY PLANTS.

PROJECT	NAME	SITE	CAPACITY (BPD)	FOREIGN BASIC ENGINEERING	NATIONAL BASIC AND DETAIL ENGINEERING	1966-1971 FIRST ERA	1972-1977 RECENT ERA
1048	NAPHTHA REFORMING PLANT	TULA, HGO.	30 000	X			X
1053	VISBREAKING PLANT	TULA, HGO.	41 000	X			X
1045	COMBINATION UNIT	TULA, HGO.	150 000		X		X
1047	NAPHTHA HYDRODESULFURIZATION PLANT.	TULA, HGO.	36 000		X		X
1066	KEROSENE HYDRODESULFURIZATION PLANT.	TULA, HGO.	25 000		X		X
1069	GASOIL HYDRODESULFURIZATION PLANT.	TULA, HGO.	25 000		X		X
1050	TREATING/FRACTIONATING PLANT	TULA, HGO.	15 000		X		X
1072	UTILITIES	TULA, HGO.			X		X

TABLE T.V. 1-B
STUDIED PROJECTS SUMMARY
PETROCHEMICAL PLANTS.

PROJECT	NAME	SITE	CAPACITY	FOREIGN BASIC ENGINEERING	NATIONAL BASIC AND DETAIL ENGINEERING	1966-1971 FIRST ERA	1972-1977 .RECENT ERA
5999	ETHYLENE	PAJARITOS, VER.	183 000 T/A	X		X	
6113	ETHYLENE	POZA RICA, VER.	183 000 T/A	X			X
1085	ETHYLENE	CANGREJERA, VER.	500 000 T/A	X			X
6417	CRYOGENICS	LA VENTA, TAB.	175 MMPCD	X		X	
1041	CRYOGENICS	POZA RICA, VER.	275 MMPCD		X	X	
1083	CRYOGENICS	CACTUS, CHIS.	500 MMPCD		X		X

TABLE T.V. 2

SPECIALIZATION DISTRIBUTION AND ACADEMIC DEGREES FROM THE PROFESSIONAL PERSONEL OF THE PROJECT ENGINEERING BRANCH.

	STUDENTS	LICENTIATE	MASTER	DOCTOR	TOTAL
ARCHITECT	3	11			14
ACCOUNTANT	3	1			4
ARCHITECT ENGINEER	3	3			6
INDUSTRIAL ENGINEER	3	4			7
CIVIL ENGINEER	17	54	5	2	78
ELECTRICAL ENGINEER	8	7			15
ELECTRONICS ENGINEER	10	16			26
ELECTRICAL/MECHANICAL ENGINEER	2	14			16
MECHANICAL ENGINEER	42	45	2		89
CHEMICAL ENGINEER	43	136	8		187
LAWYER IN ADMINISTRATION BUSINESS	2	2			4
CHEMIST	2				2
INDUSTRIAL CHEMIST ENGINEER	8	37			45
LAWYER IN INDUSTRIAL DESIGN		1			1
ELECTRONICS/COMMUNICATION ENGINEER	1				1
PETROLEUM CHEMIST ENGINEER		1			1
TOPOGRAPHER ENGINEER	1				1
TOTAL	148	332	15	2	497

TABLE T.V. 3-A

NATIONAL AND FOREIGN PARTICIPATION IN THE ENGINEERING OF PROJECTS REFINERY PLANTS.

ITEMS		PROJECT							
		1045 %	1047 %	1048 %	1050 %	1053 %	1066 %	1069 %	1072 %
I.M.P. ENGINEERING	SALARIES	59	60	55	61	59	61	61	62
	MATERIALS AND EXPENSES	12	12	11	10	10	12	11	10
	INDIRECT EXPENSES	29	28	25	29	27	27	28	28
	I.M.P. TOTAL	100	100	91	100	96	100	100	100
FOREIGN ADVISORY	PAYABLE EXPENSES								
	TECHNOLOGY TRANSFER FEES			9		4			
	TAXES								
	TOTAL FOREIGN ADVISORY			9		4			
ENGINEERING TOTAL COST		100	100	100	100	100	100	100	100

TABLE T.V. 3-B

NATIONAL AND FOREIGN PARTICIPATION IN THE ENGINEERING OF PROJECTS PETROCHEMICAL PLANTS.

ITEMS		PROJECT						
		5999 %	6417 %	6423 %	6113 %	1041 %	1083 %	1085 %
I.M.P. ENGINEERING	SALARIES	23	30	33	33	61	60	39
	MATERIALS AND EXPENSES	5	5	5	8	10	10	7
	INDIRECT EXPENSES	13	18	18	14	29	26	17
	I.M.P. TOTAL	41	53	56	55	100	96	61
FOREIGN ADVISORY	PAYABLE EXPENSES	38	22	21	8		1	1
	TECHNOLOGY TRANSFER FEES	13	17	15	29		2	36
	TAXES	8	8	8	8		1	
	TOTAL FOREIGN ADVISORY	59	47	44	45		4	37
ENGINEERING TOTAL COST		100	100	100	100	100	100	100

TABLE T.V. 4-A

MAN-HOUR USED IN THE DETAIL AND BASIC ENGINEERING FULFILMENT.

REFINERY PLANTS.

PROJECT	NAME	CAPACITY (BPD)	NATIONAL BASIC ENGINEERING M-H	NATIONAL DETAIL ENGINEERING M-H	BEGINNING DATE
1045	COMBINED UNIT TULA, HGO.	150 000		238 200	JUNE 1971
1047	NAPHTHA HYDRODESULFURIZATION PLANT TULA, HGO.	36 000	8188	67 500	OCTOBER 1971
1048	NAPHTHA REFORMING PLANT TULA, HGO.	30 000		84 400	FEBRUARY 1973
1050	TREATING/FRACTIONATING PLANT, TULA, HGO.	15 000		82 500	FEBRUARY 1973
1053	VISBREAKING PLANT, TULA, HGO.	41 000	7671	127 000	AUGUST 1972
1066/69 *	HYDRODESULFURIZATION PLANTS, TULA, HGO.	25 000	6809	94 400	SEPTEMBER 1972
1072	FACILITIES TULA, HGO.			133 500	APRIL 1973

* *Capacity is unitarian but detail and basic engineering M-H are cumulated.*

TABLE T.V. 4-B

MAN-HOUR USED IN THE DETAIL AND BASIC ENGINEERING FULFILMENT

PETROCHEMICAL PLANTS

PROJECT	NAME	CAPACITY	NATIONAL BASIC ENGINEERING M-H	NATIONAL DETAIL ENGINEERING M-H	BEGINNING DATE
5999	ETHYLENE PLANT *Pajaritos, Ver.*	183 000 T/A		533 000	FEBRUARY 1966
6417	ETHANE AND LIQUEFIED HYDROCARBONS RECOVERY PLANT *La Venta, Tab.*	175 MMSCFD		113 100	MARCH 1968
6423	ETHANE AND LIQUEFIED HYDROCARBONS RECOVERY PLANT *Pajaritos, Ver.*	200 MMSCFD		125 400	AUGUST 1968
6113	ETHYLENE PLANT *Poza Rica, Ver.*	183 000 T/A		265 900	OCTOBER 1972
1041	ETHANE AND LIQUEFIED HYDROCARBONS RECOVERY PLANT *Poza Rica, Ver.*	275 MMSCFD		205 300	FEBRUARY 1970
1083	ETHANE AND LIQUEFIED HYDROCARBONS RECOVERY PLANT *Cactus, Chis.*	500 MMSCFD		240 000	SEPTEMBER 1973
1085	ETHYLENE PLANT *La Cangrejera, Ver.*	500 000 T/A		496 500	MARCH 1973

TABLE T.V. 5-A
ENGINEERING COSTS OF PROJECTS (M.O.D.)*
REFINERY PLANTS.

AMOUNTS IN THOUSAND PESOS

SPECIALITY	1045	1047	1048	1050	1053	1066	1069	1072
PROJECT	3154	809	1032	694	1533	630	392	3397
PROCESS	1616	53	251	502	141	98	9	57
PROGRAMMING AND COSTS	861	241	362	270	469	205	119	82
MECHANICAL ENGINEERING	299	149	183	190	240	124	53	122
RECIPIENTS	888	470	470	652	353	412	121	122
PIPELINES	5865	1308	1371	1544	3389	1312	799	2245
INSTRUMENTATION	1813	564	1024	1056	987	370	361	750
ELECTRICAL ENGINEERING	1253	8	5	1	697	5	1	2412
CIVIL ENGINEERING	1512	514	521	793	887	278	100	1046
ARCHITECTURE	175	0	0	0	50	0	0	173
PURCHASES	610	434	431	329	374	419	353	312
ADMINISTRATION AND SERVICES	1240	414	566	399	668	319	251	840
ACCOUNTING	305	61	113	70	150	56	17	29
STRENGTH ANALYSIS	1014	398	545	388	695	396	309	189
HEAT TRANSFER	47	286	348	240	188	184	165	107
TOTAL	20652	5709	7222	7128	10821	4808	3050	11883

* COSTS UP TO DECEMBER 1977.

TABLE T.V. 5-B
ENGINEERING COSTS OF ?ROJECTS (M.O.D.)*
PETROCHEMICAL PLANTS.

AMOUNTS IN THOUSAND PESOS

SPECIALITY	1041	1083	6417	6113	5999	1085
PROJECT	4695	3796	1198	5034	5970	9707
PROCESS	1376	1396	39	371	2312	642
PROGRAMMING AND COSTS	1066	569	183	564	1441	955
MECHANICAL ENGINEERING	756	1042	237	747	891	755
RECIPIENTS	801	871	385	1511	1827	2570
PIPELINES	7485	5974	2621	5872	9081	13546
INSTRUMENTATION	2470	1346	656	1510	3093	4396
ELECTRICAL ENGINEERING	1447	916	753	1775	1860	1870
CIVIL ENGINEERING	2391	1628	1264	2186	3078	3358
ARCHITECTURE	218	242	138	64	371	254
PURCHASES	669	712	344	870	1205	889
ADMINISTRATION AND SERVICES	1583	925	806	1466	2171	1554
ACCOUNTING	385	101	105	138	394	116
STRENGTH ANALYSIS	1264	617	510	978	1611	1964
HEAT TRANSFER	46	1039	270	48	1057	1333
TOTAL	26652	21174	9509	23134	36362	43909

* COSTS UP TO DECEMBER 1977.

TABLE T.V. 6-A
TOTAL COST OF PROJECTS
REFINERY PLANTS.

		1045	1047	1048	1050	1053	1066/69	1072*
NATIONAL ENGINEERING	$	16840	5012	6763	6225	9212	7015	11437
	%	3.7	2.3	2.8	3.7	4.9	2.8	11.1
FOREIGN ENGINEERING	$			653		438		
	%			0.3		0.2		
NATIONAL MATERIAL AND EQUIPMENT	$	131535	50235	39317	52581	45220	61366	
	%	29.0	22.8	16.2	31.7	23.8	24.6	
FOREIGN MATERIAL AND EQUIPMENT	$	78148	55319	102902	39017	35602	92942	
	%	17.2	25.2	42.4	23.4	18.7	37.3	
CONSTRUCTION	$	205963	98341	84772	62476	89516	79754	83577
	%	45.3	44.7	34.9	37.5	47.2	32.0	80.9
MANAGEMENT	$	21956	10967	8397	6233	9919	8195	8250
	%	4.8	5.0	3.4	3.7	5.2	3.3	8.0
TOTAL	$	454442	219874	242804	166532	189907	249272	103264
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0

AMOUNTS IN THOUSAND PESOS.

* MATERIALS AND EQUIPMENT COSTS OF PROJECT 1072 ARE DISTRIBUTED IN PROJECTS 1047, 1048, 1050, 1066 AND 1069.

TABLE T.V. 6-B

TOTAL COST OF PROJECTS

PETROCHEMICAL PLANTS

		5999	6113	1085	6417	6423	1041	1083
NATIONAL ENGINEERING	$	24186	19670	61000	5990	6446	20176	27058
	%	6.0	3.0	3.0	6.9	6.3	5.7	2.6
FOREIGN ENGINEERING	$	35428	16327	38344	5414	5004		1243
	%	8.8	2.5	1.8	6.2	4.9		0.1
NATIONAL MATERIAL AND EQUIPMENT	$	93970	133997	450000	23979	27977	72378	153900
	%	23.2	20.4	21.4	27.5	27.0	20.4	15.0
FOREIGN MATERIAL AND EQUIPMENT	$	52413	128630	800000	19671	17515	102075	615600
	%	13.0	19.6	38.0	22.5	17.0	28.7	60.2
CONSTRUCTION	$	161852	322840	623600	24536	37382	144005	194900
	%	40.1	49.8	29.6	28.1	36.3	40.5	19.1
MANAGEMENT	$	36075	35197	130000	7732	8740	16709	30800
	%	8.9	5.3	6.2	8.8	8.5	4.7	3.0
TOTAL	$	403924	656661	2105944	87322	103064	355343	1023501
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0

AMOUNTS IN THOUSAND PESOS.

MEXICAN PETROLEUM INSTITUTE
CAPITAL GOODS STUDY
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TABLE T.V. 7

NAME AND SITE OF PROJECTS.

1041	CRYOGENICS PLANT	POZA RICA, VER.
1045	COMBINED UNIT	TULA, HGO.
1047	NAPHTHA HYDRODESULFURIZATION PLANT	TULA, HGO.
1048	NAPHTHA REFORMING PLANT	TULA, HGO.
1050	TREATING/FRACTIONATING PLANT	TULA, HGO.
1053	VISBREAKING PLANT	TULA, HGO.
1066	KEROSENE HYDRODESULFURIZATION PLANT	TULA, HGO.
1069	GASOIL HYDRODESULFURIZATION PLANT	TULA, HGO.
1072	FACILITIES	TULA, HGO.
1083	CRYOGENICS PLANT	CACTUS, CHIS.
1085	ETHYLENE PLANT	LA CANGREJERA, VER.
5999	ETHYLENE PLANT	PAJARITOS, VER.
6113	ETHYLENE PLANT	POZA RICA, VER.
6417	CRYOGENICS PLANT	LA VENTA, TAB.

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY
TABLE T.V. 8
CONTRIES ORIGIN OF ACQUIRED CAPITAL GOODS

GER	GERMANY
CAN	CANADA
DEN	DENMARK
FRA	FRANCE
ENG	ENGLAND
IRE	IRELAND
ITA	ITALY
JAP	JAPAN
MEX	MEXICO
SWI	SWITZERLAND
USA	UNITED STATES
NET	NETHERLANDS

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY
TABLE T.V. 9
MONEY ORIGIN OF ACQUISITIONS.

01	MEX	PESOS
02	USA	DOLLARS
03	FRA	FRANCS
04	ITA	LIRES
05	ENG	POUNDS
06	JAP	YENS
07	GER	MARKS
08	CAN	DOLLARS
09	SWI	FRANCS
10	NET	FLORINS

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY

TABLE T.V. 10

CAPACITY UNIT

01	TONVAP/HR
02	KCAL/HR
03	FT 2
04	MTS 3/HR
05	MTS 3
06	BHP
07	HP
08	BTU
09	FT3/HR
10	MMBTU/HR
11	IN
12	LB/HR
13	TON
14	KVA
15	FT
16	FT3
17	MTS
18	BBL/DAY

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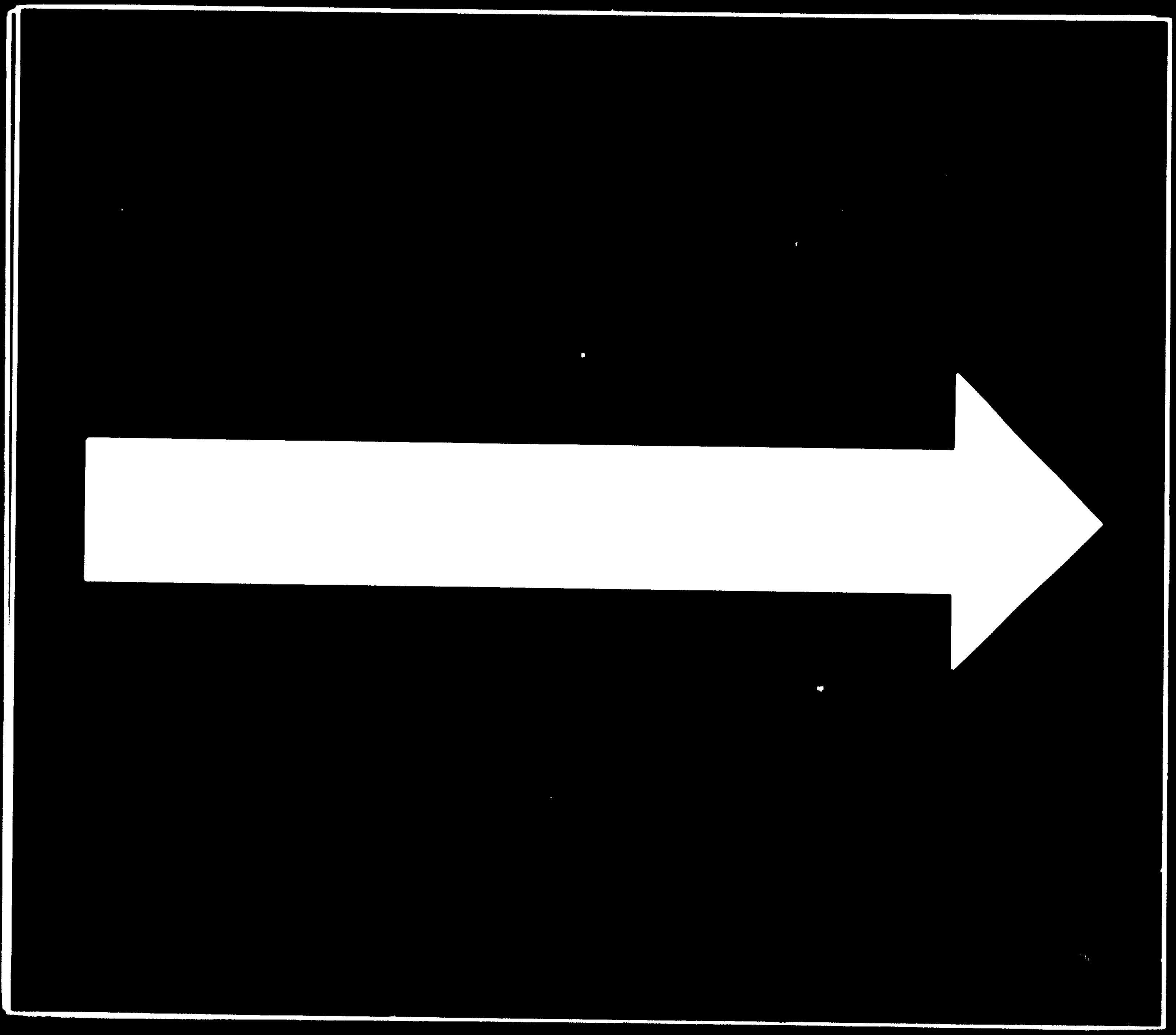

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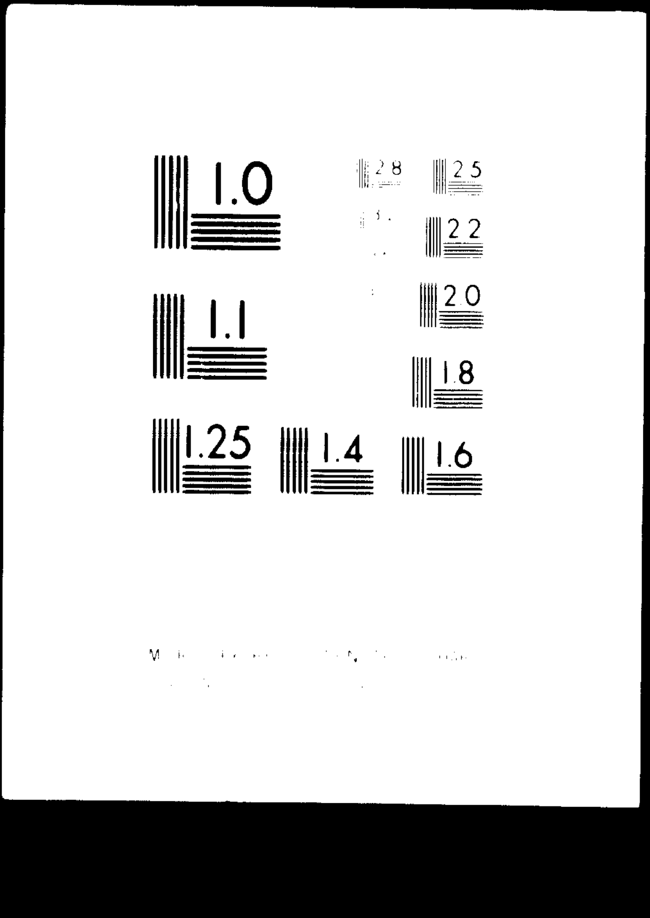

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MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY

TABLE T.V. 11

CAPITAL GOODS

BA	FURNACES
BG	WATER TREATMENT EQUIPMENT
BH	DESUPERHEATER
CA	BOILERS
DA	TOWERS
DB	TOWER INTERNALS
DC	REACTORS
EA	EXCHANGERS
EB	BLOWERS
EC	AIR COOLERS
EE	EJECTORS
EG	DEAEREATORS
FA	PROCESS VESSELS
FB	STORAGE TANK
FD	VESSEL INTERNALS
FF	GAS DRYER
GA	PUMPS
GB	COMPRESSORS
GC	TURBOEXPANSIVE
GD	SHAKERS
GE	GENERATORS
GM	MOTORS
GT	TURBINES
HA	PIPES, PIPING
HB	VALVES
HC	JOINTS
JB	STRUCTURAL STEEL
KA	INSTRUMENTS
MA	FIRE EXTINGUISHERS
NA	SUBSTATIONS
NB	TRANSFORMERS
NC	ELECTRICAL MATERIAL
PA	SPECIAL EQUIPMENTS
TA	DRUMS

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CAPITAL GOODS STUDY

TABLE T.V. 12

SUPPLY TYPE OF CAPITAL GOODS.

BA	000	FURNACE
BA	001	DESIGN
BA	002	PIPES, PIPING
BA	003	INSULATORS
BA	004	REFRACTORIES
BA	005	BLOWERS
BA	006	BURNERS
BA	007	BASIC MATERIALS
BA	008	SUPPORTS
BA	009	ACCESORIES
BA	010	QUENCH BOX
BA	011	DRAFT CONTROL
BA	012	IMMERCIBLE HEATER
BG	000	TREATMENT EQUIPMENT
BG	001	TANKS
BG	002	PUMPS
BG	003	MOTORS
BC	004	SHAKERS
BH	001	ALL TYPE
BH	002	PARTS
CA	001	THERMAL ENERGY
CA	002	OF PROCESS
DA	001	OF COOLING
DA	002	OF PLATES
DA	003	PACKAGED
DB	001	BALLAST TRAYS
DB	002	DIFFERENTIAL TRAYS
DB	003	PACKINGS
DB	004	TRAYS
DB	005	FOG EXTINGUISHER
DC	001	LESS THAN 2 IN THICKNESS
DC	002	MORE THAN 2 IN THICKNESS
DC	003	INTERNALS
DC	004	CATALYSTS
EA	001	DOUBLE PIPE
EA	002	DIVIDED FLOW
EA	003	COIL
EA	004	CONDENSER
EB	001	ALL TYPE
EC	001	ALL TYPE
EE	001	ALL TYPE
EG	001	ALL TYPE
FA	001	CYLINDRICALS
FA	002	SPHERICALS
FB	001	CYLINDRICALS
FB	002	SPHERICALS
FD	001	ALL TYPE
FF	001	ALL TYPE
GA	100	CENTRIFUGE

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CAPITAL GOODS STUDY
TABLE T.V. 12
SUPPLY TYPE OF CAPITAL GOODS

GA	101	CENTRIFUGAL AXIAL FLOW
GA	102	CENTRIFUGAL RADIAL FLOW
GA	103	CENTRIFUGAL MIXED FLOW
GA	150	CENTRIFUGAL VERTICAL
GA	200	POSITIVE DISPLACEMENT
GA	210	RECIPROCATING
GA	211	RECIPROCATING PISTON
GA	212	RECIPROCATING DIAFRAGM
GA	220	ROTARY
GA	221	ROTARY GEAR
GA	222	ROTARY SCREW
GA	223	ROTARY, OTHERS
GB	001	CENTRIFUGAL
GB	002	RECIPROCATING
GB	003	AIR CENTRIFUGAL
GB	004	AIR RECIPROCATING
GB	005	VIBRATION MONITOR SYSTEM
GB	006	TURBOEXPANSIVE COMPRESSOR
GB	007	CONTROL PANEL SYSTEM
GB	008	CONDENSOR
GC	001	ALL TYPE
GD	001	ALL TYPE
GE	001	ALL TYPE
GM	001	TILL 1000 HP IND.
GM	002	MORE THAN 1000 HP IND.
GM	003	SYNCHRONOUS
GM	004	LESS THAN 340 HP DL.
GM	005	FROM 340 - 1000 HP DL.
GM	006	MORE THAN 1000 HP DL.
GM	007	VERTICAL ELEC.
GM	008	COMPRESSORS ELEC.
GM	009	INTERNAL COMBUSTION
GT	001	PUMP VAPOR
GT	002	COMPRESSOR VAPOR
GT	003	GENERATOR VAPOR
GT	004	GASEOUS
GT	005	VERTICAL
HA	001	SEWLESS A.C.
HA	002	SEWLESS ALEAC
HA	003	HELICOIDAL WELDING
HA	004	SUPPORTS, HOLDERS
HB	001	SLIDE VALVE
HB	002	BALL VALVE
HB	003	PLUG VALVE
HB	004	CHECK VALVE
HB	005	NEEDLE VALVE
HB	006	CONTROL VALVE
HB	007	4 IN SAFETY VALVE
HB	008	4 IN SAFETY VALVE

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY
TABLE T.V. 12
SUPPLY TYPE OF CAPITAL GOODS.

HB	009	OTHERS
HC	001	EXPANSIVE JOINTS
HC	002	FLANGES
HC	003	CONNECTIONS AND ACCESSORIES
HC	004	SCREWS, ETC.
JB	001	ALL TYPE
KA	100	OF FLOW
KA	101	ALARM F.
KA	102	CONTROLER F.
KA	103	CONVERTER F.
KA	104	PRIMARY ELEM. F.
KA	105	GAUGE F.
KA	106	CONTROL GAUGE F.
KA	107	SWITCH F.
KA	108	RECORDER F.
KA	109	CONTROL RECORDER F.
KA	110	TRANSMITTER F.
KA	111	CONTROL VALVE F.
KA	200	OF LEVEL
KA	201	ALARM L.
KA	202	CONTROLLER L.
KA	203	CONVERTER L.
KA	204	PRIMARY ELEMENT L.
KA	205	GAUGE L.
KA	206	CONTROL GAUGE L.
KA	207	SWITCH L.
KA	208	RECORDER L.
KA	209	CONTROL RECORDER L.
KA	210	TRANSMITTER L.
KA	211	CONTROL VALVE L.
KA	212	GLASS LEVEL L.
KA	300	OF PRESSURE
KA	301	ALARM P.
KA	302	CONTROLLER P.
KA	303	CONVERTER P.
KA	304	PRIMARY ELEMENT P.
KA	305	GAUGE P.
KA	306	CONTROL GAUGE P.
KA	307	SWITCH P.
KA	308	RECORDER P.
KA	309	CONTROL RECORDER P.
KA	310	REGULATOR P.
KA	311	TRANSMITTER P.
KA	312	CONTROL VALVE P.
KA	313	RUPTURE DISC. P.
KA	400	OF WEIGHT
KA	401	PRIMARY ELEMENT W.
KA	402	CONTROL GAUGE W.
KA	403	RECORDER W.

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CAPITAL GOODS STUDY
TABLE T.V. 12
SUPPLY TYPE OF CAPITAL GOODS.

KA	500	TEMPERATURE
KA	501	T. ALARM
KA	502	T. CONTROLER
KA	503	T. CONVERTER
KA	504	T. PRIMARY ELEMENT
KA	505	T. GAUGE
KA	506	T. CONTROLER GAUGE
KA	507	T. SWITCH
KA	508	T. RECORDER
KA	509	T. CONTROL RECORDER
KA	510	T. TRANSMITTER
KA	511	T. CONTROL VALVE
KA	512	T. THERMOWELLS
KA	600	SPEED
KA	601	S. GAUGE
KA	602	S. RECORDER
KA	700	VISCOSITY
KA	701	V. CONTROLLER
KA	702	V. PRIMARY ELEMENT
KA	703	V. RECORDER
KA	704	V. CONTROL RECORDER
KA	800	MECHANICAL POSITION
KA	801	Z. RELIEF VALVE
KA	802	Z. SOLENOID VALVE
KA	803	Z. THREE VALVED
KA	804	Z. MOTOR OPERATING VALVE
KA	805	Z. PISTON OPERATING VALVE
KA	806	Z. MIN. FLOW VALVE
KA	900	OTHERS
KA	901	OT. ANALYZER
KA	902	OT. AMMETER
KA	903	OT. PRESSURE DIF.
KA	904	OT. LOADING MANUAL STATION
KA	905	OT. DRAFT GAUGE
KA	906	OT. SLOW SWITCH LIMIT
KA	907	OT. ALARM LAMP
KA	908	OT. COMMAND GAUGE LAMP
KA	909	OT. MOTOR
KA	910	OT. MANUAL SELECTOR
KA	911	OT. ALARM GABINET
KA	912	OT. DIGITAL CONSOLE
KA	913	OT. TOTALIZER
KA	914	OT. CONTROL VALVE
KA	915	OT. ELECTRONIC PACKAGE
KA	916	OT. BLAZE CAPTURER
KA	917	OT. DIGITAL WATCH
KA	917	OT. COMPUTING SYSTEM
KA	919	MULTIPLE PIPE AIR LINE
MA	001	ALL TYPE

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CAPITAL GOODS STUDY
TABLE T.V. 12
SUPPLY TYPE OF CAPITAL GOODS.

NA	001	SUBSTATION
NA	002	BOARDS
NA	003	MOTORS CONTROL
NA	004	STRENGTH SYSTEM
NA	005	MATERIALS
NA	006	BATTERIES
NA	007	ELECTRICAL ENERGY PLANT
NB	001	TILL 400 KV
NB	002	MORE THAN 400 KV
NC	001	CONDUCTORS
NC	002	MATERIALS
PA	001	CRANES
PA	002	HOISTERS AND LIFTERS
PA	003	LOADING ARMS
PA	004	AIR CONDITIONED
PA	005	INSTRUMENTS AIR DRYER
PA	006	BEAT MUFFLER
PA	007	SCALE MODEL MAT.
PA	008	REFRIGERATION PACK.
PA	009	MOLECULAR SIEVE
PA	010	ALUMINA
PA	011	CATALYST
PA	012	VACUUM SYSTEM PACK.
PA	013	DESALTING PLANT PACK.
TA	001	ALL TYPE

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CAPITAL GOODS STUDY
TABLE T.V. 13
CAPITAL GOODS SUPPLIERS.

BA00	MEX	IMP
BA01	FRA	ACIERES DU MANOIR P.
BA02	USA	ATLANTIC HAROWARE
BA03	MEX	A.P. GREEN
BA04	USA	BAILEY
BA05	FRA	BIRAGHI
BA06	FRA	BORN
BA07	NET	CARPENTER PATTERSON
BA08	MEX	CESCO
BA09	USA	CRANE SUPPLY CO.
BA10	USA	D. SMITH
BA11	USA	DYNA THERM
BA12	ENG	EUROTUBE
BA13	FRA	FOSTER WHEELER
BA14	ENG	F.S. KNEWARD
BA15	USA	GRINNELL
BA16	USA	HACKENSACK
BA17	MEX	HARBISON WALKER FLIR
BA18	USA	JOHN ZINC
BA19	MEX	JOHNS MANVILLE
BA20	USA	JOHNS MANVILLE
BA21	USA	K.S.M. DIVISION
BA22	ENG	LEO REFINERY
BA23	USA	MADDEN
BA24	MEX	INSULATING MATERIALS
BA25	ENG	METALURGICAL ENG. LTD.
BA26	ENG	PARAMOUNT
BA27	USA	PETROCHEM
BA28	FRA	PREAULT
BA29	USA	SCHUTTE KOERTING
BA30	FRA	SOCIETE DES FOUR
BA31	USA	SOUTHWEST WELD
BA32	USA	TELEDYNE
BA33	USA	TUBE FAB INC.
BA34	MEX	FOSTER WHEELER
BA35	USA	FOSTER WHEELER
BA36	USA	VOP
BA37	USA	KELLOGG
BA38	USA	PIPING ENG
BA39	USA	GRAHAM
BA40	USA	LUMMUS
BA41	MEX	BROWN FINTUBE
BA42	MEX	JOHN ZINC
BG00	MEX	I.M.P.
BG01	MEX	PELLETIER
BG02	USA	LUMMUS
BG03	USA	WALLACE TIERNAN
BG04	USA	DOSAPRO
BH00	MEX	I.M.P.

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CAPITAL GOODS STUDY
TABLE T.V. 13
CAPITAL GOODS SUPPLIERS.

BH01	USA	CRANE SUPPLY CO.
BH02	USA	GRAHAM
BH03	USA	SCHUTTE KOERTING
BH04	USA	STEEL SOP
BH05	USA	PIPING ENG
BH06	USA	DYNA THERM
BH07	ENG	LEO REFINERY
BH07	MEX	SWECOMEX
DA00	MEX	IMP
DA01	ITA	AC. TUB. BRESCIA
DA02	MEX	CERREY LTD.
DA03	JAP	C. ITOH
DA04	FRA	CONSTR. MET. PROVENCE
DA05	MEX	INDUSTRIAL CONSORTIUM
DA06	MEX	STEEL INDUSTRY LTD.
DA07	MEX	METALVER LTD.
DA08	MEX	PFAUDLER PERMUTIT
DA09	MEX	TATSA
DA10	FRA	BASSI SEINE
DB00	MEX	IMP
DB01	USA	GLITSCH
DB02	MEX	GLITSCH
DB03	USA	NORTON
DB04	MEX	NORTON
DB05	USA	YORK EXPORT
DB06	ITA	GLITSCH
DB07	USA	OTTO YORK
DC00	MEX	IMP
DC01	ITA	AC. TUB. BRESCIA
DC02	FRA	CONSTR. MET. PROVENCE
DC03	USA	JOHNSON DIV. UOP. INTL.
DC04	USA	UOP PROC. DIV.
EA00	MEX	IMP
EA01	MEX	AVANTE LTD.
EA02	USA	CHEMTEC
EA03	FRA	CITEC NORDON
EA04	FRA	DELAUNAY
EA05	MEX	ECOLOGY LTD.
EA06	ENG	HEAD WRIGHTSON
EA07	USA	HOUSTON HEAT EXCH.
EA08	USA	HUDSON ENG.
EA09	USA	HUGHES ANDERSON CO.
EA10	ENG	HUGHES ANDERSON CO.
EA11	USA	INDUSTRIAL FABRICATING
EA12	GER	KAHLER BREUM
EA13	DEN	KAHLER BREUM
EA14	NET	K.M.S.
EA15	USA	MADDEN
EA16	MEX	METALVER LTD.

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CAPITAL GOODS STUDY
TABLE T.V. 13
CAPITAL GOODS SUPPLIERS.

EA17	JAP	MITSUBISHI
EA18	JAP	MITSUI
EA19	USA	M.R.M.
EA20	CAN	HUIRHEAD ENG.
EA21	MEX	PFAUDLER PERMUTIT
EA22	USA	RICHARD ARMSTRONG CO.
EA23	USA	SCHUTTE KOERTING
EA24	USA	SPRY ENG
EA25	MEX	SWECOMEX
EA26	MEX	ASSEMBLY TUBES
EA27	ENG	WHESSOE
EA28	MEX	CLERMONT
EA29	ENG	STOCKTON
EA30	NET	CHEMTEC
EA31	FRA	SMITH CO
EA32	USA	PERMUTIT CO
EA33	FRA	FORGES ET AL
EA40	USA	LUMMUS
EC00	MEX	IMP
EC01	MEX	ECOLOGY LTD.
EC02	USA	HUDSON ENG
EC03	USA	SWECOMEX-ECODYNE
EC04	USA	HAPPY
EE00	MEX	IMP
EE01	USA	SCHUTTE KOERTING
EE02	USA	ELLIOTT
EE03	USA	SPRYING SYSTEMS
EE04	FRA	CONDENSEURS DELAS
FA00	MEX	IMP
FA01	MEX	ECATEPEC-STEELS
FA02	ITA	AC. TUB. BRESCIA
FA03	MEX	CERREY LTD.
FA04	MEX	UNITED MANUFACTURERS
FA05	MEX	INDUSTRIAL CONSORTIUM
FA06	MEX	AZTECA METALLIC CONST.
FA07	FRA	CONSTR. MET. PROVENCE
FA08	USA	DYNA THERM.
FA09	MEX	NAT. PETROLEUM EQUIPMENTS
FA10	MEX	FONTANOT
FA11	MEX	STEEL INDUSTRY
FA12	MEX	LA SIERRITA LTD.
FA13	USA	MADDEN
FA14	MEX	METALVER
FA15	FRA	NORDON ET CIE
FA16	MEX	PFAUDLER PERMUTIT
FA17	USA	SPRYING SYSTEMS
FA18	JAP	SUMITOMO SHOJI
FA19	MEX	TATSA
FA20	MEX	METAL TRANSPORT

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CAPITAL GOODS STUDY
TABLE T.V. 13
CAPITAL GOODS SUPPLIERS.

FA21	USA	TRINITY IND
FA22	FRA	TISSOT ET CIE
FA23	ENG	WHESSOE
FA24	MEX	FIMSA
FA24	MEX	SWECOMEX
FA26	MEX	BABCOCK WILCOX
FA27	MEX	ITT INDUSTRIAL
FA28	FRA	DELAUNAY
FB00	MEX	IMP
FB01	MEX	INDUSTRIAL CONSORTIUM
FD00	MEX	IMP
FD01	USA	BURGESS
FD02	FRA	CONTROLE APPLICATION
FD03	MEX	NAT. FILTER MANUFACTURE
FD04	ENG	FILTRATION VALVES
FD05	MEX	FILVAC
FD06	USA	GLITSCH
FD07	MEX	GLITSCH
FD08	MEX	FILVAC INDUSTRIES
FD09	USA	OTTO YORK
FD10	USA	YORK EXPORT
FD11	ITA	GLITSCH
FF00	MEX	I.M.P.
FF01	ITA	AC. TUB. BRESCIA
FF02	MEX	TATSA
FF03	FRA	CONSTR. MET. PROVENCE
GA00	MEX	I.M.P.
GA01	USA	BINGHAM WILLAMETTE
GA02	FRA	BRAN AND LUBBE
GA03	GER	BRAN AND LUBBE
GA04	MEX	BYRON JACKSON
GA05	USA	BYRON JACKSON
GA06	USA	CARTER J.C.
GA07	USA	COPPUS
GA08	FRA	DOSAPRO ROY
GA09	USA	DRESSER
GA10	USA	ELLIOTT
GA11	MEX	GOULDS
GA12	USA	GOULDS
GA13	MEX	INGERSOLL RAND
GA14	USA	INGERSOLL RAND
GA15	FRA	MILTON ROY
GA16	USA	MILTON ROY
GA17	ITA	NUOVO PIGNONE
GA18	USA	PACIFIC PUMPS
GA19	MEX	TECHNICAL SUPPLIERS
GA20	USA	TECHNICAL SUPPLIERS
GA21	MEX	WALLACE TIERNAN
GA22	MEX	WORTHINGTON

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TABLE T.V. 13
CAPITAL GOODS SUPPLIERS.

GA23	USA	YARWAY
GA24	USA	WORTHINGTON
GA25	FRA	DRESSER
GA26	FRA	WORTHINGTON
GA27	FRA	PROXIMA
GA28	FRA	E.C. MASSON
GA29	MEX	JACUZZI
GA30	FRA	CORBLIN
GA31	MEX	PEERLESS TISA
GA32	USA	AIRCO CRYOG.
GA33	USA	CLARK BROS CO.
GB00	MEX	IMP
GB01	USA	BYRON JACKSON
GB02	USA	DRESSER
GB03	USA	ELLIOTT
GB04	ITA	FRANCO TOSSI
GB05	MEX	INGERSOLL RAND
GB06	USA	INGERSOLL RAND
GB07	MEX	JACUZZI
GB08	JAP	MITSUBISHI
GB09	FRA	RATEAU
GB10	USA	ROTOFLOW
GB11	GER	SIEMENS
GB12	MEX	SWECOMEX
GB13	USA	BENTLY NEVADA
GB14	JAP	DRESSER
GB15	SWI	INGERSOLL RAND
GB16	FRA	DRESSER
GB17	ITA	NUOVO PIGNONE
GB18	USA	CLARK BROS. CO.
GC00	MEX	IMP
GC01	USA	ROTOFLOW
GC02	USA	LUMMUS
GD00	MEX	IMP
GD01	MEX	LIGHTNIN
GD02	MEX	NETTCO
GD03	FRA	E.C. MASSON
GM00	MEX	IMP
GM01	USA	GENERAL ELECTRIC
GM02	USA	ALLIS CHALMERS
GM03	USA	US MOTORS
GM04	MEX	IEM
GM05	USA	WESTINGHOUSE
GM06	MEX	RELIANCE
GM07	USA	HITACHI
GM08	GER	SIEMENS
GM09	FRA	DRESSER
GM10	FRA	ACEC.
GM11	MEX	WORTHINGTON

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CAPITAL GOODS STUDY
TABLE T.V. 13
CAPITAL GOODS SUPPLIERS.

GM12	ITA	NUOVO PIGNONE
GM13	MEX	REERLESS TISA
GT00	MEX	IMP
GT01	USA	ELLIOTT
GT02	USA	COPPUS
GT03	USA	TERRY
GT04	GER	SIEMENS
GT05	JAP	MITSUBISHI
GT06	USA	WORTHINGTON
GT07	USA	CALRK BROS. CO
HA00	MEX	IMP
HA01	FRA	BIGNIER S.L.
HA02	FRA	BIGNIER S.L.
HA03	CAN	CAPITOL PIPE
HA04	USA	CAPITOL PIPE
HA05	FRA	DIMAPE
HA06	ENG	EUROTUBE
HA07	USA	FAB. TECH.
HA08	USA	GRINNEL
HA09	USA	GULF SUPPLY
HA10	USA	INTERNATIONAL ALLOYS
HA11	ENG	LEO REFINERY
HA12	USA	PETRO HOU
HA13	USA	PETROCHEM
HA14	USA	PRECISION FABRICATOR
HA15	FRA	SOC. PHOCEENE
HA16	FRA	STARVAL
HA17	USA	T.J. LINGLE
HA18	FRA	CHARRON
HA19	FRA	VALLOUREC
HA20	FRA	COMTOIR F.B.T.
HA21	ITA	LUMACHI
HB00	MEX	IMP
HB01	ITA	CARLO RAIMONDI
HB02	FRA	DIMAPE
HB03	FRA	ELLIOTT AUTOMATIC
HB04	MEX	EMCA LTD.
HB05	USA	GULF SUPPLY
HB06	MEX	LANZAGORTA
HB07	USA	LANZAGORTA
HB08	USA	LUBOSA
HB09	FRA	MARCEL MALBRANQUE
HB10	USA	NORVELL WILDER
HB11	USA	PACIFIC VALVES
HB12	USA	PETROCHEM
HB13	FRA	PETROLE EQUIPMENT
HB14	USA	POWELL
HB15	USA	PRESANT IND
HB16	GER	RHEINHUTTE

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT

CAPITAL GOODS STUDY

TABLE T.V. 13

CAPITAL GOODS SUPPLIERS.

HB17	USA	ROCKWELL
HB18	ITA	SELLA SPA
HB19	ENG	TRIANGLE VALVE
HB20	FRA	TROUVAY CAUVIN
HB21	ITA	WALWORTH
HB22	USA	WALWORTH
HB23	FRA	WALWORTH
HB24	USA	H.P. SHERMAN
HB25	FRA	DUBAR AUTIER
HB26	FRA	AUDCO ROCKWELL
HB27	MEX	IND. MAN. SERV.
HB28	FRA	SAPAG.
HB29	USA	ATWOOD MORRILL
HC00	MEX	IMP
HC01	USA	CAPITOL PIPE
HC02	ENG	CHEMETRON
HC03	FRA	INTRAMAT
HC04	ENG	LEO REFINERY
HC05	USA	MC JUNKIN CORP.
HC06	USA	PETROCHEM
HC07	FRA	PETRO EQUIPMENT
HC08	FRA	SOC. PHOCEENE
HC09	ITA	TECHNITUBE
HC10	USA	T.J. LINGLE
HC11	FRA	TROUVAY CAUVIN
HC12	USA	KOPPERMAN
HC13	USA	ZALLEA B.
HC14	USA	BURGESS
HC15	USA	PERSANT IND.
HC16	USA	ADV. ENG. CO
HC17	FRA	SAPAG
HC18	USA	PATHWAY BELLOWS
KA00	MEX	IMP
KA01	USA	AMETEK
KA02	USA	ANALYTIC INSTR.
KA03	USA	BADGER
KA04	USA	BAILEY
KA05	USA	BALL MANUFACT
KA06	USA	BARKSDALE
KA07	USA	BECKMAN
KA08	USA	BENTLY NEVADA
KA09	USA	BIRKETT
KA10	GER	BOPP REUTHER
KA11	MEX	BRISTOL
KA12	USA	BROOKS
KA13	USA	BURLING
KA14	USA	CALMEC
KA15	USA	CONTINENTAL DISC
KA16	USA	CRANE SUPPLY CO.

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CAPITAL GOODS STUDY

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CAPITAL GOODS SUPPLIERS.

KA17	USA	CROSBY VALVE
KA18	MEX	DANIEL
KA19	USA	DANIEL
KA20	FRA	DAR
KA21	USA	DRESSER
KA22	USA	E.I. DUPONT
KA23	MEX	MONCLOVA INDUSTRIAL ELECTRONICS
KA24	MEX	EMCA LTD.
KA25	USA	ENTERPRISE
KA26	USA	ENVIROTECH
KA27	USA	FIKE METAL
KA28	MEX	FISHER
KA29	MEX	FISHER
KA30	USA	FISHER
KA31	USA	FOXBORO
KA32	USA	GRAHAM
KA33	MEX	HOJEL
KA34	MEX	HONEYWELL
KA35	USA	HONEYWELL
KA36	MEX	IISA
KA37	USA	IND. EXPORT
KA38	USA	INSTRUMATICS
KA39	USA	INTEK CORP.
KA40	USA	JERGUSON
KA41	MEX	KUNKLE
KA42	MEX	LANZAGORTA
KA43	MEX	LEEDS AND NORTHRUP
KA44	USA	LEEDS AND NORTHRUP
KA45	FRA	MARCEL MALBRANQUE
KA46	FRA	MASCA
KA47	MEX	METRON
KA48	MEX	MEXICAN TELEIND.
KA49	USA	MIDWEST INSTR
KA50	USA	MINESAFETY
KA51	FRA	MIP
KA52	USA	MOORE
KA53	FRA	NORDON ET CIE
KA54	MEX	PALL
KA55	IRE	PANAMETRIC LTD.
KA56	USA	PAMTECH
KA57	USA	PANAMETRIC LTD.
KA58	USA	PENBERTHY
KA59	FRA	PETROLE SERVICE
KA60	USA	POST SEAL
KA61	USA	PYROMETRIC
KA62	USA	RAMSON
KA63	USA	RILEY
KA64	USA	ROCHESTER GAUGES
KA65	FRA	SAPAG

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CAPITAL GOODS SUPPLIERS.

KA66	USA	SCAM
KA67	MEX	SCHULTZ
KA68	ITA	SELLA SPA
KA69	MEX	SERVOMEX
KA70	USA	SHERMANN
KA71	GER	SIEMENS
KA72	MEX	SQUARE D
KA73	MEX	TAYLOR INSTR.
KA74	USA	TECHNICAL OIL TOOL
KA75	USA	TECHTUBE
KA76	MEX	TEISA
KA77	USA	TELEDYNE
KA78	MEX	THERMOINDUSTRIES
KA79	MEX	THERMOTHEC. IND.
KA80	USA	THERMOELECTRIC
KA81	USA	UNITED SUP.
KA82	USA	VAREC INC.
KA83	USA	WESTON
KA84	FRA	WORTHINGTON
KA85	USA	YARWAY
KA86	ENG	LEEDS AND NORTHRUP
KA87	MEX	FOXBORO
KA88	USA	KUNKLE
KA89	FRA	ELLIOT AUTOMATIC
KA90	USA	AUT. SWITCH
KA91	USA	STATIC RING
KA92	USA	DIETERICH STD.
KA93	USA	TAYLOR INSTR.
KA94	USA	MASONEILAN
KA95	MEX	ENTERPRISE
KA96	MEX	WALLACE TIERNAN
KA97	USA	WALLACE TIERNAN
KA98	USA	FISHER
KA99	USA	A.O. SMITH
KB01	MEX	SCAM
NA00	MEX	IMP
NA01	USA	BAILEY
NA02	MEX	CUTLER HAMMER
NA03	MEX	GENERAL ELECTRIC
NA04	MEX	IEM
NA05	MEX	ELECT. INSTR.
NA06	MEX	SIEMENS
NA07	MEX	SQUARE D
NA08	USA	STATIC PR.
NA09	MEX	PRECISION CONTR.
NA10	USA	SOLID STATE
NA11	MEX	SELME
NA12	USA	CATERPILLAR
NB00	MEX	IMP

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CAPITAL GOODS SUPPLIERS

NB01	MEX	GENERAL ELECTRIC
NB02	MEX	ELECTRIC IND. ENG.
NB03	MEX	SIEMENS
NB04	MEX	IEM
NB05	MEX	ELECT. IND. LTD.
PA00	MEX	IMP
PA01	MEX	FAMMSA
PA02	MEX	HERCULES LTD.
PA03	MEX	MATERIAL HOIST IND
PA04	USA	GAS DRYING
PA05	MEX	TECNIA LTD
PA06	USA	ENG. MODEL
PA07	USA	PALL
PA08	USA	HYDRIL CO.
PA09	USA	UOP PROC. DIV.
PA10	MEX	PALL
PA11	USA	CARRIER INT.
PA12	USA	KEMP MANUFACT.
PA13	USA	WATSON PHIL
PA14	USA	ALCOA INT.
PA15	USA	CATALYSTS CHEM.
PA16	FRA	PECHINEY ST
PA17	USA	H.K. PORTER
PA18	MEX	PELLETIER
PA19	MEX	BABCOCK WILCOX
PA20	FRA	LUCEAT FRANC
PA21	USA	LUMMUS
PA22	USA	WALLACE AND TIERNAN
PA23	USA	DOSAPRO
PA24	USA	UNION CARBIDE
PA25	USA	GIRDLER CHEM.
PA26	USA	PETROLITE
PA27	USA	ELLIOT

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TABLE T.V. 14

WORKS CONSTRUCTION AND PROJECT SPECIFICATIONS AND STANDARDS

PROJECT STANDARDS.

2.132.01	ANTICORROSIVE PROTECTION SYSTEMS (3RD. EDITION)
2.207.01	WIND EFFECTS ON STRUCTURES
2.207.02	STRUCTURAL DESIGN.GENERAL PRINCIPLES
2.207.03	CONCRETE STRUCTURES DESIGN. GENERAL PRINCIPLES.
2.214.01	TANKS FOUNDATION
2.214.02	SLIM STRUCTURES FOUNDATION DESIGN
2.214.03	SOFT SOILS ACCELERATED CONSOLIDATION PROCEDURES CONTROL AND DESIGN
2.214.04	MACHINERY FOUNDATION
2.214.05	SOILS SAMPLING AND EXPLORATION FOR CIVIL WORKS FOUNDATIONS (1st AND 2nd PARTS)
2.225.01	ROAD DESIGN FOR PETROLEUM INSTALLATIONS (2nd EDITION).
2.332.01	INDUSTRIAL ZONES DRAINAGE
2.346.01	ELECTRICAL INSTALLATIONS DESIGN AND PROJECT IN INDUSTRIAL PLANTS
2.346.02	ELECTRICAL MOTORS
2.346.03	POWER AND DISTRIBUTION TRANSFORMERS
2.346.04	GROUND CONNECTION SYSTEMS
2.346.05	EMERGENCY SYSTEMS
2.346.06	INDUSTRIAL PLANTS LIGHTING
2.346.07	UNDERGROUND ELECTRICAL CANALIZATIONS
2.346.13	DANGEROUS AREAS CLASSIFICATION AND ELECTRICAL EQUIPMENT SELECTION (2nd EDITIO
2.374.01	NATURAL GAS DISTRIBUTION NETWORKS
2.607.11	INSTRUMENTS AIR SYSTEMS
2.607.21	WATER NETWORKS FOR SERVICE AND FIRE FIGHTING (2nd EDITION)
2.612.01	PRESSURE VESSELS (2nd EDITION)
2.612.02	ACQUISITION REQUIREMENTS FOR PRESSURE VESSELS NOT SUBJEC TO DIRECT FIRE
2.612.03	ACQUISITION REQUIREMENTS FOR FRACTIONATING TOWER PLATES
2.612.05	ACQUISITION REQUIREMENTS FOR ATMOSPHERIC VESSELS
2.613.01	PIPING BUNDLE - FRAMEWORK HEAT EXCHANGERS
2.613.03	AIR COOLED HEAT EXCHANGERS
2.613.04	DIRECT FIRE HEATERS IN PROCESS PLANTS
2.614.11	CENTRIFUGAL PUMPS (2nd EDITION)

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2.614.12	RECIPROCATING PUMPS
2.614.14	ROTARY PUMPS
2.614.21	CENTRIFUGAL COMPRESSORS (2nd EDITION)
2.614.22	RECIPROCATING COMPRESSORS (2nd EDITION)
2.614.23	GAS INTEGRAL MOTOCOMPRESSORS
2.614.31	VAPOR TURBINES FOR SPECIAL SERVICES
2.614.32	VAPOR TURBINES FOR GENERAL SERVICES
2.614.36	TURBOEXPANDERS
2.614.52	GEAR SPEED INCREASERS AND REDUCERS
2.615.01	VALVES EQUIVALENT ROLL
2.615.02	VAPOR VEINS
2.616.01	THERMAL ISOLATION FOR HIGH TEMPERATURE (2nd EDITION)
2.616.02	THERMAL ISOLATION FOR LOW TEMPERATURE (2nd EDITION)
2.618.01	CONTROL DEVICES AND INSTRUMENTS. PART I
2.618.02	CONTROL DEVICES AND INSTRUMENTS. PART II
2.618.03	GENERAL REQUIREMENTS FOR CONTROL ROOM BOARDS

CONSTRUCTION STANDARDS

3.101.01	CLEARINGS FOR ROADS
3.101.02	CLEARING
3.102.02	EXCAVATIONS FOR BUILDING AND STRUCTURES
3.102.03	EXCAVATIONS FOR DRAINAGE WORKS AND BRIDGES (2nd EDITION)
3.104.01	ROAD ROUGH DRESSING (3rd EDITION)
3.104.02	CUTS FOR ROADS (3rd EDITION)
3.104.03	LOANS FOR ROADS (3rd EDITION)
3.104.04	EMBANKMENTS FOR ROADS (3rd EDITION)
3.104.06	BUILDINGS ROUGH DRESSING (2nd EDITION)
3.104.07	EXCAVATIONS FILLS FOR BUILDINGS AND STRUCTURES
3.104.08	EXCAVATIONS FILLS FOR DRAINAGE WORKS AND BRIDGES (2nd EDITION)
3.106.02	HAULINGS FOR EARTH FILLS (3rd EDITION)
3.108.01	LOCATION AND LEVELS
3.110.01	MORTARS
3.111.01	THIRD CLASS MASONRY
3.111.02	FOUNDATION COURSES
3.112.01	CONCRETE MANUFACTURE, TRANSPORT, PLACEMENT, CONSOLIDATING, FINISHING AND CURING
3.112.02	SPECIAL MORTARS AND CONCRETES FOR FOUNDATIONS
3.112.03	CONCRETE CONTINUOUS COVERING FOR CONDUCTION PIPES

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3.112.04	ARCH CENTERINGS FOR CONCRETE
3.112.05	WATER CONCRETE MELTINGS
3.113.01	CONCRETE REINFORCED STEEL
3.132.01	COVERINGS APPLICATION FOR ANTICORROSIVE PROTECTION (3rd EDITION)
3.135.01	SYSTEMS INSTALLATION FOR CATHODIC PROTECTION
3.150.01	DISMANTLINGS AND DEMOLITIONS
3.203.01	STEEL STRUCTURES MANUFACTURE
3.210.01	STEEL PIPES AND WOOD PILES DRIVING,HANDLING AND MANUFACTURE
3.210.02	REINFORCED CONCRETE AND CONCRETE DRIVING, HANDLING AND MANUFACTURE
3.210.03	SHEET PILE AND ITS DRIVING
3.217.01	SHEET METAL LATERAL COVERINGS AND ROOFINGS
3.220.01	ROADS COVERINGS (2nd EDITION)
3.220.02	ROADS BASES AND SUB-BASES (2nd EDITION)
3.222.01	SIDEWALKS AND PACKINGS
3.222.02	CONCRETE PAVEMENTS CONSTRUCTION
3.224.01	RAILROAD AUXILIARY TRACKS
3.240.01	WALL CONCRETE DIAGONALS, BENTS AND DALES.
3.240.02	MUD FLAT BRICKS, BRICKS, THICK PARTITIONS AND CONCRETE BLOCKS
3.240.03	FOUNDATION PATTERNS
3.240.04	SIMPLE CONCRETE FOUNDATION COURSES
3.240.05	FOUNDATIONS AND ROOFS WATERPROOFING
3.241.01	HYDRAULICS INSTALLATIONS IN BUILDINGS
3.241.02	SANITARY INSTALLATIONS IN BUILDINGS
3.241.03	GAS INSTALLATIONS IN BUILDINGS
3.241.04	SANITARY FURNITURE INSTALLATIONS
3.242.01	MORTAR LEVELLINGS
3.242.02	GYPSUM SOFFITS AND LEVELLINGS
3.242.03	FLOOR TILE, CERAMIC, AND TERRAZZO FLOORS
3.242.04	ASPHALTIC FLOOR TILE
3.242.05	GLAZED TILE, GLASS FLOOR TILE AND GLAZED CLAY FLOOR TILE
3.242.06	BACKFILLINGS, BRICK PAVING, PLASTER COAT AND KNEE BRACE ON ROOFS
3.242.07	TAPESTRY COVERINGS APPLICATION
3.242.08	BLACKSMITHING AND ALUMINIUM IN BUILDINGS
3.242.09	VINYL PAINT APPLICATION
3.242.10	CARPENTRY
3.242.11	FALSE SOFFITS

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3.242.12	LOCKSMITHING
3.242.13	GLAZING.
3.242.14	STONE COVERINGS ON WALLS
3.242.15	LATTICING AND SEPARATING WALLS
3.243.01	STAIRCASES AND LADDERS
3.270.01	DIFFERENTIAL PRESSURE FLOW GAUGES (2nd EDITION)
3.332.01	GLAZED CLAY AND CONCRET PIPES SEWERS
3.332.02	DRAINAGE LINES CONSTRUCTION ON INDUSTRIAL ZONES
3.344.01	LOW POWER SUBSTATIONS INSTALLATION
3.344.02	SUBSTATIONS INSTALLATION UNTIL 10 000 KVA
3.346.01	UNDERGROUND ELECTRICAL CANALIZATIONS CONSTRUCTION
3.346.02	GROUND CONNECTION SYSTEMS INSTALLATIONS
3.346.06	LIGHTING SYSTEMS INSTALLATIONS FOR INDUSTRIAL PLANTS
3.364.01	FENCES AND WALLS
3.374.01	PIPING PETROLEUM TRANSPORT SYSTEMS
3.374.02	(ENLARGEMENT) ANTICORROSIVE PROTECTION WITH POLYETHYLENE ADHESIVE TAPES
3.374.03	NATURAL GAS DISTRIBUTION NETWORKS CONSTRUCTED WITH THERMOPLASTIC PIPES (P.V.C. AND P.E.).
3.612.01	PRESSURE VESSELS MANUFACTURE
* TA-1	ATMOSPHERICAL TANKS

QUALITY REQUIREMENTS STANDARDS

4.112.01	HYDRAULIC CEMENTS. QUALITY REQUIREMENTS
4.112.02	CONCRETE AGREGATES. QUALITY REQUIREMENTS
4.112.03	MIXING WATER. QUALITY REQUIREMENTS.
4.112.04	CONCRETE ADDITIVES. QUALITY REQUIREMENTS
4.112.05	HARDENED AND FRESH CONCRETE. QUALITY REQUIREMENTS
4.112.06	PREMIXED CONCRETE
4.113.01	REINFORCE STEEL FOR CONCRETE. QUALITY REQUIREMENTS
4.118.01	CARBON STEEL PIPES, HIGH ALLOYS STEEL AND LOW ALLOYS STEEL
4.118.02	AUSTENITIC STEEL PIPES FOR BOILERS, OVERHEATERS HEAT-EXCHANGERS AND CONDENSERS
4.118.03	AUSTENITIC STAINLESS STEEL SEAM AND SEAMLESS PIPES FOR GENERAL SERVICE
4.118.04	CARBON STEEL SPECIAL PIPES AND STEEL ALLOYS
4.118.05	STAINLESS STEEL WELDED AND SEAMLESS PIPES
4.118.06	AUSTENITIC STEEL WELDED PIPES

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4.120.01 SWEET STEEL ELECTRODE WITH COVERING. USE RECOMMENDATIONS
4.120.02 STEEL AND IRON SMALL RODS FOR GAS WELDING. USE RECOMMENDATIONS
4.120.03 ALUMINIUM ELECTRODES AND ALUMINIUM ALLOYS. USE RECOMMENDATIONS
4.120.04 CROMIUM STEEL AND CROMIUM-NIC ELECTRODES
4.120.05 LOW ALLOY STEEL ELECTRODES, WITH COATING. USE RECOMMENDATIONS
4.120.06 COPPER ELECTRODES AND COPPER ALLOY. USE RECOMMENDATIONS.
4.132.01 ANTICORROSIVE PROTECTION FOR COATINGS. QUALITY REQUIREMENTS (3rd EDITION)
4.133.01 FOUNDATIONS AND ROOFS WATERPROOFING MATERIALS

QUALITY CONTROL STANDARDS
SAMPLING AND

5.112.01 HYDRAULIC CEMENTS. QUALITY CONTROL, SAMPLING AND TESTING
5.112.02 CONCRETE AGREGATES. QUALITY CONTROL, SAMPLING AND TESTING
5.112.03 MIXING WATER. QUALITY CONTROL, SAMPLING AND TESTING
5.112.04 CONCRETE ADDITIVES. QUALITY CONTROL, SAMPLING AND TESTING
5.112.05 FRESH CONCRETE, SAMPLING AND TESTING
5.112.06 HARDENED CONCRETE, SAMPLING AND TESTING
5.112.07 HEARTWOOD AND BEAMS EXTRACTED FROM HARDENED CONCRETE
5.112.08 CONCRETE SPECIMENS CURING AND MANUFACTURE
5.112.09 AIR CONTENT, VOLUMETRIC WEIGHT AND CONCRETE EFFICIENCY
5.113.01 REINFORCED STEEL FOR CONCRETE. QUALITY CONTROL, SAMPLING AND TESTING
5.132.01 ANTICORROSIVE PROTECTION COATING. SAMPLING AND TESTING (3rd EDITION)
5.214.01 INDEX TESTS (SOIL MECHANICS)
5.214.02 CONSOLIDATING TESTS (SOIL MECHANICS)
5.332.01 CONCRETE PIPES FOR INDUSTRIAL DRAINAGES. QUALITY CONTROL,SAMPLING AND TESTING
5.332.02 CEMENT-ASBESTOS PIPES FOR INDUSTRIAL DRAINAGES.
WORK CONCEPTS CODIFICATION ACTUALIZATION.

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FOR 17 CONSTRUCTION STANDARDS.

NOTES 1).- *In those standards without edition, it means the 1st one.*

2).- *This roll includes all standards published until July 1st, 1977.*

TABLE T.V. 15

DEVELOPMENT AND EXECUTED PROJECTS (December 1977)

REFINING PROJECTS

PROJECT	CAPACITY		SITE	LICENSER
	BPD	M3/D		
NATURAL GASOLINE FRACTIONATING PLANT	70,000	11,100	MINATITLAN, VER.	I.M.P.
PRIMARY AND VACUUM DISTILLATION PLANT	110,000	17,500	SALAMANCA, GTO.	I.M.P.
PRIMARY AND VACUUM DISTILLATION PLANT	150,000	24,000	TULA, HGO.	I.M.P.
VACUUM DISTILLATION PLANT	25,000	4,000	MINATITLAN, VER.	I.M.P.
GASOLINE HYDRODESULFURIZATION PLANT	36,000	5,700	TULA, HGO.	I.M.P.
GASOLINE HYDRODESULFURIZATION PLANT	25,000	4,000	SALAMANCA, GTO.	I.M.P.
GASOLINE HYDRODESULFURIZATION PLANT	25,000	4,000	MINATITLAN, VER.	I.M.P.
GASOLINE HYDRODESULFURIZATION PLANT	86,000	13,760	CANGREJERA, VER.	I.M.P.
GASOLINE HYDRODESULFURIZATION PLANT	25,000	4,000	SALINA CRUZ, OAX.	I.M.P.
GASOLINE HYDRODESULFURIZATION PLANT	36,000	5,700	CADEREYTA, N.L.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT.	25,000	4,000	TULA, HGO.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT.	25,000	4,000	TULA, HGO.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT	25,000	4,000	CD. MADERO, TAMPS.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT	25,000	4,000	SALINA CRUZ, OAX.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT	25,000	4,000	SALINA CRUZ, OAX.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT	25,000	4,000	CADEREYTA, N.L.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT	25,000	4,000	CADEREYTA, N.L.	I.M.P.
INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT	25,000	4,000	MINATITLAN, VER.	I.M.P.
NAPHTHA REFORMING PLANT	30,000	4,700	TULA, HGO.	UOP

TABLE T.V. 15

PROJECT	CAPACITY		SITE	LICENSER
	BPD	M3/D		
NAPHTHA REFORMING PLANT	16,000	2,500	SALAMANCA, GTO.	UOP
NAPHTHA REFORMING PLANT	16,000	2,500	MINATITLAN, VER.	UOP
NAPHTHA REFORMING PLANT	20,000	3,100	SALINA CRUZ, OAX.	UOP
NAPHTHA REFORMING PLANT	20,000	3,100	CADEREYTA, N.L.	UOP
HYDROCARBONS TREATING/FRACTIONATING PLANT	12,000	1,900	TULA, HGO.	I.M.P.
HYDROCARBONS TREATING/FRACTIONATING PLANT	12,100	1,900	MINATITLAN, VER.	I.M.P.
HYDROCARBONS TREATING/FRACTIONATING PLANT	12,100	1,900	SALINA CRUZ, OAX.	I.M.P.
HYDROCARBONS TREATING/FRACTIONATING PLANT	12,700	2,000	CADEREYTA, N.L.	I.M.P.
VISCOSITY REDUCER PLANT	41,000	6,500	TULA, HGO.	KELLOG
HEAVY RUBBISH SELECTIVE DEMETALIZER PLANT (DEMEX)	39,000	6,200	CD. MADERO, TAMPS	I.M.P.
CRUDE OIL STABILIZER PLANT	200,000	31,800	CANGREJERA, VER.	I.M.P.
HYDROCARBONS FRACTIONATING PLANT	103,000	16,377	CANGREJERA, VER.	I.M.P.
HYDROCARBONS FRACTIONATING PLANT	103,000	16,377	SITIO GRANDE, CHIS.	I.M.P.
HYDROCARBONS FRACTIONATING PLANT	103,000	16,377	ALLENDE, TAB.	I.M.P.
HYDROCARBONS FRACTIONATING PLANT	103,000	16,377	CUNDUACAN, TAB.	I.M.P.
COMPLETE REFINERY	80,000	12,800	LUANA, JAMAICA	I.M.P.

TABLE T.V. 15

PETROCHEMICAL PROJECTS.

PROJECT	CAPACITY BPD	 M3/D	SITE	LICENSER
PETROCHEMICAL SPECIALTIES	-----	2,700	SAN MARTIN TEX., PUE.	I.M.P.
ETHYLENE PLANT	183,000	T/A	PAJARITOS, VER.	LUMMUS
ETHYLENE PLANT	183,000	T/A	POZA RICA, VER.	LUMMUS
ETHYLENE PLANT	500,000	T/A	CANGREJERA, VER.	LUMMUS
ETHYLENE PLANT	500,000	T/A	ALLENDE, VER.	LUMMUS
ETHYLENE PLANT ENLARGEMENT	22,546	T/A	PAJARITOS, VER.	LUMMUS
ETHYLENE PLANT ENLARGEMENT	22,546	T/A	POZA RICA, VER.	LUMMUS
BTX REFORMING PLANT	45,000	7,200	CANGREJERA, VER.	EXXON
STYRENE ETHYLBENCENE PLANT	150,000	T/A	CANGREJERA, VER.	LUMMUS
ISOPROPYLIC ALCOHOL	150,000	T/A	SALAMANCA, GTO.	TOKUYAMA
ACETONITRILE PURIFICATION	2,000	T/A	TULA, HGO.	I.M.P.
TETRAMERAL UNIT	80,000	T/A	SAN MARTIN TEX., PUE.	I.M.P.
ALKYLTOLVENE UNIT	70,000	T/A	SAN MARTIN TEX., PUE.	I.M.P.
PROPYLENE PLANT	300,000	T/A	MORELOS, TAB.	UOP

TABLE T.V. 15
NATURAL GAS PROCESSING.

PROJECT	CAPACITY		SITE	LICENSER
	FT3/D	M3/D		
CONDENSABLE HYDROCARBONS FRACTIONATING/ SWEETENING PLANT, I.	134,750.0	3,815.0	CACTUS, CHIS.	I.M.P.
CONDENSABLE HYDROCARBONS FRACTIONATING/ SWEETENING PLANT, II.	134,750.0	3,815.0	CACTUS, CHIS.	I.M.P.
CONDENSABLE HYDROCARBONS FRACTIONATING/ SWEETENING PLANT, III.	134,750.0	3,815.0	CUNDUACAN, TAB.	I.M.P.
CONDENSABLE HYDROCARBONS FRACTIONATING/ SWEETENING PLANT, IV.	134,750.0	3,815.0	CUNDUACAN, TAB.	I.M.P.
SOUR GAS TREATENING PLANT	300.0	8.5	POZA RICA, VER.	I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING, CRYOGENICS PLANT	176×10^6	5×10^6	LA VENTA, TAB.	FLUOR
LIQUEFIABLES AND ETHANE RECOVERING, CRYOGENICS PLANT	191×10^6	5.4×10^6	PAJARITOS, VER.	FLUOR
LIQUEFIABLES AND ETHANE RECOVERING, CRYOGENICS PLANT	200×10^6	5.7×10^6	CD. PEMEX, TAB.	FLUOR/I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING, CRYOGENICS PLANT	275×10^6	7.8×10^6	POZA RICA, VER.	I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING I, CRYOGENICS PLANT	500×10^6	14.3×10^6	CACTUS, CHIS.	I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING II, CRYOGENICS PLANT	500×10^6	14.3×10^6	CACTUS, CHIS.	I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING III, CRYOGENICS PLANT	500×10^6	14.3×10^6	CUNDUACAN, TAB.	I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING IV, CRYOGENICS PLANT	500×10^6	14.3×10^6	CUNDUACAN, TAB.	I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING, CRYOGENICS PLANT	44.0	1,535.0	CANGREJERA, VER.	I.M.P.
CRYOGENICS PLANT ENLARGEMENT	240×10^6	6.8×10^6	LA VENTA, TAB.	I.M.P.
CONDENSABLE HYDROCARBONS FRACTIONATING/ SWEETENING PLANT, V.	13,475.0	3,815.0	TABASCO AREA	I.M.P.
LIQUEFIABLES AND ETHANE RECOVERING V, CRYOGENICS PLANT	500×10^6	14.3×10^6	CUNDUACAN, TAB.	I.M.P.

TABLE T.V. 16
EXPLOITATION PROJECTS

PROJECT	CAPACITY	SITE	LICENSER
"CHAAC" OFFSHORE DRILLING PLATFORM	12 WELLS	GULF OF MEXICO	I.M.P.
OFFSHORE DRILLING PLATFORM	12 WELLS	CAMPECHE AREA	I.M.P.
OIL-GAS SEPARATING/GATHERING MODULUS	30-60 000 BARRELS	SOUTHEAST	I.M.P.
CRUDE-OIL DESALTING MODULUS	30-60 000 BARRELS	SOUTHEAST	I.M.P.

TABLE T.V. 16
STORAGE TERMINAL.

PROJECT	CAPACITY	SITE	LICENSER
ETHYLENE HANDLING/STORING TERMINAL	4 000 TON.	TUXPAN, VER.	I.M.P.
ETHYLENE HANDLING/STORING TERMINAL	4 000 TON.	PAJARITOS, VER.	I.M.P.
ETHYLENE HANDLING/STORING TERMINAL ENLARGEMENT	60 000 TON.	TUXPAN, VER.	I.M.P.

TABLE T.V. 16

DOCKS

PROJECT	CAPACITY	SITE	LICENSER
FOR ETHYLENE LOADING AND UNLOADING	6 000 DWT	COBOS, VER.	I.M.P.
FOR ETHYLENE LOADING AND UNLOADING	26 000 DWT	PAJARITOS, VER.	I.M.P.
FOR HYDROCARBON LOADING AND UNLOADING	40 000 DWT	PAJARITOS, VER.	I.M.P.

TABLE T.V. 16

DIVERSES

PROJECT	CAPACITY	SITE	LICENSER
50 - GAS, PROCESSES EVALUATION		GUAYMAS, SON.	
PROCESSES EVALUATION		PAJARITOS, VER.	
SULFUR PLANT GAS OUTLET SO_2 LOWERING		PAJARITOS, VER.	
SFTG TO DAP PLANT MODIFICATION			
CATALYSTS MANUFACTURE		PAJARITOS, VER.	

TABLE T.V. 17

NEW WORKS MATERIALS, EQUIPMENTS, ACQUISITIONS AND COMPARISON.

(MILLION PESOS)

	1971 - 1976 TOTAL	1977
NATIONAL MATERIALS AND EQUIPMENTS	$ 12,695.118	$ 8,371
%	56.39	54.17
IMPORT MATERIALS AND EQUIPMENTS	9,816.776	7,082.457
%	43.61	45.83
TOTAL	22,511.894	15,453.691
%	100.00	100.00

TABLE T.V. 18

NEW WORKS MATERIALS, EQUIPMENTS, ACQUISITIONS AND COMPARISON.

(MILLION PESOS)

	1971	1972	1973	1974	1975	1976	1977
NATIONAL MATERIALS AND EQUIPMENTS	$ 763.007	1,102.244	1,937.338	1,778.905	3,682.824	3,430.800	8,371.234
%	87.30	72.90	65.66	46.78	51.75	54.84	54.17
IMPORT MATERIALS AND EQUIPMENTS	111.048	409.809	1,013.038	2,024.080	3,433.101	2,825.700	7,082.457
%	12.70	27.10	34.34	53.22	48.25	45.16	45.83
TOTAL	874.055	1,512.053	2,950.376	3,802.985	7,115.925	6,256.500	15,453.691
%	100	100	100	100	100	100	100

TABLE T.V. 19

USED INDEXES NAME

KEY	REFERENCE (1)	INDEX DESCRIPTION
1013 248	BLS	STRUCTURAL SHAPES
106	BLS	HEATING EQUIPMENT
107	BLS	FABRICATED STRUCTURAL METAL PRODUCTS
1072	BLS	METAL TANKS
1074	BLS	FABRICATED STEEL PIPE AND FITTINGS
1141 02	BLS	INDUSTRIAL PUMPS
1141 04	BLS	GAS COMPRESSORS
117	BLS	ELECTRICAL MACHINERY AND EQUIPMENT
1173 01	BLS	ELECTRICAL MOTORS
* 111	B OF M	METAL PRODUCTS REPAIR AND MANUFACTURE
* 164	B OF M	MACHINERY REPAIR AND CONSTRUCTION
* 163	B OF M	ELECTRICAL ARTICLES AND MACHINERY REPAIR AND CONSTRUCTION
* 146	NELSON	INTERNAL-COMB. ENGINES
* 147	NELSON	INSTRUMENTS
* 148	NELSON	HEAT EXCHANGERS

(1) NOTE BLS.- WHOLESALE PRICES AND PRICE INDEXES.- U.S. DEPARTMENT OF LABOR. BUREAU OF LABOR STATISTICS.
B OF M.-BANK OF MEXICO ECONOMICAL INDEXES
NELSON.-COST INDEXES. THE OIL AND GAS JOURNAL.

*I.M.P. IDENTIFICATION NUMBER.

TABLE T.VI.1

INICIATED WORKS THAT WILL BE CONCLUDED DURING THE SIX YEARS PERIOD.

1977 - 1982

ACTUAL PLANTS ENLARGEMENT

MADERO:

- 28 800 B/D ENLARGEMENT OF CATALYTIC CRACKING PLANT.

NEW UNITS IN ACTUAL REFINERIES.

MADERO:

- 25 000 B/D INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT.
- 35 000 B/D RUBBISH DESASPHALTING PLANT.

MINATITLAN

- 25 000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
- 20 000 B/D NAPHTHA REFORMING PLANT
- 25 000 B/D INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT
- TREATING/FRACTIONATING PLANT
- 85 T/D SULFUR RECOVERING PLANT

SALAMANCA

- 40 000 B/D CATALYTIC CRACKING PLANT
- 25 000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
- 16 800 B/D NAPHTHA REFORMING PLANT.

NEW REFINERY CENTERS

SALINA CRUZ I:

170 000 B/D PROCESSING CAPACITY REFINERY, WITH THE FOLLOWING PLANTS:

- 170 000 B/D PRIMARY DISTILLATION PLANT
- 75 000 B/D VACUUM DISTILLATION PLANT
- 40 000 B/D CATALYTIC CRACKING PLANT
- 25 000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
- 20 000 B/D NAPHTHA REFORMING PLANT
- 50 000 B/D INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT (TWO UNITS).
- 85 TON/D SULFUR RECOVERING PLANT.

(continues...)

TABLE T.VI.1

INICIATED WORKS THAT WILL BE CONCLUDED DURING THE SIX YEARS PERIOD.

1977 - 1982

(Continues...)

CADEREYTA I:

- 235 000 B/D CAPACITY REFINERY, WITH THE FOLLOWING PLANTS:
  - 100 000 B/D PRIMARY DISTILLATION PLANT
  - 62 000 B/D VACUUM DISTILLATION PLANT
  - 135 000 B/D COMBINED UNIT
  - 40 000 B/D CATALYTIC CRACKING
  - 36 000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
  - 20 000 B/D NAPHTHA REFORMING PLANT
  - 50 000 B/D INTERMEDIATE DISTILLATION HYDRODESULFURIZATION PLANT (TWO UNITS).
  - 85 TON/D SULFUR RECOVERING.

PRODUCTS TRANSPORTATION PIPE-LINES.

CADEREYTA-MONTERREY MULTIPIPE-LINE
(SAN RAFAEL)
CADEREYTA-MONTERREY FUEL-OIL PIPE-LINE

TABLE T.VI.2

INICIATED WORKS THAT WILL BE CONCLUDED DURING THE SIX YEARS PERIOD.

1977 - 1982

ACTUAL PLANTS ENLARGEMENT

SALAMANCA:

- ADDITIONS TO PLANTS FOR INCREASING THE LUBRICATING OIL PRODUCTION TO 2,000 B/D

NEW REFINERY CENTERS

SALINA CRUZ II:

SECOND STAGE FOR INCREASING THE PROCESS CAPACITY IN 200 000 B/D WITH THE FOLLOWING PLANTS:

- 200,000 B/D PRIMARY DISTILLATION PLANT
- 100,000 B/D VACUUM DISTILLATION PLANT
- 40,000 B/D CATALYTIC CRACKING PLANT
- 36,000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
- 25,000 B/D NAPHTHA REFORMING PLANT
- 25,000 B/D INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT (TWO UNITS).
- TREATING/FRACTIONATING PLANT
- 85 TON/D SULFUR RECOVERING PLANT.

TULA II:

SECOND/STAGE FOR INCREASING THE PROCESS CAPACITY IN 200,000 B/D WITH THE FOLLOWING PLANTS:

- 200,000 B/D PRIMARY DISTILLATION PLANT
- 100,000 B/D VACUUM DISTILLATION PLANT
- 40,000 B/D CATALYTIC CRACKING PLANT
- 36,000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
- 25,000 B/D NAPHTHA REFORMING PLANT
- 25,000 B/D INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT (TWO UNITS).
- 85 TON/D SULFUR RECOVERING PLANT.

(Continues...)

TABLE T.VI.2

INICIATED WORKS THAT WILL BE CONCLUDED DURING THE SIX YEARS PERIOD.

1977 - 1982

(*Continues...*)

PRODUCTS TRANSPORTATION PIPE-LINES.

- CADEREYTA-MONTERREY MULTIPIPE-LINE
  (SAN JERONIMO, CHIH.)
- CADEREYTA-SAN RAFAEL MULTIPIPE-LINE
- MEXICO-TOLUCA MULTIPIPE-LINE
- MEXICO-CUERNAVACA MULTIPIPE-LINE
- AGUASCALIENTES-ZACATECAS MULTIPIPE-LINE
- MAZATLAN-CULIACAN MULTIPIPE-LINE
- ROSARITO-MEXICALI MULTIPIPE-LINE.

TABLE T.VI.3

INICIATED WORKS DURING THE PERIOD 1977-1982 THAT WILL BE COMPLETED DURING THE NEXT SIX YEARS.

NEW REFINING CENTERS

SALINA CRUZ III:

- THIRD STAGE FOR INCREASING THE PROCESS CAPACITY IN 200,000 B/D WITH THE FOLLOWING PLANTS:
- 200,000 B/D PRIMARY DISTILLATION PLANT
- 100,000 B/D VACUUM DISTILLATION PLANT
- 40,000 B/D CATALYTIC CRACKING PLANT
- 36,000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
- 25,000 B/D NAPHTHA REFORMING PLANT
- 25,000 B/D INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT (TWO UNITS).
- TREATING/FRACTIONATING PLANT
- 85 TON/D SULFUR RECOVERY PLANT.

CADEREYTA II:

- SECOND STAGE FOR INCREASING THE PROCESS CAPACITY IN 200 000 B/D WITH THE FOLLOWING PLANTS:
- 200,000 B/D PRIMARY DISTILLATION PLANT
- 100,000 B/D VACUUM DISTILLATION PLANT
- 40,000 B/D CATALYTIC CRACKING PLANT
- 36,000 B/D NAPHTHA HYDRODESULFURIZATION PLANT
- 25,000 B/D NAPHTHA REFORMING PLANT
- 25,000 B/D INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT (TWO UNITS).
- TREATING/FRACTIONATING PLANT
- 85 TON/D SULFUR RECOVERY PLANT

COMPLETE TRAIN FOR THE LUBRICATING OIL MANUFACTURE WITH 100,000 B/D CAPACITY.

PRODUCTS TRANSPORTATION PIPE-LINES.

DISTRIBUTION NETWORK FOR HANDLING THE PRODUCTION INCREASE CORRESPONDING TO TULA II.

TABLE T.VI.4
FORECASTING CAPACITIES FOR THE PETROCHEMICAL PLANTS.

WORK SITE	CAPACITY
COSOLEACAQUE	
Ammonia VII	445 000 T/A
Ammonia VIII	445 000 T/A
SALAMANCA, GTO.	
Int. and Ammonia	300 000 T/A
MINATITLAN, VER.	
Sulfur	26 400 T/A
POZA RICA, VER.	
Ethylene IV	182 000 T/A
Polyethylene	100 000 T/A
Int. and auxiliary services	
SAN MARTIN TEX., PUE.	
Methanol	150 000 T/A
Tetramer	80 000 T/A
Acrylic acid	30 000 T/A
Dodecytolvene	70 000 T/A
Int. and auxiliary services	
CACTUS, CHIS.	
(a) Sweetening Plant and (b) Sulfur V (a) 200 MMPCD and (b)	52 800 T/A
" " VI "	52 800 T/A
" " VII "	52 800 T/A
" " VIII "	52 800 T/A
" " IX "	52 800 T/A
" " X "	52 800 T/A
" " XI "	52 800 T/A
" " XII "	52 800 T/A
CRYOGENICS I (Including Fractionating)	150 MMPCD
CRYOGENICS II "	150 MMPCD
CRYOGENICS III (without Fractionating)	500 MMPCD
CRYOGENICS IV "	500 MMPCD
HYDROCARBON STABILIZER AND SWEETENING PLANT	24 000 B/D
" "	24 000 B/D
NATURAL GASOLINE FRACTIONATING PLANT	100 000 B/D
INT. AND AUXILIARY SERVICES.	
TULA, HGO.	
Acrylonitrile II	50 000 T/A
Acetonitrile	2 000 T/A
Sulfur	52 800 T/A
Sulfur	52 800 T/A

TABLE T.VI.4 (Continues...)

CANGREJERA, VER.	
Acetaldehyde II	100 000 T/A
Ethylene oxide II	100 000 T/A
Ethylene V	500 000 T/A
Oxygene	200 000 T/A
Aromatic Comp. (1)	1 335 000 T/A
Ethylbencene	187 500 T/A
Styrene	150 000 T/A
Crude oil stabilizer	200 000 B/D
Natural Gasoline Fractionating Plant	100 000 B/D
Cumene	40 000 T/A
Low Density Polyethylene	240 000 T/A
Auxiliary Services	
Integration	
ALLENDE, VER.	
Ethylene VI	500 000 T/A
Oxygene	270 000 T/A
High density Polyethylene	100 000 T/A
Ethylene oxide III	200 000 T/A
Acetaldehide III	100 000 T/A
Propylene	300 000 T/A
Propylene oxide	60 000 T/A
Polypropylene	100 000 T/A
Butadiene	100 000 T/A
Natural Gasoline Fractionating Plant	82 000 B/D
Int. and auxiliary services	
PAJARITOS, VER.	
Dichloroethane (Direct coloration)	
Dichloroethane (Oxichlorination)	330 000 B/D
Vinyl Chloride	200 000 B/D
Perchloroethylene	16 000 B/D
Carbon Tetrachloride	16 000 B/D
Integration	
CUNDUACAN, TAB.	
Ammonia IX	445 000 B/D
Ammonia X	445 000 B/D
Ammonia XI	445 000 B/D
Ammonia XII	445 000 B/D
(a) Sweetening Plant and (b) Sulfur I (a) 400 MMPCD and (b)	52 800 B/D
" Sulfur II "	52 800 B/D
Cryogenics I	500 MMPCD
Cryogenics II	500 MMPCD
Cond. Stabilizing and sweetening plant I	24 000 B/D
" " II	24 000 B/D
Natural Gasoline Fractionating Plant	84 000 B/D
Int. and auxiliary services	

TABLE T.VI.4 (Continues...)

SALINA CRUZ, OAX.	
Sulfur	26 000 T/A
Sulfur	26 000 T/A
Sulfur	26 000 T/A
CADEREYTA, N.L.	
Sulfur	26 000 T/A
Sulfur	26 000 T/A
UNDEFINED	
Butadiene	55 000 T/A
Chlorated Deriv. (2)	56 200 T/A
Acrylonitrile	75 000 T/A
Methanol	150 000 T/A
Propylene oxide	60 000 T/A
L.D. Poliethylene IV	140 000 T/A
Styrene III	150 000 T/A
Aromatic comp. III (3)	715 500 T/A
Cumene	40 000 T/A
Cryogenics VII	500 MMPCD
3 Sweetening (a) and Sulfur (b) (a) 400 MMPCD, (b)	52 800 T/A EACH
Ciclohexane	20 000 T/A
Auxiliary services	
H.D. Polyethylene III	100 000 T/A
L.D. Polyethylene V	140 000 T/A
Acetaldehyde IV	100 000 T/A
Ethylene VII	500 000 T/A
Ammonia XIII and XIV	445 000 T/A EACH
Acrylonitrile IV	75 000 T/A
Cryogenics VIII	500 MMPCD
2 Sweetening Plants (a) and Sulfur (b) (a) 400 MMPCD (b)	52 800 T/A EACH
Propylene	300 000 T/A
Polypropylene	100 000 T/A
Int. and auxiliary services	

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(1) Bencene	299 000 T/A
Tolvene	371 000 T/A
M and P-Xylene	370 000 T/A
P-Xylene	240 000 T/A

TABLE T:VI.4 (Continues...)

(2)	Vynil chloride	200 000 T/A
	1,2 - dichloroethane	330 000 T/A
	Perchloroethylene	16 000 T/A
	Carbon tetrachloride	16 000 T/A
(3)	Bencene	183 000 T/A
	Tolvene	277 500 T/A
	O-Xylene	55 000 T/A
	P-Xylene	200 000 T/A

TABLE T.VI.5

PETROLEUM INDUSTRY CAPITAL GOODS (MATERIALS AND EQUIPMENT) CUSTUMS CLASSIFICATION.

CONCEPT	CUSTUMS CLASSIFICATION
CEMENTING ACCESSORY	7314A, 7314B
PIPING	7317A, 7318A, 7318B, 7318C, 8308A
CONNECTIONS	7320A
TOWERS	7321A, 7322A
PROCESS VESSELS	7321A
TOWERS INTERNALS, SPECIAL CONTAINERS, REACTORS, VESSELS	7322A
TANKS	7322A, 7324A
SEPARATORS, VESSELS INTERNALS	7327A, 7322A
DRILLING BITS	8205A
REPAIR EQUIPMENT	8204A, 8204B, 8205A, 8315A, 8445A
DRILLING EQUIPMENT	8205A, 8423A
PUMPS, MOTOR PUMPS	8410A, 8410D, 8410V, 8411A
COMPRESSORS, MOTOR COMPRESSORS	8411A
EJECTORS, COOLING TOWERS, VAPOR RECOVERING	8417A
INTERNAL COMBUSTION MOTOR	8406A, 8406E
TURBINES	8405A, 8407A, 8407B
BLOWERS	8459A

TABLE T.VI.5 (Continues...)

CONCEPT	CUSTOMS CLASSIFICATION
BOILERS	8401A, 8402A
SPECIAL EQUIPMENTS	8422A, 8422C
VALVES, CHRISTMAS TREES	8461A, 8461B
GENERAL MECHANICAL EQUIPMENT	8405A, 8406A, 8406B, 8406E
FURNACES	8411A, 8414A
EXCHNAGERS, AIR COOLERS	8417A
INSTRUMENTS	9023A, 9023B, 9024A

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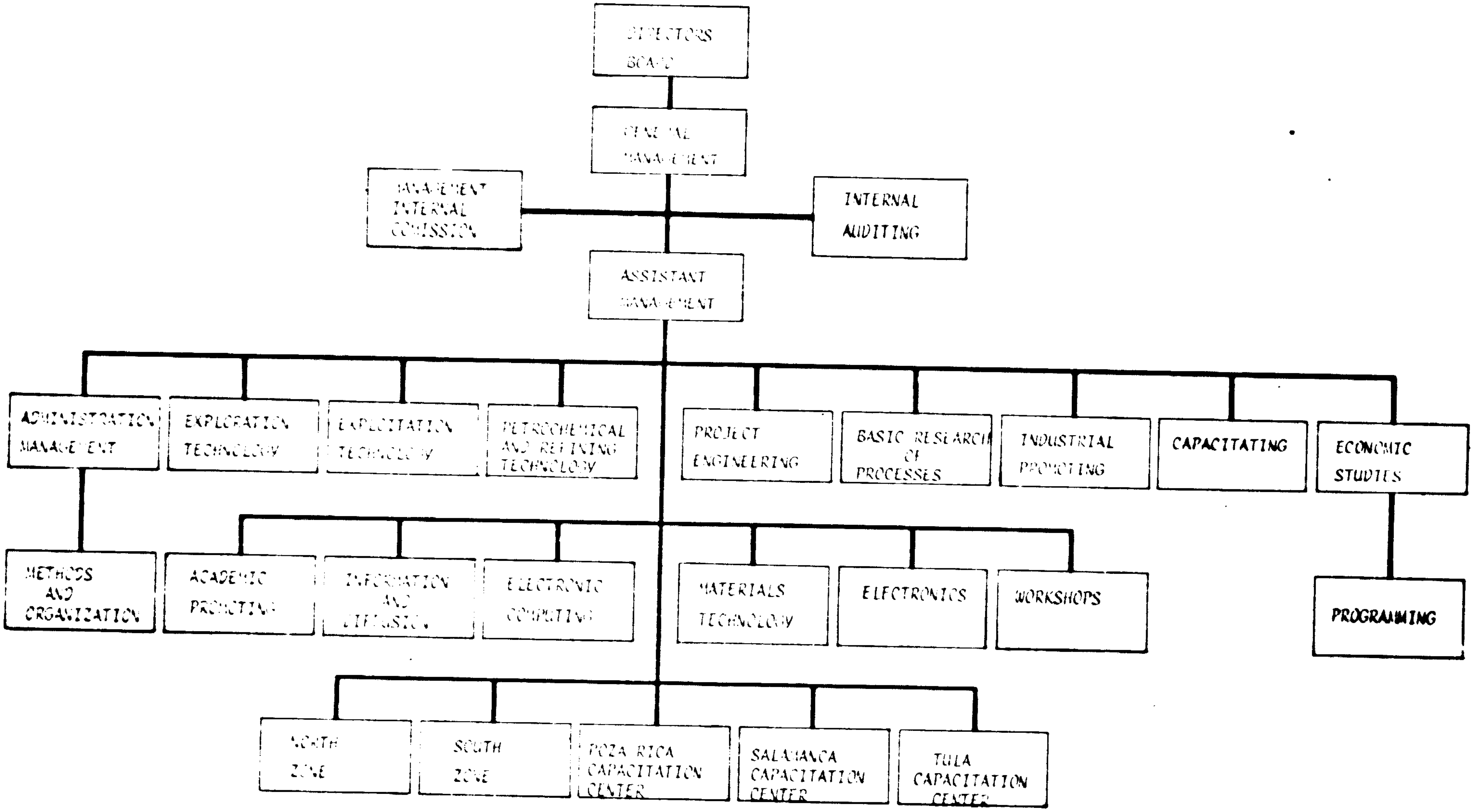

GRAPH G V. I

SUBDIRECCION DE INGENIERIA DE PROYECTO GROWING

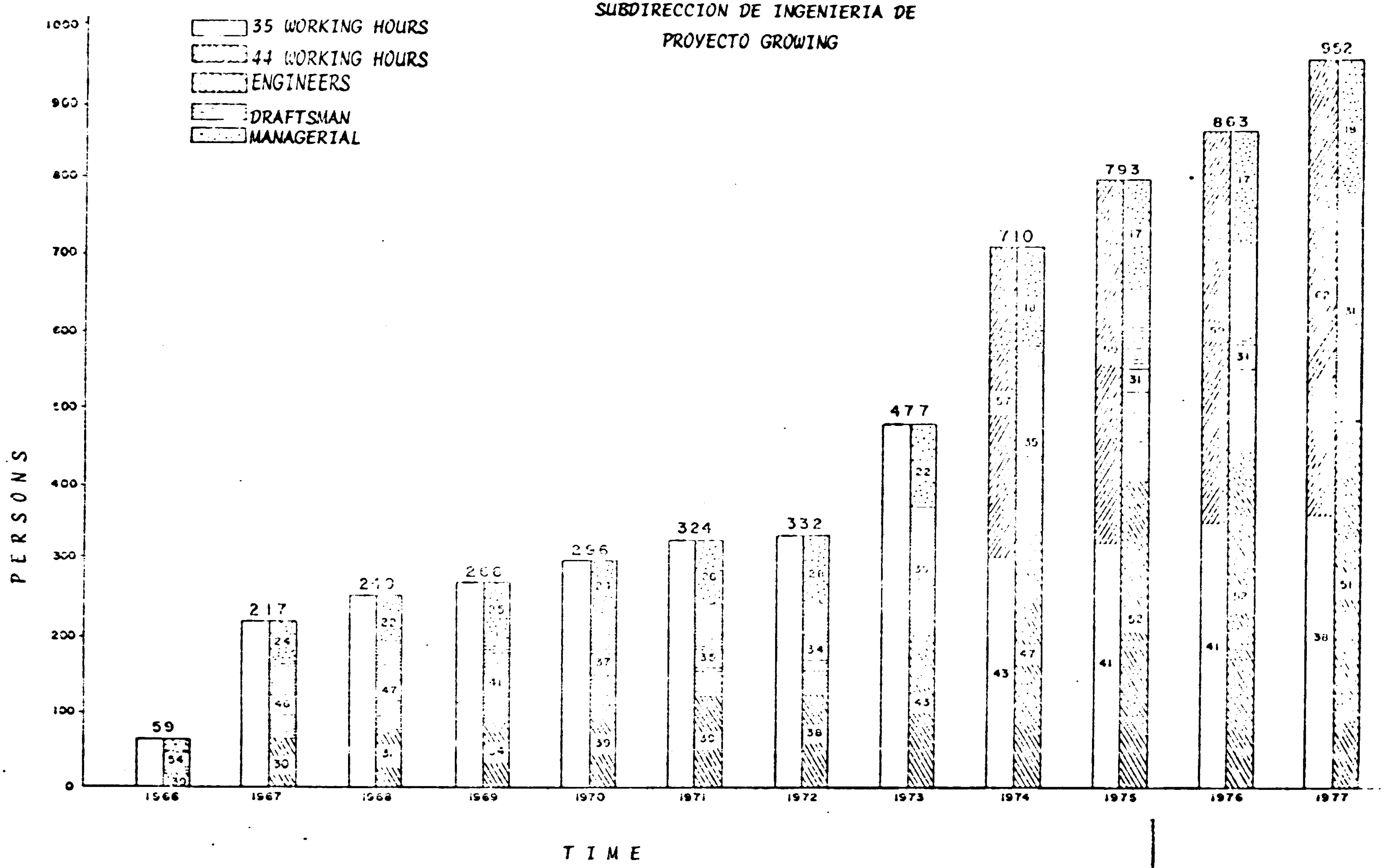

TABLE G.V.2

TABLE C.VI.4

FORECAST INVESTMENTS SUMMARY ON THE EQUIPMENTS AND MATERIALS ACQUISITION FOR THE PETROLEUM INDUSTRY: 1977-1986 (1)

(1977'S MILLION PESOS)

SECTORS YEARS	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
I. TOTAL INVESTMENT ON MATERIALS AND EQUIPMENTS											
I.1 EQUIPMENTS AND MATERIALS TOTAL	13,869.1	28,331.6	19,618.2	16,085.8	12,615.6	13,412.5	13,215.4	14,566.5	13,981.1	8,939.9	154,735.7
I.2 ENGINEERING TOTAL	831.4	1,701.1	896.3	735.7	589.5	533.3	700.1	679.9	499.4	189.3	7,356.0
II. EXPLOITATION SECTOR											
II.1 MATERIALS AND EQUIPMENTS	3,455.5	5,022.5	6,990.5	6,050.0	6,342.6	8,089.7	6,346.0	5,877.8	6,723.0	6,565.7	61,463.3
II.2 ENGINEERING	20.1	41.1	32.4	29.9	34.9	34.6	34.2	34.0	33.6	33.2	328.0
III. REFINING SECTOR											
III.1 MATERIALS AND EQUIPMENTS	2,867.1	4,122.8	2,690.6	3,092.9	3,537.4	3,031.1	2,375.9	1,716.3	953.8	207.5	24.595.4
III.2 ENGINEERING	233.1	336.7	211.1	216.6	287.5	247.5	189.9	137.9	80.5	23.5	1,964.4
IV. PETROCHEMICAL SECTOR											
IV.1 MATERIALS AND EQUIPMENTS	5,946.9	9,703.9	7,525.0	3,796.7	2,482.7	1,866.9	3,498.3	4,168.9	3,699.7	1,657.2	44,346.2
IV.2 ENGINEERING	504.3	791.7	629.5	385.0	259.9	231.5	448.9	411.9	304.4	111.7	4,078.8
V. DISTRIBUTION AND TRANSPORTATION SECTOR											
V.1 MATERIALS AND EQUIPMENTS	1,599.6	9,482.4	2,412.1	3,146.2	252.9	424.8	995.2	2,903.5	2,604.6	509.5	24,330.8
V.2 ENGINEERING	73.9	531.7	25.3	109.8	14.6	24.8	28.5	96.1	80.9	20.9	1,006.5

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(1) IT ONLY REFERS TO THE MORE OUTSTANDING INTERMEDIATES AND CAPITAL GOODS PURCHASES FOR THE PETROLEUM INDUSTRY. NOT INCLUDES EXPLORATION, COMMERCIALIZATION, MANAGEMENT, ETC.

TABLE C.VI.5

FORECAST INVESTMENTS SUMMARY FOR THE ACQUISITION OF MATERIALS AND EQUIPMENT FOR THE PETROLEUM INDUSTRY: 1977-1986 (*)

(PERCENTAGES)

SECTORS YEARS	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
I. TOTAL INVESTMENT ON MATERIALS AND EQUIPMENTS											
I.1 EQUIPMENTS AND MATERIALS TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
I.2 ENGINEERING TOTAL (1)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
(2)	6.0	6.0	4.6	4.6	4.7	4.0	5.3	4.6	3.6	2.1	4.8
II. EXPLOITATION SECTOR											
II.1 MATERIALS AND EQUIPMENTS	24.9	17.7	35.6	37.6	50.3	60.3	48.0	40.1	48.1	73.4	39.7
II.2 ENGINEERING (1)	2.4	2.4	3.6	4.1	5.9	6.5	4.9	5.0	6.7	17.5	4.5
(2)	0.2	0.1	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.4	0.2
III. REFINING SECTOR											
III.1 MATERIALS AND EQUIPMENTS	20.7	14.6	13.7	19.2	28.0	22.6	18.0	11.7	6.8	2.3	15.9
III.2 ENGINEERING (1)	28.0	19.8	23.6	29.4	48.8	46.4	27.1	20.3	16.1	12.4	26.7
(2)	1.7	1.2	1.1	1.3	2.3	1.8	1.4	0.9	0.6	0.3	1.3
IV. PETROCHEMICAL SECTOR											
IV.1 MATERIALS AND EQUIPMENTS	42.9	34.2	38.4	23.6	19.7	13.9	26.5	28.4	26.5	18.6	28.7
IV.2 ENGINEERING (1)	60.7	46.5	70.2	52.3	44.1	43.4	64.1	60.6	61.0	59.0	55.4
(2)	3.6	2.8	3.2	2.4	2.1	1.7	3.4	2.8	2.2	1.2	2.6
V. DISTRIBUTION AND TRANSPORTATION SECTOR											
V.1 MATERIALS AND EQUIPMENTS	11.5	33.5	12.3	19.6	2.0	3.2	7.5	19.8	18.6	5.7	15.7
V.2 ENGINEERING (1)	8.9	31.3	2.9	14.9	2.5	4.7	4.1	14.1	16.2	11.1	13.7
(2)	0.5	1.9	0.1	0.7	0.1	0.2	0.2	0.7	0.6	0.2	0.7

(*) IT ONLY REFERS TO THE MORE OUTSTANDING INTERMEDIATES AND CAPITAL GOODS PURCHASES FOR THE PETROLEUM INDUSTRY. NOT INCLUDES EXPLORATION, COMMERCIALIZATION, MANAGEMENT, ETC.

(1) PERCENTAGES IN RESPECT TO THE ENGINEERING ANNUAL TOTAL.

(2) PERCENTAGES IN RESPECT TO THE EQUIPMENTS AND MATERIALS ANNUAL TOTAL.

TABLE C.VI.6
INVESTMENTS PLAN ON EXPLOITATION SURFACE INSTALLATIONS
MATERIALS AND EQUIPMENTS/ENGINEERING

(1977'S MILLION PESOS)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
SURFACE INST. TOTAL	550.4	1,122.2	885.1	815.7	954.0	945.2	937.0	927.6	918.3	908.2	8,963.7
MATERIALS TOTAL	530.3	1,081.1	852.7	785.8	919.1	910.6	902.8	893.6	884.7	875.0	8,635.7
ENGINEERING TOTAL	20.1	41.1	32.4	29.9	34.9	34.6	34.2	34.0	33.6	33.2	328.0
GATHERING											
1. MATERIALS	29.6	60.1	47.5	43.8	51.1	50.7	50.2	49.7	49.2	48.8	480.7
PIPING	26.2	53.3	42.1	38.8	45.3	44.9	44.5	44.1	43.6	43.2	426.0
SPECIAL EQUIPMENTS	1.9	3.8	3.0	2.8	3.2	3.2	3.2	3.1	3.1	3.1	30.4
VALVES AND CONNECTIONS	1.5	3.0	2.4	2.2	2.6	2.6	2.5	2.5	2.5	2.5	24.3
2. ENGINEERING	1.1	2.3	1.8	1.7	1.9	1.9	1.9	1.9	1.9	1.8	18.2
SEPARATION AND MEASUREMENT											
1. MATERIALS	88.6	180.6	142.4	131.2	153.5	152.1	150.7	149.2	147.8	146.1	1,442.2
SEPARATORS	67.3	137.2	108.2	99.7	116.6	115.5	114.5	113.3	112.2	111.0	1,095.6
SPECIAL VESSELS	11.2	22.9	18.0	16.6	19.4	19.3	19.1	18.9	18.7	18.5	182.6
CONTROL AND MEAS. SP. EQUIPMENT	5.6	11.4	9.0	8.3	9.7	9.6	9.5	9.4	9.4	9.2	91.1
VALVES AND CONNECTIONS	4.5	9.1	7.2	6.6	7.8	7.7	7.6	7.6	7.5	7.4	73.0
2. ENGINEERING	3.4	6.9	5.4	5.0	5.8	5.8	5.7	5.7	5.5	5.5	54.3
CRUDE-OIL PUMPING											
1. MATERIALS	38.6	42.2	41.8	43.7	43.3	43.0	42.6	42.2	41.7	41.2	420.3
MOTOPUMPS	34.2	37.4	37.1	38.7	38.4	38.1	37.7	37.4	37.0	36.5	372.5
SECURITY AND CONTROL SP. EQUIT.	2.4	2.7	2.6	2.8	2.7	2.7	2.7	2.7	2.6	2.6	26.5
VALVES AND CONNECTIONS	2.0	2.1	2.1	2.2	2.2	2.2	2.2	2.1	2.1	2.1	21.3
2. ENGINEERING	1.5	1.6	1.6	1.7	1.7	1.6	1.6	1.6	1.6	1.6	16.1
GAS COMPRESSION											
1. MATERIALS	314.5	677.9	526.1	479.7	568.8	563.5	558.8	553.0	547.5	541.5	5,331.3
MOTOCOMPRESSORS	278.7	600.7	466.2	425.0	504.0	499.3	495.1	490.0	485.1	479.8	4,723.9
SEC. AND CONT. SP. EQT.	19.9	42.9	33.3	30.4	36.0	35.7	35.4	35.0	34.7	34.3	337.6
VALVES AND CONNECTIONS	15.9	34.3	26.6	24.3	28.8	28.5	28.3	28.0	27.7	27.4	269.8
2. ENGINEERING	11.9	25.7	20.0	18.2	21.6	21.4	21.2	21.0	20.8	20.6	202.4

TABLE C.VI.7

INVESTMENTS PLAN ON WELL DRILLING AND REPAIR: EXPLOITATION SECTOR

MATERIALS AND EQUIPMENT

(1977'S MILLION PESOS)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
MATERIALS TOTAL	2,925.2	3,941.4	6,137.8	5,264.2	5,423.5	7,179.1	5,443.2	4,984.2	5,838.3	5,690.7	52,827.6
REPAIR EQUIPMENTS	121.7	295.5	208.5	243.3	451.9	232.9	486.7	260.7	278.1	260.7	2,840.0
DRILLING EQUIPMENTS	1,097.6	1,304.2	3,020.3	1,784.7	1,372.9	2,883.0	686.4	137.3	755.1	343.2	13,384.7
DRILL PIPE	92.8	24.2	18.6	41.7	39.4	66.3	30.6	102.1	61.1	59.0	535.8
CASING	1,040.7	1,551.0	1,936.6	2,143.0	2,389.4	2,684.1	1,845.9	3,009.3	3,182.6	3,372.1	24,154.7
CEMENTING DEVICES	69.4	103.4	129.1	142.9	159.3	178.9	189.7	200.6	212.2	224.8	1,610.3
DRILL BITS	242.8	361.9	451.9	500.0	557.5	626.3	664.0	700.2	742.6	786.8	5,636.0
CHRISTMAS TREE	260.2	301.2	372.8	408.6	453.1	507.6	539.9	572.0	606.6	644.1	4,666.1

TABLE C.VI.8

INVESTMENTS PLAN FOR THE REFINING SECTOR

MATERIALS AND ENGINEERING/EQUIPMENTS
(1977'S THOUSAND PESOS)

REFINERIES	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT	7,151,530	10,156,480	5,735,760	6,761,000	7,496,000	7,329,000	6,950,000	5,555,000	2,890,000	335,000	60,359,770
PROCESS P. AND AUX. SERVS.	4,750,370	6,815,210	4,296,330	4,970,000	5,705,000	4,335,000	3,631,000	2,015,000	1,455,000	335,000	38,344,910
MATERIALS	3,867,084	4,122,763	2,690,595	3,092,933	3,537,430	3,031,117	2,375,909	1,716,300	953,730	207,500	24,595,391
ENGINEERING	233,055	336,704	211,091	216,628	287,481	247,520	189,930	137,900	80,547	23,476	1,984,352
1. AZCAPOTZALCO, D.F.											
TOTAL INVESTMENT	93,080	52,600									145,680
PROCESS P. AND AUX.SERVS.	31,200	18,600									49,800
MATERIALS	19,283	10,611									28,894
ENGINEERING	192	84									276
2. CD. MADERO, TAM.											
TOTAL INVESTMENT	564,600	580,000									1,144,600
PROCESS P. AND AUX.SERVS.	335,900	354,000									689,900
MATERIALS	131,385	146,618									278,003
ENGINEERING	15,237	13,177									28,414
3. SALINA CRUZ, OAX.											
TOTAL INVESTMENT	3,231,940	3,500,000									6,731,940
PROCESS P. AND AUX.SERVS.	2,122,200	2,487,460									4,609,660
MATERIALS	1,288,509	1,483,218									2,771,727
ENGINEERING	101,175	129,432									230,607
4. TULA, HGO. I											
TOTAL INVESTMENT	184,400	300,000	20,000								504,400
PROCESS P. AND AUX.SERVS.	25,950	35,250									61,200
MATERIALS	16,102	21,796									37,898
ENGINEERING	1,149	1,555									2,704
5. SALAMANCA, GTO.											
TOTAL INVESTMENT	275,150	732,780	142,420								1,150,350
PROCESS P. AND AUX.SERVS.	323,160	377,000	89,890								790,050
MATERIALS	204,113	243,817	64,620								512,550
ENGINEERING	14,256	13,262	1,256								28,774
6. MINATITLAN, VER.											
TOTAL INVESTMENT	643,360	731,100	337,740								1,712,200
PROCESS P. AND AUX.SERVS.	459,260	454,600	229,840								1,153,700
MATERIALS	250,501	251,698	133,501								614,024
ENGINEERING	26,906	20,802	10,400								58,108
7. CADEREYTA, N.L.											
TOTAL INVESTMENT	2,159,000	3,200,000	1,531,600								6,890,600
PROCESS P. AND AUX.SERVS.	1,442,720	2,346,300	1,331,600								5,120,600
MATERIALS	957,591	1,521,905	848,323								3,327,919
ENGINEERING	74,140	131,292	85,117								290,549
8. SALINA CRUZ, OAX. II											
TOTAL INVESTMENT		1,000,000	2,565,000	2,965,000	1,795,000	335,000					8,700,000
PROCESS P. AND AUX.SERVS.		740,000	1,910,000	2,310,000	1,475,000	335,000					6,770,000
MATERIALS		433,100	1,175,000	1,397,600	874,700	157,500					4,096,600
ENGINEERING		27,100	52,259	101,425	87,407	25,509					321,700

(Continues)

TABLE C.VI.8

(Continues...)

INVESTMENTS PLAN FOR THE REFINING SECTOR

MATERIALS AND EQUIPMENT/ENGINEERING

(1977'S THOUSAND PESOS)

REFINERIES	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT	7,151,530	10,156,480	5,735,760	6,761,000	7,496,000	7,329,000	6,950,000	5.555,000	2,890,000	335,000	60,359,770
PROCESS P. AND AUX. SERVS.	4,750,370	6,813,210	4,296,330	4,970,000	5,705,000	4,835,000	3,690,000	2,615,000	1,455,000	335,000	39,454,910
MATERIALS	3,667,084	4,122,763	2,690,595	3,092.933	3,557.430	3,031,117	2,375,999	1,715,300	955,760	227,500	24,595,391
ENGINEERING	233,055	336,704	211,097	213,628	257,491	247,500	189,950	137,420	80,147	23,478	1,964,352
9. TULA, HGO. II											
TOTAL INVESTMENT			1,139,000	2,736,000	3,136,000	1,874,000	335,000				9,220,000
PROCESS P.AND AUX.SERVS.			735,000	1,920,000	2,320,000	1,470,000	335,000				6,780,000
MATERIALS			470,251	1,232,233	1,489,130	944,857	217,709				4,354,780
ENGINEERING			28,078	82.448	110,393	79,502	23,473				323,900
10. SALINA CRUZ, OAX. III											
TOTAL INVESTMENT				1,060,000	2,565,000	2,965.000	1,795,000	335,000			8,700,000
PROCESS P.AND AUX. SERVS.				740,000	1,910,000	2,310,000	1,475,000	335,000			6,770,000
MATERIALS				463,100	1,175,600	1,397,600	874,700	187,600			4,096,600
ENGINEERING				27,100	82,259	110,241	78,591	23,509			321,700
11. CADEREYTA, N.L. II											
TOTAL INVESTMENT						2,155,000	4,520,000	5,000,000	2,890,000	335,000	15,400,000
PROCESS P.AND AUX. SERVS.						720,000	1,880,000	2,280,000	1,455,000	335,000	6,670,000
MATERIALS						501,060	1,283,500	1,327,700	758,740	227,500	4,474,500
ENGINEERING						27,723	86,403	114,240	80,147	23,478	334,000

SOURCE: BUDGET INDEX OF CAPITALIZATION WORKS INVESTMENTS, 1977. GERENCIA DE PROYECTOS Y CONSTRUCCION, PETROLEOS MEXICANOS.

NOTE: THE ENGINEERING AND MATERIALS DISTRIBUTION ON EACH YEAR WAS MAKE AFTER THE FORECAST INVESTMENTS PROPORTION FOR EACH YEAR AND WITH THE ENGINEERING AND MATERIALS CONTENT PERCENTAGES OBSERVED IN 1977.

TABLE C.VI.9

[illegible] PLAN FOR THE REFINING SECTOR

[illegible]'S MILLION PESOS)

REFINERIES PROJECTS	1977	1978	1979	1980	1981
TOTAL INVESTMENT	[illegible]750,370	6,813,210	4,296,330	4,970,000	5.7[illegible]
AZCAPOTZALCO, D.F.					
1. KEROSENE TREATING PLANT	[illegible] 200	18,600			
2. RECONDITIONING WORKS	[illegible]0				
3. STORAGE TANKS		5,400			
CD. MADERO, TAMPS.	27,[illegible]	13,200			
1. CATALYTIC CRACKING ENLARGEMENT (23000-51000 B/D)	335,[illegible]	[illegible]000			
2. [illegible] PLANT	60,[illegible] 40,4[illegible]				
3. INTERMEDIATES DISTILLATES HYDRODESULFURIZATION PLANT (25000 B/D)	110,800	60[illegible]			
4. STORAGE TANKS	124,000	144,0[illegible]			
SALINA CRUZ I					
1. PRIMARY DISTILLATION PLANT (170000 B/D)	2,122,200	2,487,[illegible]			
2. VACUUM DISTILLATION PLANT (75000 B/D)	146,000	10[illegible]			
3. HYDROCARBON TREATING FRACTIONATING PLANT V.	146,000				
4. CATALYTIC CRACKING PLANT (40000 B/D)	235,000				
5. 2 INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)	429,[illegible]				
6. NAPHTHA REFINING PLANT (20000 B/D)	294,[illegible]	[illegible]			
7. NAPHTHA HYDRODESULFURIZATION PLANT (25000 B/D)	1[illegible]	23[illegible]			
8. BITTER WATER TREATING PLANT	[illegible],600				
9. AUXILIARY SERVICES	[illegible],000				
TULA, HGO. I					
1. NAPHTHA STABILIZING HYDRODESULFURIZATION PLANT (36500 B/D)	25,[illegible]				
2. NAPHTHA REFINING PLANT (30000 B/D)	[illegible]				
3. HYDROCARBONS TREATING FRACTIONATING PLANT (9500 B/D)					
4. 2 INTERMEDIATES DISTILLATES HYDRODESULFURIZATION PLANT [illegible] B/D EACH					
5. AUXILIARY SERVICES					
SALAMANCA, GTO.					
1. GASOLINE HYDRODESULFURIZATION PLANT (25000 B/D)					
2. GASOLINE REFINING PLANT (16500 B/D)					
3. FCC CATALYTIC CRACKING					
4. STORAGE TANKS					
5. AUXILIARY SERVICES					
MINATITLAN, VER.					
1. GAS SWEETENING PLANT					
2. HYDROCARBONS TREATING/FRACT[illegible] PLANT					
3. NAPHTHA HYDRODESULFURIZAT[illegible] (25000 B/D)					
4. GASOLINE REFINING P[illegible] B/D)					
5. REFINERY [illegible] FOR HYDROGENAT[illegible]					
6. [illegible]					
7. [illegible]ES HYDRODESULFURIZ[illegible]					

[illegible]PORTS	ENGINEERING NATIONAL EXTERNAL		INTERNAL		ENGINEERING TOTAL		MATERIALS AND ENGINEERING	
0.1	1,881,888	4.8	35,23[illegible]		1,964,352	5.0	26,[illegible],743	67.3
				.6	276	0.6	[illegible]	[illegible]
				4.0	28	4.0	[illegible]	[illegible]
				[illegible]	[illegible]	[illegible]	3,[illegible]	[illegible]
				.6	241	0.3	[illegible]	[illegible]
	12,651	2.9	[illegible]	0.5	28,[illegible]	4.1	300,[illegible]	[illegible]
			218	0.4	4,049	7.0	31,[illegible]	[illegible]
					9,140	4.8	119,570	[illegible]
					11,273	6.6	47,[illegible]	[illegible]
			3,752	1.4	3,750	1.4	38,[illegible]	[illegible]
					237,[illegible]	[illegible]	3,0[illegible]	[illegible]
					[illegible]	4.7	14,0[illegible]	[illegible]
							237,[illegible]3	[illegible]

SECTION [illegible]

TABLE C.VI.9
INVESTMENTS PLAN FOR THE REFINING SECTOR
(1977'S MILLION PESOS)

REFINERIES/PROJECTS	1977	1978	1979	
TOTAL INVESTMENT	4,750,370	6,813,210	4,296,330	4
AZCAPOTZALCO, D.F.	31,200	18,600		
1. KEROSENE TREATING PLANT	700			
2. RECONDITIONING WORKS	3,500	5,400		
3. STORAGE TANKS	27,000	13,200		
CD. MADERO, TAMPS.	335,900	354,000		
1. CATALYTIC CRACKING ENLARGEMENT (23000-51000 B/D)	60,700			
2. [illegible] CRYSTALLIZATION V. PLANT	40,400	150,000		
3. INTERMEDIATES DISTILLATES HYDRODESULFURIZATION PLANT (25000 B/D)	110,800	60,000		
4. STORAGE TANKS	124,000	144,000		
SALINA CRUZ I	2,122,200	2,487,460		
1. PRIMARY DISTILLATION PLANT (170000 B/D)	146,000	104,000		
2. VACUUM DISTILLATION PLANT (75000 B/D)	146,000	119,780		
3. HYDROCARBON TREATING/FRACTIONATING PLANT V.	235,000	242,320		
4. CATALYTIC CRACKING PLANT (40000 B/D)	429,000	545,220		
5. 2 INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)	294,000	485,320		
6. NAPHTHA REFINING PLANT (20000 B/D)	175,600	251,220		
7. NAPHTHA HYDRODESULFURIZATION PLANT (25000 B/D)	209,000	295,760		
8. BITTER WATER TREATING PLANT	18,600	34,870		
9. AUXILIARY SERVICES	469,000	327,900		
TULA, HGO. I	25,950	32,250		
1. NAPHTHA STABILIZING/HYDRODESULFURIZATION PLANT (36500 B/D)	4,250	5,750		
2. NAPHTHA REFINING PLANT (30000 B/D)	5,000	7,000		
3. HYDROCARBONS TREATING/FRACTIONATING PLANT (9800 B/D)	7,750	10,250		
4. 2 INTERMEDIATES DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)	8,500	11,500		
5. AUXILIARY SERVICES	450	750		
SALAMANCA GTO.	323,160	377,000	89,890	
1. GASOLINE HYDRODESULFURIZATION PLANT (25000 B/D)	35,060	75,000		
2. GASOLINE REFINING PLANT (16500 B/D)	74,980	100,000		
3. FCC CATALYTIC CRACKING	150,000			
4. STORAGE TANKS		31,000		
5. AUXILIARY SERVICES	63,120	171,000	89,890	
MINATITLAN, VER.	469,260	454,600	229,840	
1. GAS SWEETENING PLANT	22,000	16,000		
2. HYDROCARBONS TREATING/FRACTIONATING PLANT	120,000	45,000	45,000	
3. NAPHTHA HYDRODESULFURIZATION (1) (25000 B/D)	117,000	60,000		
4. GASOLINE REFINING PLANT (20000 B/D)	110,000	100,000	154,500	
5. REFINERY MODERNIZATION WORKS FOR HYDROGENATION OF LUBRICATING OILS		12,000		
6. STORAGE TANKS	24,200	60,100		
7. INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANT (25000 B/D)	65,160	100,000	30,340	
8. AUXILIARY SERVICES	10,900	61,500		

[redacted]

1979	1980	1981	1982	1983	1984	1985	1986	TOTAL INVESTMENT	NATIONAL
4,296,330	4,970,000	5,705,000	4,835,000	3,690,000	2,615,000	1,455,000	335,000	39,464,910	10,768,659
								49,800	24,619
								700	147
								8,900	2,483
								40,200	21,989
								689,900	130,570
								60,700	16,389
								190,400	41,558
								170,800	22,545
								268,000	49,848
								4,609,660	1,145,456
								250,000	57,500
								295,750	100,565
								527,520	147,850
								977,290	244,322
								777,320	163,237
								425,820	89,632
								504,760	105,999
								53,470	21,388
								796,900	215,163
								61,200	16,256
								10,000	3,090
								12,000	228
								18,000	7,038
								20,000	5,600
								1,200	300
89,890								790,050	284,391
								110,060	32,468
								174,980	52,659
								150,000	37,500
								31,000	9,145
89,890								324,010	152,609
229,840								1,153,700	282,709
								38,000	15,200
45,000								210,000	58,800
								177,000	44,250
154,500								364,500	98,415
								12,000	2,450
								84,500	31,191
30,340								195,500	2,346
								72,400	30,046

SECTION 3

	MATERIALS				MATERIALS		ENGINEERING						
T	NATIONAL		IMPORTS		TOTAL		IMPORTS		NATIONAL EXTERNAL		INTERNAL		
	10,768,659	27.3	13,826,732	35.0	24,595,391	62.3	47,230	0.1	1,881,888	4.8	35,234	0.1	1,
	24,619	49.4	5,275	10.6	28,894	60.0					276	0.6	
	147	21.0	182	26.0	329	47.0					28	4.0	
	2,483	27.9	792	8.9	3,275	36.8					7	1.1	
	21,989	54.7	4,301	10.7	26,290	65.4					241	0.6	
	130,370	18.9	147,333	21.4	278,003	40.3	4,768	0.7	19,651	2.8	3,995	0.6	
	16,389	27.0	10,501	17.3	26,890	44.3	4,006	6.6			243	0.4	
	41,588	22.0	68,544	36.0	110,432	58.0	762	0.4	8,378	4.4			
	22,545	13.2	63,196	37.0	85,741	50.2			11,273	6.6			
	49,848	18.6	5,092	1.9	54,940	20.5					3,752	1.4	
	1,145,456	24.8	1,626,271	35.3	2,771,727	60.1			230,607	5.0			
	57,500	23.0	95,000	38.0	152,500	61.0			10,000	4.0			
	100,565	34.0	91,692	31.0	192,257	65.0			17,747	6.0			
	147,650	28.0	179,289	34.0	326,939	62.0			36,912	7.0			
	244,322	25.0	342,052	35.0	586,374	60.0			29,319	3.0			
	163,237	21.0	272,062	35.0	435,299	56.0			54,412	7.0			
	89,632	21.0	149,387	35.0	239,019	56.0			29,877	7.0			
	105,999	21.0	176,666	35.0	282,665	56.0			35,333	7.0			
	21,388	40.0	5,347	10.0	26,735	50.0			1,069	2.0			
	215,163	27.0	314,776	39.5	529,939	66.5			15,938	2.0			
	16,256	26.6	21,642	35.4	37,898	62.0			2,620	4.3	84	0.1	
	3,090	30.9	3,320	33.2	6,410	64.1			390	3.9			
	228	1.9	5,796	48.3	6,024	50.2			372	3.1			
	7,038	39.1	4,608	25.6	11,646	64.7			918	5.1			
	5,600	28.0	7,700	38.5	13,300	66.5			940	4.7			
	300	25.0	218	18.2	518	43.2					84	7.0	
	284,391	36.2	228,159	29.4	512,550	65.6			26,604	3.8	2,170	0.1	
	32,468	29.5	33,458	30.4	65,926	59.9			7,594	6.9			
	52,669	30.1	58,268	33.3	110,937	63.4			9,974	5.7			
	37,500	25.0	52,500	35.0	90,000	60.0			4,500	3.0			
	9,145	29.5	3,255	10.5	12,400	40.0					2,170	7.0	
	152,609	47.1	80,678	24.9	233,287	72.0			4,536	1.4			
	282,708	24.5	332,792	28.8	615,500	53.4			54,199	4.7	3,909	0.3	
	15,200	40.0	3,800	10.0	19,000	50.0			2,014	5.3			
	58,800	28.0	71,400	34.0	130,200	62.0			14,700	7.0			
	44,250	25.0	39,825	22.5	84,075	47.5			11,682	6.6	1,416	0.8	
	98,415	27.0	123,201	33.8	221,616	60.8			12,393	3.4			
	2,460	20.5	492	4.1	2,952	24.6					300	2.5	
	31,191	37.0	5,058	6.0	36,249	43.0					1,686	2.0	
	2,346	1.2	72,726	37.2	75,072	38.4			12,903	6.6			
	30,046	41.5	16,290	22.5	46,336	64.0			507	0.7	507	0.7	

SECTION 4

MATERIALS TOTAL		ENGINEERING IMPORTS		ENGINEERING NATIONAL EXTERNAL		ENGINEERING INTERNAL		ENGINEERING TOTAL		MATERIALS AND ENGINEERING	
24,595,391	62.3	47,230	0.1	1,881,888	4.8	35,234	0.1	1,964,352	5.0	26,559,743	67.3
28,894	60.0					276	0.6	276	0.6	29,170	60.6
329	47.0					28	4.0	28	4.0	357	51.0
3,275	36.8					7	1.1	7	1.1	3,282	37.9
26,290	65.4					241	0.6	241	0.6	26,531	66.0
278,003	40.3	4,768	0.7	19,651	2.8	3,995	0.6	28,414	4.1	306,417	44.4
26,890	44.3	4,006	6.6			243	0.4	4,249	7.0	31,139	51.3
110,432	58.0	762	0.4	8,378	4.4			9,140	4.8	119,572	62.8
85,741	50.2			11,273	6.6			11,273	6.6	97,014	56.8
54,940	20.5					3,752	1.4	3,752	1.4	58,692	21.9
2,771,727	60.1			230,607	5.0			230,607	5.0	3,002,334	65.1
152,500	61.0			10,000	4.0			10,000	4.0	162,500	65.0
192,257	65.0			17,747	6.0			17,747	6.0	210,004	71.0
326,939	62.0			36,912	7.0			36,912	7.0	363,851	69.0
586,374	60.0			29,319	3.0			29,319	3.0	615,693	63.0
435,299	56.0			54,412	7.0			54,412	7.0	489,711	63.0
239,019	56.0			29,877	7.0			29,877	7.0	268,896	63.0
282,665	56.0			35,333	7.0			35,333	7.0	317,998	63.0
26,735	50.0			1,069	2.0			1,069	2.0	27,804	52.0
529,939	66.5			15,938	2.0			15,938	2.0	545,877	68.5
37,898	62.0			2,620	4.3	84	0.1	2,704	4.4	40,602	66.4
6,410	64.1			390	3.9			390	3.9	6,800	68.0
6,024	50.2			372	3.1			372	3.1	6,396	53.3
11,646	64.7			918	5.1			918	5.1	12,564	69.8
13,300	66.5			940	4.7			940	4.7	14,240	71.2
518	43.2					84	7.0	84	7.0	602	50.2
512,550	65.6			26,604	3.8	2,170	0.1	28,774	3.9	541,324	69.5
65,926	59.9			7,594	6.9			7,594	6.9	73,520	66.8
110,937	63.4			9,974	5.7			9,974	5.7	120,911	69.1
90,000	60.0			4,500	3.0			4,500	3.0	94,500	63.0
12,400	40.0					2,170	7.0	2,170	7.0	14,570	47.0
233,287	72.0			4,536	1.4			4,536	1.4	237,823	73.4
615,500	53.4			54,199	4.7	3,909	0.3	58,108	5.0	673,608	58.4
19,000	50.0			2,014	5.3			2,014	5.3	21,014	55.3
130,200	62.0			14,700	7.0			14,700	7.0	144,900	69.0
84,075	47.5			11,682	6.6	1,416	0.8	13,098	7.4	97,173	54.9
221,616	60.8			12,393	3.4			12,393	3.4	234,009	64.2
2,952	24.6					300	2.5	300	2.5	3,252	27.1
36,249	43.0					1,686	2.0	1,686	2.0	37,935	45.0
75,072	38.4			12,903	6.6			12,903	6.6	87,975	45.0
46,336	64.0			507	0.7	507	0.7	1,014	1.4	47,350	65.4

[redacted]

TABLE C.VI.9 (Continues...)

INVESTMENTS PLAN FOR THE REFINING SECTOR
(1977'S MILLION PESOS)

REFINERIES/PROJECTS	1977	1978	1979
TOTAL INVESTMENT	4,750,370	6,813,210	4,296,
CADEREYTA, N.L. I	1,442,700	2,346,300	1,331,
1. TOPPING PLANT (100000 B/D)	189,000	49,500	
2. VACUUM DISTILLATION (62000 B/D)	83,000	102,000	80,
3. COMBINED UNIT (135000 B/D)	50,000	450,000	340,
4. HYDROCARBONS TREATING/FRACTIONATING PLANT (11862 B/D)	88,000	252,000	179,
5. CATALYTIC CRACKING (40000 B/D)	216,800	403,200	263,
6. 2 INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)	231,700	273,300	208,
7. NAPHTHA REFINING PLANT (20000 B/D)	137,000	173,300	106,
8. NAPHTHA HYDRODESULFURIZATION PLANT (36000 B/D)	157,000	203,000	144,
9. AUXILIARY SERVICES	290,200	440,000	
SALINA CRUZ, OAX. II		740,000	1,910,
1. PRIMARY DISTILLATION PLANT (200000 B/D)		180,000	400,
2. VACUUM DISTILLATION PLANT (100000 B/D)		50,000	150,
3. CATALYTIC CRACKING (40000 B/D)		220,000	450,
4. NAPHTHA HYDRODESULFURIZATION PLANT (36000 B/D)			100,
5. NAPHTHA REFINING PLANT (25000 B/D)			90,0
6. 2 INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)			145,0
7. TREATING/FRACTIONATING PLANT		90,000	175,
8. AUXILIARY SERVICES		200,000	400,0
TULA, HGO. II			735,
1. PRIMARY DISTILLATION PLANT (200000 B/D)			180,
2. VACUUM DISTILLATION PLANT (100000 B/D)			50,
3. CATALYTIC CRACKING (40000 B/D)			200,
4. NAPHTHA HYDRODESULFURIZATION PLANT (36000 B/D)			
5. NAPHTHA REFINING PLANT (30000 B/D)			
6. 2 INTERMEDIATE DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)			
7. HYDROCARBONS TREATING/FRACTIONATING PLANT			90,
8. AUXILIARY SERVICES			215,
SALINA CRUZ, OAX. III			
1. PRIMARY DISTILLATION PLANT (200000 B/D)			
2. VACUUM DISTILLATION PLANT (100000 B/D)			
3. CATALYTIC CRACKING (40000 B/D)			
4. NAPHTHA HYDRODESULFURIZATION PLANT (36000 B/D)			
5. NAPHTHA REFINING PLANT (30000 B/D)			
6. 2 INTERMEDIATES DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)			
7. TREATING/FRACTIONATING PLANT			
8. AUXILIARY SERVICES			
CADEREYTA, N.L. II			
1. PRIMARY DISTILLATING PLANT (200000 B/D)			
2. VACUUM DISTILLATION PLANT (100000 B/D)			
3. CATALYTIC CRACKING (40000 B/D)			
4. NAPHTHA HYDRODESULFURIZATION PLANT (36000 B/D)			
5. NAPHTHA REFINING PLANT (30000 B/D)			
6. 2 INTERMEDIATES DISTILLATES HYDRODESULFURIZATION PLANTS (25000 B/D EACH)			
7. TREATING/FRACTIONATING PLANT			
8. AUXILIARY SERVICES			

SECRET

1979	1980	1981	1982	1983	1984	1985	1986	TOTAL INVESTMENT	NATIONALS	MA
,296,330	4,970,000	5,705,000	4,835,000	3,690,000	2,615,000	1,455,000	335,000	39,464,910	10,768,659	27.
,331,600								5,120,600	1,522,949	29.
								238,500	109,233	45.
80,800								265,800	90,372	34.0
349,500								849,500	237,530	28.0
179,300								519,300	145,404	28.0
263,100								853,100	282,592	32.
208,800								713,500	228,413	32.0
106,000								416,300	116,564	28.0
144,100								504,100	105,361	21.0
								730,200	206,547	28.3
,910,000	2,310,000	1,475,000	335,000					6,770,000	1,659,600	24.
400,000	400,000	180,000						1,160,000	266,800	23.
150,000	150,000	50,000						400,000	136,000	34.
450,000	450,000	220,000						1,340,000	335,000	25.0
100,000	250,000	250,000	100,000					700,000	147,000	21.0
90,000	185,000	185,000	90,000					550,000	115,500	21.0
145,000	300,000	300,000	145,000					890,000	186,900	21.0
175,000	175,000	90,000						530,000	148,400	28.0
400,000	400,000	200,000						1,200,000	324,000	27.0
735,000	1,920,000	2,320,000	1,470,000	335,000				6,750,000	1,904,530	28.1
180,000	400,000	400,000	180,000					1,160,000	266,800	23.0
50,000	150,000	150,000	50,000					400,000	136,000	34.0
200,000	420,000	420,000	200,000					1,240,000	396,800	32.0
	100,000	250,000	250,000	100,000				700,000	147,000	21.0
	90,000	185,000	185,000	90,000				550,000	154,000	28.0
	145,000	300,000	300,000	145,000				890,000	284,800	32.0
90,000	175,000	175,000	90,000					530,000	148,400	28.0
215,000	440,000	440,000	215,000					1,310,000	370,750	28.3
	740,000	1,910,000	2,310,000	1,475,000	335,000			6,770,000	1,659,600	24.5
	180,000	400,000	400,000	180,000				1,160,000	266,800	23.0
	50,000	150,000	150,000	50,000				400,000	136,000	34.0
	220,000	450,000	450,000	220,000				1,240,000	335,000	25.0
		100,000	250,000	250,000	100,000			700,000	147,000	21.0
		90,000	185,000	185,000	90,000			550,000	115,500	21.0
		145,000	300,000	300,000	145,000			890,000	186,900	21.0
	90,000	175,000	175,000	90,000				530,000	148,400	28.0
	200,000	400,000	400,000	200,000				1,200,000	324,000	27.0
			720,000	1,880,000	2,280,000	1,455,000	335,000	6,670,000	2,137,550	32.1
			180,000	400,000	400,000	180,000		1,160,000	531,280	45.8
			50,000	150,000	150,000	50,000		400,000	136,000	34.0
			200,000	420,000	420,000	200,000		1,240,000	396,500	32.0
				100,000	250,000	250,000	100,000	700,000	147,000	21.0
				90,000	185,000	185,000	90,000	550,000	154,000	32.0
				145,000	300,000	300,000	145,000	890,000	284,800	32.0
			90,000	175,000	175,000	90,000		530,000	148,400	28.0
			200,000	400,000	400,000	200,000		1,200,000	339,300	28.3

SECTION 3

MATERIALS						ENGINEERING							
IONALS		IMPORTS		MATERIALS TOTAL		IMPORTS		NATIONAL EXTERNAL		INTERNAL		ENGINEERING TOTAL	
59	27.3	13,826,732	35.0	24,595,391	62.3	47,230	0.1	1,881,888	4.8	35,234	0.1	1,964,352	5.
19	29.7	1,804,970	35.2	3,327,919	64.9	17,662	0.3	274,887	5.4			292,549	5.
33	45.8	72,504	30.4	181,737	76.2			7,632	3.2			7,632	3.
72	34.0	82,398	31.0	172,770	65.0			15,948	6.0			15,948	6.
30	28.0	288,830	34.0	526,690	62.0			59,465	7.0			59,465	7.
04	28.0	176,562	34.0	321,966	62.0			36,351	7.0			36,351	7.
92	32.0	335,578	38.0	618,170	70.0	17,662	2.0	26,493	3.0			44,135	5.
16	32.0	242,692	34.0	471,108	66.0			49,966	7.0			49,966	7.
34	28.0	141,542	34.0	258,106	62.0			29,141	7.0			29,141	7.
61	21.0	176,435	35.0	282,296	56.0			35,287	7.0			35,287	7.
47	28.3	288,429	39.5	495,076	67.8			14,604	2.0			14,604	2.
00	24.5	2,437,000		4,096,600	60.5			321,700	4.7			321,700	4.
00	23.0	440,800	38.0	707,600	61.0			46,400	4.0			46,400	4.
00	34.0	124,000	31.0	260,000	65.0			24,000	6.0			24,000	6.
00	25.0	469,000	35.0	804,000	60.0			40,200	3.0			40,200	3.
00	21.0	245,000	35.0	392,000	56.0			49,000	7.0			49,000	7.
500	21.0	192,500	35.0	308,000	56.0			38,500	7.0			38,500	7.
00	21.0	311,500	35.0	498,400	56.0			62,500	7.0			62,500	7.
00	28.0	180,200	34.0	328,600	62.0			37,100	7.0			37,100	7.
00	27.0	474,000	39.5	798,000	66.5			24,000	2.0			24,000	2.
30	28.1	2,449,650	36.1	4,354,180	64.2			320,700	4.4	24,800	0.4	345,500	4.
00	23.0	440,800	38.0	707,600	61.0			46,400	4.0			46,400	4.
00	34.0	105,400	31.0	241,400	60.3			24,000	6.0			24,000	6.
[illegible]	32.0	471,200	38.0	868,000	70.0			37,200	3.0	24,800	2.0	62,000	5.
00	21.0	245,000	35.0	392,000	56.0			49,000	7.0			49,000	7.
[illegible]	28.0	187,000	34.0	341,000	62.0			38,500	7.0			38,500	7.
00	32.0	302,600	34.0	537,400	66.0			62,300	7.0			62,300	7.
[illegible]	28.0	180,200	34.0	328,600	62.0			37,100	7.0			37,100	7.
[illegible]	28.3	517,450	39.5	888,180	67.8			26,200	2.0			26,000	2.
0	24.5	2,437,000	36.0	4,096,000	60.5			321,700	4.7			321,700	4.
00	23.0	440,800	38.0	707,600	61.0			46,400	4.0			46,400	4.
00	34.0	124,000	31.0	260,000	65.0			24,000	6.0			24,000	[illegible]
00	25.0	469,000	35.0	804,000	60.0			40,200	3.0			40,200	3
00	21.0	245,000	35.0	392,000	56.0			49,000	7.0			49,000	7.
[illegible]	21.0	192,500	35.0	308,000	56.0			38,500	7.0			38,500	7.
[illegible]	21.0	311,500	35.0	498,400	56.0			62,500	7.0			62,500	7.
[illegible]	28.0	180,200	34.0	328,600	62.0			37,100	7.0			37,100	7.
00	27.0	474,000	39.5	798,000	66.5			24,000	2.0			24,000	2.
80	32.1	2,336,640	35.0	4,474,520	67.1	24,800	0.4	309,220	4.6			334,020	5.
280	45.8	352,640	30.4	883,920	76.2			37,120	3.2			37,120	2
00	34.0	124,000	31.0	260,000	65.0			24,000	6.0			24,000	6.
00	32.0	471,200	38.0	868,000	70.0	24,800	2.0	37,200	3.0			62,000	5.
00	21.0	245,000	35.0	392,000	56.0			49,000	7.0			49,000	7.
[illegible]	32.0	187,000	34.0	341,000	62.0			38,500	7.0			38,500	7
0	32.0	302,600	34.0	587,400	66.0			62,300	7.0			62,300	7
[illegible]	28.0	180,200	34.0	328,600	62.0			37,100	7.0			37,100	7
0	28.3	474,000	39.5	813,600	67.8			24,000	2.0			24,000	2

SECTION 4

MATERIALS TOTAL		ENGINEERING						ENGINEERING TOTAL		MATERIALS AND ENGINEERING TOTAL	
		IMPORTS		NATIONAL EXTERNAL		INTERNAL					
4,595,391	62.3	47,230	0.1	1,881,888	4.8	35,234	0.1	1,964,352	5.0	26,559,743	67.3
3,327,919	64.9	17,662	0.3	274,887	5.4			292,549	5.7	3,620,468	70.7
181,737	76.2			7,632	3.2			7,632	3.2	189,369	79.4
172,770	65.0			15,948	6.0			15,948	6.0	188,718	71.0
526,690	62.0			59,465	7.0			59,465	7.0	586,155	69.0
321,966	62.0			36,351	7.0			36,351	7.0	358,317	69.0
618,170	70.0	17,662	2.0	26,493	3.0			44,155	5.0	662,325	75.0
471,108	66.0			49,966	7.0			49,966	7.0	521,074	73.0
258,106	62.0			29,141	7.0			29,141	7.0	287,247	69.0
282,296	56.0			35,287	7.0			35,287	7.0	317,583	63.0
495,076	67.8			14,604	2.0			14,604	2.0	509,680	69.8
4,096,600	60.5			321,700	4.7			321,700	4.7	4,418,300	65.2
707,600	61.0			46,400	4.0			46,400	4.0	754,000	65.0
260,000	65.0			24,000	6.0			24,000	6.0	284,000	71.0
804,000	60.0			40,200	3.0			40,200	3.0	844,200	63.0
392,000	56.0			49,000	7.0			49,000	7.0	441,000	63.0
308,000	56.0			38,500	7.0			38,500	7.0	346,500	63.0
498,400	56.0			62,500	7.0			62,500	7.0	560,900	63.0
328,600	62.0			37,100	7.0			37,100	7.0	365,700	69.0
798,000	66.5			24,000	2.0			24,000	2.0	822,000	68.5
4,354,180	64.2			320,700	4.4	24,800	0.4	345,500	4.8	4,699,680	69.0
707,600	61.0			46,400	4.0			46,400	4.0	754,000	65.0
241,400	60.3			24,000	6.0			24,000	6.0	243,800	66.3
868,000	70.0			37,200	3.0	24,800	2.0	62,000	5.0	930,000	75.0
392,000	56.0			49,000	7.0			49,000	7.0	441,000	63.0
341,000	62.0			38,500	7.0			38,500	7.0	379,500	69.0
587,400	66.0			62,300	7.0			62,300	7.0	649,700	73.0
328,600	62.0			37,100	7.0			37,100	7.0	365,700	69.0
888,180	67.8			26,200	2.0			26,200	2.0	914,380	69.3
4,096,000	60.5			321,700	4.7			321,700	4.7	4,418,300	65.2
707,600	61.0			46,400	4.0			46,400	4.0	754,000	65.0
260,000	65.0			24,000	6.0			24,000	6.0	284,000	71.0
804,000	60.0			40,200	3.0			40,200	3.0	844,000	63.0
392,000	56.0			49,000	7.0			49,000	7.0	441,000	63.0
308,000	56.0			38,500	7.0			38,500	7.0	346,500	63.0
498,400	56.0			62,500	7.0			62,500	7.0	560,900	63.0
328,600	62.0			37,100	7.0			37,100	7.0	365,700	69.0
798,000	66.5			24,000	2.0			24,000	2.0	822,000	68.5
4,474,520	67.1	24,800	0.4	309,220	4.6			334,020	5.0	4,808,540	72.1
883,920	76.2			37,120	3.2			37,120	2.0	921,040	79.4
260,000	65.0			24,000	6.0			24,000	6.0	284,000	71.0
868,000	70.0	24,800	2.0	37,200	3.0			62,000	5.0	930,000	75.0
392,000	56.0			49,000	7.0			49,000	7.0	441,000	63.0
341,000	62.0			38,500	7.0			38,500	7.0	379,500	69.0
587,400	66.0			62,300	7.0			62,300	7.0	649,700	73.0
328,600	62.0			37,100	7.0			37,100	7.0	365,700	69.0
813,600	67.8			24,000	2.0			24,000	2.0	837,600	69.8

TABLE C.VI.10

INVESTMENTS PLAN FOR THE ENGINEERING EQUIPMENTS, MATERIALS AND PETROCHEMICAL SECTOR
(1977'S MILLION PESOS)

WORK CENTERS	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT (1)	9,692.9	15,563.8	12,098.3	6,414.6	4,288.0	3,290.2	5,970.4	6,367.8	4,936.9	1,973.8	70,596.7
PROCESS AND AUXILIARY SERVICES	8,495.0	13,209.3	10,725.4	6,167.6	3,991.0	3,052.2	5,484.6	5,947.8	4,426.9	1,593.8	63,093.6
MATERIALS	5,946.9	9,703.9	7,525.0	3,796.7	2,482.7	1,866.9	3,498.3	4,168.9	3,699.7	1,657.2	44,346.2
ENGINEERING	504.3	791.7	629.5	385.0	259.9	231.5	448.9	411.9	304.4	111.7	4,078.8
1. COSOLEACAQUE, VER.											
TOTAL INVESTMENT	270.7										270.7
PROCESS P. AND AUXILIARY SERVS.	270.7										270.7
MATERIALS	189.5										189.5
ENGINEERING	13.5										13.5
2. SALAMANCA, GTO.											
TOTAL INVESTMENT	91.9										91.9
PROCESS P. AND AUXILIARY SERVS.	91.9										91.9
MATERIALS	49.7										49.7
ENGINEERING	5.6										5.6
3. MINATITLAN, VER.											
TOTAL INVESTMENT	3.3										3.3
PROCESS P. AND AUXILIARY SERVS.	3.3										3.3
MATERIALS	2.0										2.0
ENGINEERING	0.4										0.4
4. POZA RICA, VER.											
TOTAL INVESTMENT	765.0	331.5									1,096.5
PROCESS P. AND AUXILIARY SERVS.	600.0	264.0									864.0
MATERIALS	482.3	209.0									691.3
ENGINEERING	19.6	23.2									42.8
5. PAJARITOS, VER.											
TOTAL INVESTMENT	430.9	287.3	124.5								842.7
PROCESS P. AND AUXILIARY SERVS.	430.9	287.3	124.5								842.7
MATERIALS	236.9	158.0	68.5								463.4
ENGINEERING	30.2	20.1	8.7								59.0
6. SAN MARTIN TEX., PUE.											
TOTAL INVESTMENT	589.6	345.5	111.5								1,046.6
PROCESS P. AND AUXILIARY SERVS.	477.1	246.5	71.0								794.6
MATERIALS	350.2	200.2	60.2								610.6
ENGINEERING	28.8	16.4	4.8								50.0
7. CANGREJERA, VER.											
TOTAL INVESTMENT	4,131.6	4,598.7	856.1	26.3							9,612.7
PROCESS P. AND AUXILIARY SERVS.	3,795.9	3,751.4	765.7	26.3							8,337.3
MATERIALS	2,543.6	2,832.9	538.4	14.6							5,929.5
ENGINEERING	264.3	294.8	42.1	1.9							603.4
8. CUNDUACAN, TAB.											
TOTAL INVESTMENT	523.4	4,726.5	5,016.4	1,080.6	421.2						11,768.1
PROCESS P. AND AUXILIARY SERVS.	496.6	4,575.6	4,764.4	1,028.0	421.2						11,285.8
MATERIALS	368.5	3,325.9	3,525.8	759.1	295.1						8,274.4
ENGINEERING	23.5	211.2	227.8	49.6	21.1						533.2

(2) TABLE C.VI.10 (*Continues...*)

INVESTMENTS PLAN FOR THE ENGINEERING/EQUIPMENTS, MATERIALS AND PETROCHEMICAL SECTOR

(1977'S MILLION PESOS)

WORK CENTERS	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT	9,692.9	15,563.8	12.098.3	6,414.6	4,288.0	3,290.2	5,970.4	6,367.8	4,736.9	1,973.8	70,396.7
PROCESS AND AUXILIARY SERVS.	8,495.0	13,209.3	10,725.4	6,167.6	3,991.0	3,052.2	5,484.6	5,947.8	4.426.9	1,593.8	63,093.2
MATERIALS	5,946.9	9,703.9	7,525.0	3,796.7	2,482.7	1,866.9	3,435.3	4,165.9	3,699.7	1,647.2	44,346.2
ENGINEERING	504.3	791.7	629.5	385.0	259.9	231.5	448.9	411.9	504.4	111.7	4,278.8
9. ALLENDE, VER.											
TOTAL INVESTMENT	395.1	3,681.1	4,645.2	2,027.9	454.8						11,204.1
PROCESS P.AND AUXILIARY SERVS.	303.2	2,864.3	3,812.6	1,969.9	454.8						9,404.8
MATERIALS	222.1	2,045.7	2,555.1	1,104.6	245.1						6,172.6
ENGINEERING	12.6	161.7	280.9	151.3	36.3						642.8
10. CACTUS, CHIS.											
TOTAL INVESTMENT	2,128.0	1,392.3	507.3	136.4	297.0	198.0	85.8				4,754.5
PROCESS P.AND AUXILIARY SERVS.	1,672.0	1,019.3	351.9								3,043.2
MATERIALS	1,328.0	832.0	254.4	65.5	142.5	95.1	41.1				2,758.6
ENGINEERING	74.3	45.5	14.6	4.0	9.0	6.0	2.4				156.1
11. TULA, HGO.											
TOTAL INVESTMENT	300.9	160.0	46.3	27.0	18.0	7.8					560.0
PROCESS P.AND AUXILIARY SERVS.	300.9	160.0	46.3	27.0	18.0	7.8					560.0
MATERIALS	142.0	75.3	22.7	16.5	10.9	4.8					272.2
ENGINEERING	24.2	12.8	4.1	3.8	2.5	1.1					48.5
12. SALINA CRUZ, OAX.											
TOTAL INVESTMENT	21.0	19.9	40.5	27.0	24.9	49.5	33.0	14.3			230.1
PROCESS P.AND AUXILIARY SERVS.	21.0	19.9	40.5	27.0	24.9	49.5	33.0	14.3			230.1
MATERIALS	12.8	12.1	24.7	16.4	15.2	30.2	20.2	8.7			140.3
ENGINEERING	2.9	2.8	5.7	3.8	3.4	7.0	4.6	2.0			32.2
13. CADEREYTA, N.L.											
TOTAL INVESTMENT	31.5	21.0	9.1			10.8	40.5	27.0	11.7		151.6
PROCESS P.AND AUXILIARY SERVS.	31.5	21.0	9.1			10.8	40.5	27.0	11.7		151.6
MATERIALS	19.3	12.8	5.6			6.6	24.7	16.5	7.1		92.6
ENGINEERING	4.4	2.9	1.3			1.5	5.7	3.5	1.6		21.2
14. UNDEFINED											
TOTAL INVESTMENT			741.4	3,089.4	3,072.1	3,024.1	5,811.1	6,326.5	4,905.2	1,973.8	28,963.6
PROCESS P.AND AUXILIARY SERVS.			741.4	3,089.4	3,072.1	2,984.1	5,411.1	5,905.5	4,475.2	1,593.8	27,213.6
MATERIALS			439.6	1,820.0	1,773.9	1,730.2	3,412.3	4,143.7	3,690.8	1,657.2	18,869.5
ENGINEERING			39.5	170.6	187.6	218.9	436.2	406.1	300.8	111.7	1,870.4

(1) AFTER THE PETROCHEMICAL WORKS PROGRAM. DIVISION DE PLANEACION DE PETROQUIMICA. I.M.P. 1978.

[redacted]

TABLE C.VI.11

INVESTMENTS PLAN FOR THE PETROCHEMICAL SECTO

(1977'S MILLION PESOS)

WORK CENTERS	1977	1978	1979	1980	1981	198
TOTAL INVESTMENTS (*)	9,692.9	15,563.8	12,098.3	6,414.6	4,288.0	3,29
COSOLEACAQUE, VER.	270.7					
AMMONIA VII	135.3					
AMMONIA VIII	135.4					
SALAMANCA, GTO.	91.9					
INTEGRATION AND AMMONIA	91.9					
MINATITLAN, VER.	3.3					
SULFUR	3.3					
POZA RICA, VER.	765.0	331.5				
ETHYLENE IV	240.0	104.0				
POLYETHYLENE	300.0	130.0				
INTEGRATION AND AUX. SERVS.	115.0	97.5				
SAN MARTIN TEX., PUE.	589.6	345.5	111.5			
METHANOL	204.0	88.4				
TETRAMER III	51.3	34.2	14.9			
ACRYLIC ACID	73.2	48.8	21.2			
DODECYL TOLVENE	58.6	39.1	16.9			
INTEGR. AND AUX. SERVS.	202.5	135.0	58.5			
CACTUS, CHIS.	2,138.0	1,392.3	507.3	136.4	297.0	198.
SULFUR AND SWEETENING V	28.6					
SULFUR AND SWEETENING VI	66.0	28.6				
SULFUR AND SWEETENING VII	66.0	28.6				
SULFUR AND SWEETENING VIII	26.4	99.0	66.0	28.6		
SULFUR AND SWEETENING IX	26.4	99.0	66.0	28.6		
SULFUR AND SWEETENING X				26.4	99.0	6
SULFUR AND SWEETENING XI				26.4	99.0	6
SULFUR AND SWEETENING XII				26.4	99.0	6
CRYOGENICS I (INCLUDES CRACKING)	90.0	39.0				
CRYOGENICS II (INCLUDES CRACKING)	90.0	39.0				
CRYOGENIC III (NO CRACKING)	343.7	148.9				
CRYOGENIC IV (NO CRACKING)	527.8	351.9	152.5			
HYDROCARBONS STABILIZING AND SWEETENING	48.0	20.8				
HYDROCARBONS STABILIZING AND SWEETENING	72.0	48.0	20.8			
NATURAL GASOLINE CRACKING PLANT	53.9	23.3				
INTEGRATION AND AUXILIARY SERVICES	699.2	466.2	202.0			
TULA, HGO.	300.9	160.0	46.3	27.0	18.0	
ACRYLONITRILE II	160.8	69.7				
ACETONITRILE	135.5	90.3	39.1			
SULFUR	4.6					
SULFUR			7.2	27.0	18.0	7

(Continues...)

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ECTOR

						M A T E R I A L S					
1982	1983	1984	1985	1986	TOTAL	NATIONAL	%	IMPORT	%	MATERIALS TOTAL	
,290.2	5,970.4	6,367.8	4,936.9	1,973.8	70,596.7	15,731.6	22.3	27,288.6	38.6	43,020.2	60.9
					270.7	27.0	10.0	162.5	60.0	189.5	70.0
					135.3	13.5	10.0	81.2	60.0	94.7	70.0
					135.4	13.5	10.0	81.3	60.0	94.8	70.0
					91.9	17.5	19.0	32.2	35.0	49.7	54.1
					91.9	17.5	19.0	32.2	35.0	49.7	54.0
					3.3	1.6	48.0	0.4	13.0	2.0	61.0
					3.3	1.6	48.0	0.4	13.0	2.0	61.0
					1,096.5	364.9	33.3	326.4	29.7	691.3	63.0
					344.0	110.1	32.0	113.5	33.0	223.6	65.0
					430.0	116.1	27.0	180.6	42.0	296.7	69.0
					322.5	138.7	43.0	32.3	10.0	171.0	53.0
					1,046.6	259.5	24.8	351.1	12.9	610.6	58.3
					292.4	61.3	22.0	140.4	48.0	204.7	70.0
					100.4	18.1	18.0	29.1	29.0	47.2	47.0
					143.2	25.8	18.0	41.5	29.0	67.3	47.0
					114.6	20.6	18.0	33.2	29.0	53.8	47.0
					396.0	130.7	33.0	106.9	27.0	237.6	60.0
198.0	85.8				4,754.8	1,161.1	24.4	1,627.5	34.2	2,788.6	58.6
					28.6	8.3	29.0	5.4	19.0	13.7	48.0
					94.6	27.4	29.0	18.0	19.0	45.4	48.0
					94.6	27.4	29.0	18.0	19.0	45.4	48.0
					220.0	63.8	29.0	41.8	19.0	105.6	48.0
					220.0	63.8	29.0	41.8	19.0	105.6	48.0
66.0	28.6				220.0	63.8	29.0	41.8	19.0	105.6	48.0
66.0	28.6				220.0	63.8	29.0	41.8	19.0	105.6	48.0
66.0	28.6				220.0	63.8	29.0	41.8	19.0	105.6	48.0
					129.0	28.4	22.0	58.1	45.0	86.5	67.0
					129.0	28.4	22.0	58.1	45.0	86.5	67.0
					492.6	93.6	19.0	315.3	64.0	408.9	83.0
					1,032.2	196.1	19.0	660.6	64.0	856.7	83.0
					68.8	23.4	34.0	15.1	22.0	38.5	56.0
					140.8	47.9	34.0	31.0	22.0	78.9	56.0
					77.2	19.3	25.0	20.1	26.0	39.4	51.0
					1,367.4	341.9	25.0	218.8	16.0	560.7	41.0
7.8					560.0	120.2	21.5	152.0	27.1	272.2	48.6
					230.5	41.5	18.0	66.8	29.0	108.3	47.0
					264.9	47.7	18.0	76.8	29.0	124.5	47.0
					4.6	2.2	48.0	0.6	13.0	2.8	61.0
7.8					60.0	28.8	48.0	7.8	13.0	36.6	61.0

SECTION 3

MATERIALS TOTAL		ENGINEERING IMPORT	%	ENGINEERING NATIONAL EXTERNAL	%	ENGINEERING NATIONAL INTERNAL	%	ENGINEERING TOTAL		MATERIALS AND ENGINEERING TOTAL	
43,020.2	60.9	2,405.4	3.4	1,388.5	1.9	195.3	0.3	3,989.2	5.6	47,009.4	66.5
189.5	70.0	13.5	5.0					13.5	5.0	203.0	75.0
94.7	70.0	6.7	5.0					6.7	5.0	101.4	74.9
94.8	70.0	6.8	5.0					6.8	5.0	101.6	75.0
49.7	54.1	4.6	5.0			1.0	1.0	5.6	6.0	55.3	60.1
49.7	54.0	4.6	5.0			1.0	1.0	5.6	6.0	55.3	60.1
2.0	61.0			0.4	14.0			0.4	14.0	2.4	75.0
2.0	61.0			0.4	14.0			0.4	14.0	2.4	75.0
691.3	63.0	29.3	2.7	10.3	0.9	3.2	0.3	42.8	3.9	734.1	66.9
223.6	65.0	3.5	1.0	10.3	3.0			13.8	4.0	237.4	69.0
296.7	69.0	25.8	6.0					25.8		322.5	75.0
171.0	53.0					3.2	1.0	3.2		174.2	54.0
610.6	58.3	36.7	3.5	6.4	0.6	6.9	0.7	50.0	4.8	660.6	63.1
204.7	70.0	11.7	4.0	2.9	1.0	2.9	1.0	17.5	6.0	222.2	76.0
47.2	47.0	7.0	7.0	1.0	1.0			8.0	8.0	55.2	58.0
67.3	47.0	10.0	7.0	1.1	1.0			11.4	8.0	78.7	54.9
53.8	47.0	8.0	7.0	1.1	1.0			9.1	8.0	62.9	55.0
237.6	60.0					4.0	1.0	4.0	1.0	241.6	61.0
2,788.6	58.6	26.4	0.6	116.0	2.4	13.7	0.3	156.1	3.3	2,944.7	61.9
13.7	48.0	0.6	2.0	0.3	1.0			0.9	3.0	14.6	51.0
45.4	48.0	1.9	2.0	1.0	1.0			2.9	3.0	48.3	51.1
45.4	48.0	1.9	2.0	1.0	1.0			2.9	3.0	48.3	51.1
105.6	48.0	4.4	2.0	2.2	1.0			6.6	3.0	112.2	51.1
105.6	48.0	4.4	2.0	2.2	1.0			6.6	3.0	112.2	51.1
105.6	48.0	4.4	2.0	2.2	1.0			6.6	3.0	112.2	51.1
105.6	48.0	4.4	2.0	2.2	1.0			6.6	3.0	112.2	51.1
105.6	48.0	4.4	2.0	2.2	1.0			6.6	3.0	112.2	51.1
86.5	67.0			6.5	5.0			6.5	5.0	93.0	72.1
86.5	67.0			6.5	5.0			6.5	5.0	93.0	72.1
408.9	83.0			24.6	5.0			24.6	5.0	433.5	88.1
856.7	83.0			51.6	5.0			51.6	5.0	908.3	87.9
38.5	56.0			3.4	5.0			3.4	5.0	41.9	60.9
78.9	56.0			7.0	5.0			7.0	5.0	85.9	61.0
39.4	51 0			3.1	4.0			3.1	4.0	42.5	55.1
560.7	41.0					13.7	1.0	13.7	1.0	574.4	42.0
272.2	48.6			43.6	7.8	4.9	0.9	48.5	8.7	320.7	57.3
108.3	47.0			16.1	7.0	2.3	1.0	18.4	8.0	126.7	54.9
124.5	47.0			18.5	7.0	2.6	1.0	21.1	8.0	145.6	54 9
2.8	61.0			0.6	14.0			0.6	14.0	3.4	73.9
36.6	61.0			8.4	14.0			8.4	14.0	45.0	75.0

[redacted]

TABLE C.VI.11 (Continues...)

INVESTMENTS PLAN FOR THE PETROCHEMICAL SECTOR
(1977'S MILLION PESOS)

WORK CENTERS	1977	1978	1979	1980	1981	1982	1
TOTAL INVESTMENT*	9,692.9	15,563.8	12,098.3	6,414.6	4,288.0	3,290.2	5,
CANGREJERA, VER.	4,131.6	4,598.7	856.1	26.3			
ACETALDEHYDE II	74.4	46.0					
ETHYLENE OXIDE II	128.1	73.6					
ETHYLENE V	533.0	317.3					
OXYGENE	74.4	46.0					
AROMATICS COMPLEX (1)	942.0	1,145.1	106.1				
ETHYLBENCENE-STYRENE II	194.2	239.1	14.6				
CRUDE OIL STABILIZER	214.8	257.5	24.0				
NATURAL GASOLINE CRACKING	66.1	78.2	6.8				
AUXILIARY SERVICES	561.9	588.6	169.5				
INTEGRATION	999.8	1,112.9	225.2				
CUMENE	45.4	50.6	10.3				
L.D. POLYETHYLENE	297.5	643.8	299.6	26.3			
ALLENDE, VER.	395.1	3,681.1	4,645.2	2,027.9	454.8		
ETHYLENE VI		360.7	1,098.3	713.8	158.6		
OXYGENE		55.2	161.1	107.5	19.4		
H.D. POLIETHYLENE II		169.3	512.5	324.5	86.4		
ETHYLENE OXIDE III		110.4	329.4	208.9	55.5		
ACETALDEHYDE III		47.9	146.4	95.3	21.2		
PROPYLENE	32.4	224.6	148.5	20.3			
PROPYLENE OXIDE	19.4	136.2	86.5	14.2			
POLYPROPYLENE	71.5	496.9	317.0	54.7			
BUTADIENE		147.3	450.0	267.7	97.5		
NATURAL GASOLINE CRACKING		36.8	112.5	73.0	16.2		
INTEGRATION AND AUXILIARY SERVS.	271.8	1,895.8	1,283.0	148.0			
PAJARITOS, VER.	430.9	287.3	124.5				
CHLORINATED DERIVATIVES	430.9	287.3	124.5				
CUNDUACAN, TAB.	523.4	4,726.5	5,016.4	1,080.6	421.2		
AMMONIA IX	83.7	723.1	647.1	126.4			
AMMONIA X	83.7	723.1	647.1	126.4			
AMMONIA XI	83.7	723.1	647.1	126.4			
AMMONIA XII		193.8	968.2	290.7	421.2		
SULFUR AND SWEETENING I	19.4	170.2	150.5	29.2			
SULFUR AND SWEETENING II	19.4	170.2	150.5	29.2			
CRYOGENICS I	76.9	666.4	597.0	115.6			
CRYOGENICS II	77.5	671.2	597.0	116.7			
CONDENSATES STABILIZING AND SWEETENING I	9.4	80.4	70.2	14.1			
CONDENSATES STABILIZING AND SWEETENING II	9.4	80.4	70.2	14.1			
NATURAL GASOLINE CRACKING PLANT	9.5	85.1	75.2	15.1			
INTEGRATION AND AUXILIARY SERVICES	50.8	439.5	396.3	76.7			
SALINA CRUZ, OAX.	21.0	19.9	40.5	27.0	24.9	49.5	
SULFUR	21.0	9.1					
SULFUR		10.8	40.5	27.0	11.7		
SULFUR					13.2	49.5	

(Continues...)

[redacted]

	1982	1983	1984	1985	1986	TOTAL	NATIONAL	%	MATERIALS IMPORT	%	MATERIALS TOTAL	
)	3,290.2	5,970.4	6,367.8	4,936.9	1,973.8	70,596.7	15,731.6	22.3	27,288.6	38.6	43,020.2	60
						9,612.7	2,432.4	25.3	3,497.1	36.4	5,929.5	61
						120.4	19.3	16.0	27.7	23.0	47.0	3
						201.7	38.3	19.0	60.5	30.0	98.8	4
						850.3	195.6	23.0	263.6	31.0	459.2	54
						120.4	24.1	20.0	57.8	48.0	81.9	68.
						2,193.2	438.6	20.0	811.5	37.0	1,250.1	57
						447.9	85.1	19.0	165.7	37.0	250.8	56
						496.3	139.0	28.0	168.7	34.0	307.7	6
						151.1	37.8	25.0	39.3	26.0	77.1	51
						1,320.0	422.4	32.0	580.8	44.0	1,003.2	76
						2,337.9	721.7	31.0	865.0	37.0	1,589.7	68
						106.3	28.7	27.0	38.3	36.0	67.0	6
						1,267.2	278.8	22.0	418.2	33.0	697.0	5
8						11,204.1	2,760.4	24.6	3,412.2	30.5	6,172.6	55
6						2,331.4	536.2	23.0	722.7	31.0	1,258.9	54
:						343.2	68.6	20.0	164.7	48.0	233.3	68.
4						1,092.7	295.0	27.0	458.9	42.0	753.9	67.
5						704.2	98.6	14.0	211.3	30.0	309.9	44.
2						310.8	49.7	16.0	71.5	23.0	121.2	3
						425.8	76.6	18.0	123.5	29.0	200.1	47.
						256.3	46.1	18.0	74.3	29.0	120.4	47.
						940.1	169.2	18.0	272.6	29.0	441.8	4
5						962.5	173.3	18.0	279.1	29.0	452.4	4
2						238.5	59.6	25.0	62.0	26.0	121.6	51.
						3,598.6	1,187.5	33.0	971.6	27.0	2,159.1	6
						842.7	202.2	24.0	261.2	31.0	463.4	5
						842.7	202.2	24.0	261.2	31.0	463.4	5
.2						11,768.1	1,912.6	16.2	6,361.8	54.1	8,274.4	7
						1,580.3	158.0	10.0	948.2	60.0	1,106.2	7
						1,580.3	158.0	10.0	948.2	60.0	1,106.2	7
						1,580.3	158.0	10.0	948.2	60.0	1,106.2	7
.2						1,873.9	187.4	10.0	1,124.3	60.0	1,311.7	7
						369.3	107.1	29.0	70.2	19.0	177.3	4
						369.3	107.1	29.0	70.2	19.0	177.3	4
						1,455.9	276.6	19.0	931.8	64.0	1,208.4	8
						1,452.4	277.9	19.0	935.9	64.0	1,213.8	8
						174.1	59.2	34.0	38.3	22.0	97.5	5
						174.1	59.2	34.0	38.3	22.0	97.5	5
						184.9	46.2	25.0	48.1	26.0	94.3	5
						963.3	317.9	33.0	260.1	27.0	578.0	6
.9	49.5	33.0	14.3			230.1	110.4	48.0	29.9	13.0	140.3	6
						30.1	14.4	48.0	3.9	13.0	18.3	6
.7						90.0	43.2	48.0	11.7	13.0	54.9	6
.2	49.5	33.0	14.3			110.0	52.8	48.0	14.3	13.0	67.1	6

SECTION 3

			ENGINEERING									
	MATERIALS TOTAL		IMPORT	%	NATIONAL EXTERNAL	%	INTERNAL	%	ENGINEERING TOTAL		MATERIALS AND ENGINEERING TOTAL	
.6	43,020.2	60.9	2,405.4	3.4	1,388.5	1.9	195.3	0.3	3,989.2	5.6	47,009.4	66.5
.4	5,929.5	61.7	427.3	4.4	139.2	1.5	36.6	0.4	603.1	6.3	6,532.6	67.9
.0	47.0	39.0	33.7	28.0					33.7	28.0	80.7	67.0
.0	98.8	47.0	16.1	8.0	6.1	3.0			22.2	11.0	121.0	60.0
.0	459.2	54.0			51.0	6.0			51.2	6.0	510.2	60.0
.0	81.9	68.0	7.2	6.0					7.2	6.0	89.1	74.0
.0	1,250.1	57.0	241.3	11.0	43.9	2.0			285.2	13.0	1,535.3	70.0
.0	250.8	56.0	40.3	9.0					40.3	9.0	291.1	65.0
.0	307.7	62.0			24.8	5.0			24.8	5.0	332.5	67.0
.0	77.1	51.0			6.0	4.0			6.0	4.0	83.1	55.0
.0	1,003.2	76.0					13.2	1.0	13.2	1.0	1,016.4	77.0
.0	1,589.7	68.0					23.4	1.0	23.4	1.0	1,613.1	69.0
.0	67.0	63.0			7.4	7.0			7.4	7.0	74.4	70.0
.0	697.0	55.0	88.7	7.0					88.7	7.0	785.7	62.0
.5	6,172.6	55.1	410.4	3.7	196.4	1.7	36.0	0.3	642.8	5.7	6,815.4	60.8
.0	1,258.9	54.0			139.9	6.0			139.9	6.0	1,398.8	60.0
.0	233.3	68.0	20.6	6.0					20.6	6.0	253.9	74.0
.0	753.9	69.0	65.6	6.0					65.6	6.0	819.5	75.0
.0	309.9	44.0	56.3	8.0	21.1	3.0			77.4	11.0	387.3	55.0
.0	121.2	39.0	87.0	28.0					87.0	28.0	208.2	67.0
.0	200.1	47.0	29.8	7.0	4.3	1.0			34.1	8.0	234.2	55.0
.0	120.4	47.0	17.9	7.0	2.6	1.0			20.5	8.0	140.9	54.9
.0	441.8	47.0	65.8	7.0	9.4	1.0			75.7	8.0	517.0	55.0
.0	452.4	47.0	67.4	7.0	9.6	1.0			77.0	8.0	529.4	55.0
.0	121.6	51.0			9.5	1.0			9.5	1.0	131.1	55.0
.0	2,159.1	60.0					36.0	1.0	36.0	1.0	2,195.1	61.0
.0	463.4	55.0	33.7	4.0	16.9	2.0	8.4	1.0	59.0	7.0	522.4	62.0
.0	463.4	55.0	33.7	4.0	16.9	2.0	8.4	1.0	59.0	7.0	522.4	62.0
.1	8,274.4	70.3	345.5	2.9	178.1	1.5	9.6	0.1	533.2	4.5	8,807.6	74.8
.0	1,106.2	70.0	79.0	5.0					79.0	5.0	1,185.2	75.0
.0	1,106.2	70.0	79.0	5.0					79.0	5.0	1,185.2	75.0
.0	1,106.2	70.0	79.0	5.0					79.0	5.0	1,185.2	75.0
.0	1,311.7	70.0	93.7	5.0					93.7	5.0	1,405.4	75.0
.0	177.3	48.0	7.4	2.0	3.7	1.0			11.1	3.0	188.4	51.0
.0	177.3	48.0	7.4	2.0	3.7	1.0			11.1	3.0	188.4	51.0
.0	1,208.4	83.0			72.8	5.0			72.8	5.0	1,281.2	58.0
.0	1,213.8	83.0			73.1	5.0			73.1	5.0	1,286.9	58.0
.0	97.5	56.0			8.7	5.0			8.7	5.0	106.2	61.0
.0	97.5	56.0			8.7	5.0			8.7	5.0	106.2	61.0
.0	94.3	51.0			7.4	4.0			7.4	4.0	101.7	55.0
.0	578.0	60.0					9.6	1.0	9.6	1.0	587.6	61.0
.0	140.3	61.0			32.2	14.0			32.2	14.0	172.5	75.0
.0	18.3	61.0			4.2	14.0			4.2	14.0	22.5	73.7
.0	54.9	61.0			12.6	14.0			12.6	14.0	67.5	75.0
.0	67.1	61.0			15.4	14.0			15.4	14.0	82.5	75.0

[redacted]

TABLE C.VI. 11 (Continues...)

INVESTMENTS PLAN FOR THE PETROCHEMICAL SECTOR

(1977'S MILLION PESOS)

WORK CENTERS	1977	1978	1979	1980	1981	1982	1983	19
TOTAL INVESTMENT*	9,692.9	15,563.8	12,098.3	6,414.6	4,288.0	3,290.2	5,970.[illegible]	6,3
CADEREYTA, N.L.	31.5	21.0	9.1			10.8	40.5	[illegible]
SULFUR	31.5	21.0	9.1					
SULFUR						10.8	40.5	[illegible]
UNDEFINED			741.4	3,089.4	3,072.1	3,024.1	5,811.1	6,3
BUTADIENE				139.9	524.7	349.8	151.6	
CHLORINATED DERIVATIVES IV (2)				87.9	329.5	219.6	95.2	
ACRYLONITRILE III			80.1	300.2	200.1	86.7		
METHANOL III				81.6	306.0	204.0	88.4	
PROPYLENE OXIDE						39.9	149.4	[illegible]
L.D. POLYETHYLENE IV						114.0	427.5	[illegible]
STYRENE III					58.6	219.6	140.4	6
AROMATIC COMPOUNDS III (3)						420.0	1,575.0	1,05
CUMENE II						15.6	58.5	3
CRYOGENICS VII			192.0	720.0	480.0	208.0		
3 SULFUR AND SWEETENING PLANTS			162.0	607.5	405.0	175.5		
AUXILIARY SERVICES "A"						240.0	900.0	60
CYCLOHEXANE			14.4	54.0	36.0	15.6		
H.D. POLYETHYLENE III						186.0	697.3	46
L.D. POLYETHYLENE V								10
ACETALDEHYDE IV								4
ETHYLENE VII			292.9	1,098.3	732.2	317.3		
AMMONIA XIII AND XIV							388.8	1,45
ACRYLONITRILE IV								[illegible]
CRYOGENICS VIII							216.0	[illegible]
2 SULFUR AND SWEETENING PLANTS							120.0	[illegible]
INTERNAL AND AUXILIARY SERVICES "B"								[illegible]
POLYPROPYLENE II						146.1	547.9	[illegible]
PROPYLENE						66.4	249.1	1

*AFTER THE PETROCHEMICAL WORKS PROGRAM. DIVISION DE PLANEACION DE PETROQUIMICA I.M.P. 1978.
(1)(2)(3) SEE ANNEX TO THE INVESTMENTS PLAN FOR THE PETROCHEMICAL SECTOR (FOR CAPACITIES AND COMPLEX DETAILS)
AUXILIARY SERVICES "A": REFERS TO FORECAST PLANTS ON UNDEFINED TIME
AUXILIARY SERVICES "B": REFERS TO PLANTS ON VERY LONG TERM UNDEFINED TIME.
H.D. HIGH DENSITY
L.D. LOW DENSITY

SECRET

83	1984	1985	1986	TOTAL	NATIONAL	%	IMPORT	%	MATERIALS TOTAL		IMPORT
70.4	6,367.8	4,936.9	1,973.8	70,596.7	15,731.6	22.3	27,288.6	38.6	43.020.2	60.9	2,405.4
40.5	27.0	11.7		151.6	72.8	48.0	19.8	13.1	92.6	61.1	
				61.6	29.6	48.0	8.1	13.0	37.7	61.0	
0.5	27.0	11.7		90.0	43.2	48.0	11.7	13.0	54.9	61.0	
11.1	6,326.5	4,925.2	1,973.8	28,963.6	6,289.0	21.7	11,054.5	38.2	17,343.5	59.9	1,078.0
51.6				1,166.0	209.9	18.0	338.1	29.0	548.0	47.0	81.6
95.2				732.2	175.7	24.0	226.9	31.0	402.6	55.0	29.3
				667.1	120.0	18.0	193.5	29.0	313.5	47.0	46.7
88.4				680.0	149.6	22.0	326.4	48.0	476.0	70.0	27.2
9.4	99.6	43.2		332.1	59.8	18.0	96.3	29.0	156.1	47.0	23.2
27.5	285.0	123.5		950.0	209.0	22.0	313.5	33.0	522.5	55.0	66.5
15.4	63.4			488.0	92.7	19.0	180.6	37.0	273.3	56.0	43.9
75.0	1,050.0	455.0		3,500.0	700.0	20.0	1,295.0	37.0	1,995.0	57.0	385.0
58.5	39.0	16.9		130.0	35.1	27.1	46.8	36.0	81.9	63.0	
				1,600.0	304.0	19.0	1,024.0	64.0	1,328.0	83.0	
				1,350.0	391.5	29.0	256.5	19.0	648.0	48.0	27.0
00.0	600.0	260.0		2,000.0	660.0	33.0	540.0	27.0	1,200.0	60.0	
				120.0	21.6	18.0	34.8	29.0	56.4	47.0	8.4
7.3	464.9	201.4		1,549.6	418.4	27.0	650.8	42.0	1,069.2	69.0	93.0
	107.4	402.8	268.5	778.7	171.3	22.0	257.0	33.0	428.3	55.0	54.5
	48.0	180.0	120.0	348.0	55.7	16.0	80.0	23.0	135.7	39.0	9.7
				2,440.7	561.4	23.0	756.6	31.0	1,318.0	54.0	
88.8	1,458.0	972.0	421.2	3,240.0	324.0	10.0	1,944.0	60.0	2,268.0	70.0	62.0
	80.0	300.2	200.1	550.3	101.4	18.0	168.3	29.0	272.7	47.0	
16.0	810.0	540.0	234.0	1,800.0	342.0	19.0	1,152.0	64.0	1,494.0	83.0	
20.0	450.0	300.0	130.0	1,000.0	290.0	29.0	190.0	19.0	480.0	48.0	20.0
	240.0	900.0	600.0	1,740.0	574.2	33.0	469.8	27.0	1,044.0	60.0	
17.9	365.2	153.3		1,217.5	219.1	18.0	353.1	29.0	572.2	47.0	
49.1	166.0	71.9		553.4	99.6	18.0	160.5	29.0	260.1	47.0	

X DETAILS)

SECTION 3

			ENGINEERING									
%	MATERIALS TOTAL		IMPORT	%	NATIONAL EXTERNAL	%	INTERNAL	%	ENGINEERING TOTAL		MATERIALS AND ENGINEERING TOTAL	
8.6	43.020.2	60.9	2,405.4	3.4	1,388.5	1.9	195.3	0.3	3,989.2	5.6	47,009.4	66.5
5.1	92.6	61.1			21.2	14.0			21.2	14.0	113.8	75.1
3.0	37.7	61.0			8.6	14.0			8.6	14.0	46.3	75.0
3.0	54.9	61.0			12.6	14.0			12.6	14.0	67.5	75.0
8.2	17,343.5	59.9	1,078.0	3.7	627.8	2.2	75.0	0.2	1,780.8	6.1	19,124.3	66.0
9.0	548.0	47.0	81.6	7.0	11.7	1.0			93.3	8.0	641.3	55.0
1.0	402.6	55.0	29.3	4.0	14.6	2.0	7.3	1.0	51.2	7.0	453.8	62.0
9.0	313.5	47.0	46.7	7.0	6.7	1.0			53.4	8.0	366.9	55.0
8.0	476.0	70.0	27.2	4.0	6.8	1.0	6.8	1.0	40.8	6.0	516.8	76.0
9.0	156.1	47.0	23.2	7.0	3.3	1.0			26.5	8.0	182.6	55.0
3.0	522.5	55.0	66.5	7.0					66.5	7.0	589.0	62.0
7.0	273.3	56.0	43.9	9.0					43.9	9.0	317.2	65.0
7.0	1,995.0	57.0	385.0	11.0	70.0	2.0			455.0	13.0	2,450.0	70.0
6.0	81.9	63.0			9.1	7.0			9.1	7.0	91.0	70.0
1.0	1,328.0	83.0			80.0	5.0			80.0	5.0	1,408.0	88.0
19.0	648.0	48.0	27.0	2.0	13.5	1.0			40.5	3.0	688.5	51.0
7.0	1,200.0	60.0					20.0	1.0	20.0	1.0	1,220.0	61.0
9.0	56.4	47.0	8.4	7.0	1.2	1.0			9.6	8.0	66.0	55.0
2.0	1,069.2	69.0	93.0	6.0					93.0	6.0	1,162.2	75.0
3.0	428.3	55.0	54.5	7.0					54.5	7.0	482.8	62.0
3.0	135.7	39.0	9.7	28.0					9.7	28.0	145.4	41.8
1.0	1,318.0	54.0			146.4	6.0			146.4	6.0	1,464.4	60.0
0.0	2,268.0	70.0	62.0	5.0					162.0	5.0	2,430.0	75.0
9.0	272.7	47.0			40.6	7.0	5.8	1.0	46.4	8.0	319.1	54.0
4.0	1,494.0	83.0			90.0	5.0			90.0	5.0	1,584.0	88.0
19.0	480.0	48.0	20.0	2.0	10.0	1.0			30.0	3.0	510.0	51.0
7.0	1,044.0	60.0					17.4	1.0	17.4	1.0	1,061.4	61.0
9.0	572.2	47.0			85.2	7.0	12.2	1.0	97.4	8.0	669.6	55.0
9.0	260.1	47.0			38.7	7.0	5.5	1.0	44.2	8.0	304.3	55.0

TABLE C.VI.12

INVESTMENTS PLAN FOR THE ENGINEERING/EQUIPMENT, MATERIALS AND TRANSPORTATION (*) SECTOR

(1977'S MILLION PESOS)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT	1,673.5	10,014.1	2,437.4	3,256.0	267.5	449.6	1,023.7	2,999.6	1,685.5	530.4	25,337.3
GAS PIPE-LINES	460.0	7,297.0	820.0	2,371.0		164.9	100.0	773.3	886.8	411.9	13,284.9
I. LINE	460.0	7,277.0	800.0	500.0		80.3	100.0	486.1	350.5	237.1	10,290.8
1. MATERIALS	441.0	6,827.0	800.0	495.8		75.2	91.3	465.2	339.3	219.6	9,754.2
a) PIPING	441.0	6,527.0	800.0	381.8		68.7	91.3	434.0	299.7	200.7	9,244.2
b) VALVES		220.0		89.0		5.1		24.7	31.3	15.0	384.9
c) CONNECTIONS		80.0		25.0		1.4		6.5	8.3	3.9	125.1
2. ENGINEERING	19.0	450.0		4.2		5.1	8.7	20.9	11.2	17.5	536.6
II. STATIONS		20.0	20.0	1,871.0		84.6		287.2	536.5	174.8	2,994.1
1. MATERIALS		20.0	20.0	1,800.7		81.4		270.4	516.6	172.5	2,881.6
a) MOTOCOMPRESSORS		20.0	20.0	990.2		44.9		178.8	259.6	71.1	1,584.6
b) VALVES				154.0		6.9		17.4	48.8	19.3	246.4
c) PIPING				54.1		2.4		6.1	17.2	6.7	86.5
d) CONNECTIONS				54.1		2.4		6.1	17.2	6.7	86.5
e) INSTRUMENTS				5.5		0.3		0.7	1.7	0.7	8.9
f) GENERAL MECH. EQPT.				542.8		24.5		61.3	172.1	68.0	868.7
2. ENGINEERING				70.3		3.2		16.8	19.9	2.3	112.5
OIL PIPE-LINES	700.0	2,046.1	1,135.3	298.9	42.9	50.0	567.2	2,205.7	1,243.5		8,289.6
I. LINE	700.0	1,565.3	501.2	116.7		50.0	435.8	1,974.4	263.6		5,607.0
1. MATERIALS	674.9	1,563.3	494.4	116.7		46.0	435.8	1,943.9	263.6		5,538.6
a) PIPING	674.9	1,437.1	475.1	93.3		46.0	424.4	1,880.6	181.2		5,212.6
b) VALVES		98.5	16.4	17.0			11.4	47.6	64.3		255.2
c) CONNECTIONS		27.7	2.9	6.4				15.7	18.1		70.8
2. ENGINEERING	25.1	2.0	6.8			4.0		30.5			68.4
II. STATIONS		480.8	634.1	182.2	42.9		131.4	231.3	979.9		2,682.6
1. MATERIALS		430.9	629.3	172.4	42.9		131.4	203.4	954.7		2,565.0
a) MOTOPUMPS		287.9	262.0	122.9			131.4	131.6	530.1		1,465.9
b) VALVES		27.4	70.8	13.8	3.9			13.7	81.6		211.2
c) PIPING		9.6	24.9	3.0	3.3			4.9	28.7		74.4
d) CONNECTIONS		9.6	24.9	3.0	3.3			4.9	28.7		74.4
e) TANKS		14.3	36.8	4.4	4.8			7.2	40.1		107.6
f) INSTRUMENTS		1.0	2.5	0.3	0.3			0.5	2.9		7.5
g) MECH. EQUIPMENT		81.1	207.4	25.0	27.3			40.6	242.6		624.0
2. ENGINEERING		49.9	4.8	9.8				27.9	25.2		117.6

(2) TABLE C VI.12 (Continues)

INVESTMENTS PLAN FOR THE ENGINEERING/EQUIPMENT, MATERIALS AND TRANSPORTATION (*) SECTOR
(1977's MILLION PESOS)

C O N C E P T	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT	1,673.5	10,014.1	2,437.4	3,256.0	267.5	449.6	1,023.7	2,999.6	1,685.5	530.4	25,337.3
MULTIPIPE-LINES	513.5	671.0	482.1	586.1	224.6	234.7	356.5	20.6	555.2	118.5	3,762.8
I. LINE	454.4	377.9	259.5	345.0	169.8	127.7	245.5		469.0		2,448.8
1. Materials	427.4	365.6	250.7	330.1	158.0	119.6	231.4		448.3		2,331.1
a) Piping	413.7	313.1	233.3	301.0	144.8	109.8	212.0		413.3		2,141.0
b) Valves	11.7	40.5	13.7	22.9	10.5	7.7	15.3		27.5		149.8
c) Connections	2.0	12.0	3.7	6.2	2.7	2.1	4.1		7.5		40.3
2. Engineering	27.0	12.3	8.8	14.9	11.8	8.1	14.1		20.7		117.7
II. STATIONS	59.1	293.1	222.6	241.1	54.8	107.0	111.0	20.6	86.2	118.5	1,314.0
1. Materials	56.3	275.6	217.7	230.5	52.0	102.6	105.3	20.6	82.3	117.4	1,260.3
a) Motopumps	35.6	162.7	115.2	131.6	33.6	54.7	71.8		47.4	56.6	709.2
b) Valves	5.2	20.6	19.8	19.1	4.8	7.9	10.4		6.3	9.6	104.2
c) Piping	1.7	7.3	6.9	6.7	1.4	3.0	3.6		2.4	3.4	36.4
d) Connections	1.7	7.3	6.9	6.7	1.1	3.2	2.6		2.4	3.4	36.4
e) Tanks	2.4	10.9	10.2	9.8	1.6	5.0	5.4		3.5	5.0	53.8
f) Instruments	0.1	0.8	0.7	0.6	0.2	0.4	0.4		0.2	0.4	3.8
g) Mech. Equip.	9.6	66.0	58.0	56.0	9.3	28.3	10.1	20.6	19.6	29.0	306.5
2. Engineering	2.8	17.5	4.9	10.6	2.8	4.4	5.7		3.9	1.1	53.7

(*) Anticorrosives, labor, freight, management, land, civil work and other sectors not included

TABLE C.VI.13

INVESTMENTS PLAN FOR THE TRANSPORTATION SECTOR (1)
(1977's MILLION PESOS)

TRANSPORTATION MEDIUM ORIGIN/DESTINATION	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT	1,700.0	18,938.8	4,047.9	4,230.0	1,960.0	683.2	1,329.3	3,898.0	4,166.0	2,127.7	43,080.9
I. GAS PIPE-LINE	460.0	15,220.0	820.0	3,000.0	1,030.0	190.0	190.0	1,070.0	1,546.0	930.0	24,456.0
1. Cd. Pemex-México (3a. Linea)	460.0	200.0	800.0	2,500.0	835.0						4,795.0
2. Vta. Carpio-Salamanca (Ampliación)		20.0	20.0					200.0	735.0		976.0
3. Salamanca-Guadalajara									200.0	280.0	480.0
4. Tierra Blanca-Veracruz						80.0	40.0				120.0
5. México-Cuernavaca						110.0	50.0				160.0
6. Querétaro-San Luis Potosí									190.0	80.0	270.0
7. Monterrey-Torreón							100.0	570.0			570.0
8. Torreon Chihuahua								300.0	420.0		720.0
9. Chihuahua-Cd. Juárez										370.0	370.0
10. Lampazos-Monterrey				500.0	195.0						695.0
11. Torreon-Durango										200.0	200.0
12. Cactus-Reynosa (2)		15,000.0									15,000.0
II. OIL PIPE-LINE	700.0	2,620.0	2,141.0	351.0	300.0	50.0	603.0	2,515.0	1,950.0	685.0	11,916.0
1. Cunduacan-Dos Bocas		120.0	373.0								493.0
2. Cunduacan-Nuevo Teapa						50.0	470.0	415.0			935.0
3. Nvo. Teapa-Vta. Carpio-Tula	300.0	1,600.0	1,378.0								3,278.0
4. Nvo. Teapa - Poza Rica								1,150.0	1,450.0	250.0	2,850.0
5. Nvo. Teapa-Salina Cruz	400.0	900.0					133.0				1,433.0
6. Poza Rica-Naranjos			200.0	215.0	200.0						515.0
7. Naranjos-Cd. Madero			190.0	136.0	100.0						426.0
8. Cd. Madero-Cadereyta								950.0	500.0	436.0	1,856.0
III. MULTI PIPE-LINE	540.0	1,098.8	1,086.9	879.0	630.0	443.2	536.3	313.0	670.0	511.7	6,708.9
1. Cadereyta-San Rafael	15.0	51.2									65.2
2. Cadereyta-San Jerónimo	110.0	142.9									252.9
3. San Jerónimo-Torreon	150.0	304.6	200.0								654.6
4. Torreón-Chihuahua		300.0	396.7								696.7
5. Chihuahua-Cd. Juárez							320.0	260.0			580.0
6. Cadereyta-Reynosa									180.0	46.3	226.3
7. Cadereyta-Sabinas						220.0	136.3				356.3
8. México-Cuernavaca	40.0	38.2									78.2
9. Mexico-Toluca	25.0	31.5									56.5
10. Tula-Pachuca			20.0	55.1							75.1
11. Salamanca-San Luis Potosí					90.0	80.2					170.2
12. Salamanca-Irapuato-León			80.0	55.5							135.5
13. Salamanca-Morelia					110.0	43.0					153.0

(2)

TABLE C.VI.13

(Continues)

INVESTMENTS PLAN FOR THE TRANSPORTATION SECTOR (1)
(1977's MILLION PESOS)

TRANSPORTATION MEDIUM ORIGIN/DESTINATION	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1985
14. Aguascalientes-Zacatecas											
15. Salamanca-Guadalajara							80.0	44.0			124.0
16. Minatitlan-Veracruz-Puebla						60.0					60.0
17. Progreso-Mérida				600.0	350.0						950.0
18. Guaymas-Cd. Obregón				28.0							28.0
19. Topolobampo-Los Mochis-Culiacán					80.0	40.0					120.0
20. Salina Cruz-Tuxtla Gutiérrez	80.0	150.0	90.2								320.2
21. Rosarito-Mexicali									190.0	145.2	335.2
22. Cactus-Cangrejera	110.0	80.4									190.4
23. Cunduacán-Allende			300.0	140.4							440.4
									300.0	320.2	620.2

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(1) Includes investments on anticorrosives, labor, freights, management, lands, civil works and others.

(2) Investment refers to the Cactus, Chis.- Sn. Fernando, Tamps.- Monterrey, N.L. length.

TABLE C.VI.14
FORECAST INVESTMENTS SUMMARY ON THE MATERIALS AND EQUIPMENT ACQUISITION FOR THE EXPLOITATION SECTOR

(1977's millios pesos)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
I. Exploitation Surface Installations.	530.3	1,081.1	852.7	785.8	919.1	910.8	902.8	893.6	884.7	875.0	8,635.7
Piping	26.2	53.3	42.1	38.8	45.3	.9	44.5	44.1	43.6	43.2	426.0
Connections and valves	26.9	54.6	43.1	39.7	46.6	46.1	45.7	45.2	44.8	44.3	437.0
Motopumps	34.2	37.4	37.1	38.7	38.4	38.1	37.7	37.4	37.0	36.5	372.5
Motocompressors	278.7	600.7	466.2	425.0	504.0	499.3	495.1	490.0	485.1	479.8	4,723.9
Tanks	44.8	91.4	72.1	66.4	77.7	77.0	76.3	75.6	74.8	74.0	730.1
Special Equipments	33.5	68.4	53.9	49.8	58.1	57.6	57.2	56.5	56.0	55.4	546.4
Separators	67.3	137.2	108.2	99.7	116.6	115.5	114.5	113.3	112.2	111.0	1,095.5
Special Vassels	11.2	22.9	18.0	16.6	19.4	19.3	19.1	18.9	18.7	18.5	182.6
Vapor Recuperators	7.5	15.2	12.0	11.1	13.0	12.8	12.7	12.6	12.5	12.3	121.7
Engineering	20.1	41.1	32.4	29.9	34.9	34.6	34.2	34.0	33.6	33.2	328.0
II. Well Drilling and Repair	2,925.2	3,941.4	6,137.8	5,264.2	5,423.5	7,179.1	5,443.2	4,984.2	5,838.3	5,690.7	52,827.6
Repair Equipment	121.7	295.5	208.5	243.3	451.9	232.9	486.7	260.7	278.1	260.7	2,840.0
Drilling Equipment	1,097.6	1,304.2	3,020.3	1,784.7	1,372.9	2,833.0	686.4	137.3	755.1	343.2	13,334.7
Drilling Pipe	92.8	24.2	18.6	41.7	39.4	66.3	30.6	102.1	61.1	59.0	535.8
Casing	1,040.7	1,551.0	1,936.6	2,143.0	2,389.4	2,684.1	2,845.9	3,009.3	3,182.6	3,372.1	24,154.7
Cementing Acc.	69.4	103.4	129.1	142.9	159.3	178.9	189.7	200.6	212.2	224.8	1,610.3
Drill Bits	242.8	361.9	451.9	500.0	557.5	626.3	664.0	702.2	742.6	786.8	5,636.0
Christmas Trees	260.2	301.2	372.8	408.6	453.1	507.6	539.9	572.0	606.6	644.1	4,666.1
TOTAL	3,475.6	5,063.6	7,022.9	6,079.9	6,377.5	8,124.3	6,380.2	5,911.8	6,756.6	6,598.9	61,791.3

SOURCE: Subdirección de Estudios Económicos y Planeación Industrial.- I.M.P.

TABLE C.VI.15

FORECAST INVESTMENTS SUMMARY ON THE MATERIALS AND EQUIPMENT ADQUISITION FOR THE EXPLOITATION SECTOR

(Percentages)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
1. Exploitation Surface Installations	15.2	21.4	12.1	12.9	14.4	11.2	14.2	15.1	13.1	13.3	14.0
Piping	.7	1.0	.6	.6	.7	.6	.7	.7	.6	.7	.7
Connections and Valves	.8	1.1	.6	.7	.8	.6	.7	.8	.7	.7	.7
Motopumps	1.0	.7	.5	.6	.6	.5	.6	.6	.5	.6	.6
Motocompressors	8.0	11.9	6.6	7.0	7.9	6.1	7.8	8.3	7.2	7.3	7.6
Tanks	1.3	1.8	1.0	1.1	1.2	.9	1.2	1.3	1.1	1.1	1.2
Special Equipments	1.0	1.4	.8	.8	.9	.7	.9	1.0	.8	.8	.9
Separators	1.9	2.7	1.5	1.6	1.8	1.4	1.8	1.9	1.7	1.6	1.8
Special Vessels	.3	.5	.3	.3	.3	.2	.3	.3	.3	.3	.3
Vapor Recuperators	.2	.3	.2	.2	.2	.2	.2	.2	.2	.2	.2
Engineering.	.6	.8	.5	.5	.6	.4	.5	.6	.5	.5	.5
2. Well Drilling and Repair	**84.2**	**77.8**	**87.4**	**86.6**	**85.0**	**88.4**	**85.3**	**84.3**	**86.4**	**86.2**	**85.5**
Repair Equipment	3.5	5.8	3.0	4.0	7.1	2.9	7.6	4.4	4.1	4.0	4.6
Drilling Equipment	31.6	25.8	43.0	29.4	21.5	35.5	10.8	2.3	11.2	5.2	21.7
Drilling Pipe	2.7	.5	.3	.7	.6	.8	.5	1.7	.9	.9	.9
Casing	29.9	30.6	27.6	35.2	37.5	33.0	44.6	50.9	47.1	51.1	39.1
Cementing Acc.	2.0	2.0	1.8	2.4	2.5	2.2	3.0	3.4	3.1	3.4	2.6
Drill Bits	7.0	7.2	6.4	8.2	8.7	7.7	10.4	11.9	11.0	11.9	9.1
Christmas Trees	7.5	5.9	5.3	6.7	7.1	6.3	8.4	9.7	9.0	9.7	7.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Subdirección de Estudios Económicos y Planeación Industrial. IMP.

TABLE C.VI.16

FORECAST INVESTMENTS SUMMARY ON THE MATERIALS, EQUIPMENT AND ENGINEERING ACQUISITION FOR THE REFINING SECTOR: 1977-1986 (*)

(1977's Thousand Pesos)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
Engineering, Equipment and Materials Total	3.953,587	4.169,970	3.062,279	3.850,198	3.922,901	3.068,425	2.517,354	1.643,081	335,733	18,119	26.546,653
Furnaces	72,743	95,251	175,653	228,455	163,267	85,852	96,333	83,839	-	-	1.001,393
Towers	61,893	88,507	153,160	181,195	129,402	95,102	78,052	66,430	-	-	853,651
Towers Internals	17,113	28,923	52,465	60,401	27,220	37,187	28,027	14,547	-	-	265,883
Reactors	64,162	39,155	114,118	173,674	131,402	74,961	56,540	14,268	-	-	668,280
Exchangers	174,395	147,355	266,474	557,187	565,400	480,524	222,621	309,375	-	-	2.723,331
Air Coolers	7,861	5,789	16,058	20,507	14,253	10,269	10,699	4,450	-	-	83,941
Ejectors	4,190	6,939	139	350	348	140	92	93	-	-	12,291
Process Vessels	79,498	45,908	124,065	153,296	84,660	64,447	67,964	22,335	-	-	642,173
Storage Tanks	756	9,750	722	1,004	1,009	11,020	10,928	409	-	-	35,598
Vessels Internals	209	94	353	650	565	360	191	51	-	-	2,473
Pumps	52,104	57,223	161,195	252,779	243,504	267,901	177,564	92,325	17,584	-	1.322,179
Compressors	206,204	218,802	181,742	254,045	340,799	255,743	242,875	65,367	83,815	-	1.849,392
Special Equipments	25,423	32,793	68,209	67,895	32,794	35,691	35,379		-	-	298,184
Desuperheaters	43	133	135	137	87	96	96	-	-	-	727
Boilers	96,386	36,060	104,122	179,170	142,300	101,298	172,582	102,676	-	-	934,594
Cooling Towers	4,036	13.805	29.172	15.365	13,805	27,831	14,076	-	-	-	118,140
Vessels	4.981	17,037	36,001	18,962	17,037	34.408	17,371	-	-	-	145,797
Blowers	1.972	6,743	14.248	7.505	6,743	13,618	6,875	-	-	-	57,704
Internal Combustion Motors	467	479	3,246	3,020	479	3,201	2,766	-	-	-	13,658
Turbines	48,113	97,739	80,558	72,379	152,936	73,793	72,379	73,794	-	-	671,691
Water Treatment Plant	2,065	7,062	14,923	7,860	7,062	14,262	7,201	-	-	-	60,435
Equipment Total	924,614	955,547	1.596,758	2.255,836	2.075.068	1.687,664	1.321,111	850,019	101,339	-	11.758,016
Piping	655,195	619,144	206,716	326,705	359,379	240,788	230,521	136,168	21,781	-	2.886,397
Valves	470,680	440,001	214,595	238,353	250,379	167,734	171,423	99,737	14,963	-	2.067,865
Connections	284,240	267,169	126,371	140,740	154,201	103,690	99,439	58,562	9,342	-	1.243,754
Instruments	398,084	448,641	235,443	224,525	229,901	175,842	186,175	118,727	19,922	-	2.037,260
Electrical Material	343,829	357,802	173,991	167,870	196,870	131,265	130,863	86,617	15,873	-	1.604,980
Others	585,681	771,932	246,519	230,248	343,252	296,173	185,713	167,557	112,245	13,937	2.953,857
Materials Total	2.737,709	2.904,689	1.293,635	1.328,441	1.533,982	1.115,492	1.004,134	667,368	194,726	13,937	12.734,112
Equipment and Materials Total	3.662,323	3.860,236	2.890,393	3.584,277	3.609,050	2.803,156	2.325,245	1.517,387	296,125	13,937	24.562,129
Engineering	291,264	309,734	171,886	265,921	313,851	265,269	192,109	130,694	39,614	4,182	1.984,524

SOURCE: Subdirección de Estudios Económicos y Planeación Industrial in respect to the desintegration of capital goods per families made at the Subdirección de Ingeniería de Proyecto. IMP.

(*) It refers only to the more outstanding purchases of capital goods and intermediates.

TABLE C.VI. 17
FORECAST INVESTMENTS SUMMARY ON THE MATERIALS, EQUIPMENT AND ENGINEERING ACQUISITION FOR THE REFINING SECTOR: 1977-1986 (*)
(Percentages)

C O N C E P T	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
Total Investment	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Fornaces	1.8	2.3	5.7	5.9	4.2	2.8	3.8	5.0	-	-	3.8
Towers	1.6	2.1	5.0	4.7	3.3	3.1	3.1	4.0	-	-	3.2
Towers Internals	0.4	0.7	1.7	1.6	0.7	1.2	1.1	0.9	-	-	1.0
Reactors	1.6	0.9	3.7	4.5	3.3	2.5	2.3	0.9	-	-	2.5
Exchangers	4.4	3.5	8.7	14.5	14.4	15.7	8.9	16.8	-	-	10.3
Air Coolers	0.2	0.2	0.5	0.5	0.3	0.3	0.4	0.3	-	-	0.3
Ejectors	0.1	0.2	-	-	-	-	-	-	-	-	0.1
Process Vessels	2.0	1.1	4.1	4.0	2.2	2.1	2.7	1.4	-	-	2.4
Storage Tanks	0.1	0.2	-	-	0.1	0.4	0.4	-	-	-	0.1
Towers Internals	-	-	-	-	-	-	-	-	-	-	-
Pumps	1.3	1.4	5.3	6.6	6.2	8.7	7.1	5.6	5.2	-	5.0
Compressors	5.2	5.2	5.9	6.6	8.7	8.3	9.6	4.0	25.0	-	7.0
Special Equipments	0.6	0.8	2.2	1.8	0.8	1.2	1.4	-	-	-	1.1
Desuperheaters	-	-	-	-	-	-	-	-	-	-	-
Boilers	2.4	0.9	3.4	4.7	3.6	3.3	6.9	6.2	-	-	3.5
Cooling Towers	0.1	0.3	1.0	0.4	0.4	0.9	0.6	-	-	-	0.4
Vessels	0.1	0.4	1.2	0.5	0.4	1.1	0.7	-	-	-	0.6
Blowers	0.1	0.2	0.5	0.2	0.2	0.4	0.2	-	-	-	0.2
Internal Combustion Motors	0.1	-	0.1	-	-	0.1	0.1	-	-	-	0.1
Turbines	1.2	2.3	2.6	1.9	3.9	2.4	2.9	4.5	-	-	2.5
Water Treatment Plant	0.1	0.2	0.5	0.2	0.2	0.5	0.3	-	-	-	0.2
Equipment Total	23.4	22.9	52.1	58.6	52.9	55.0	52.5	51.6	30.2	-	44.3
Piping	16.6	14.8	9.7	8.5	9.2	7.8	9.1	8.2	6.5	-	10.9
Valves	11.9	10.6	7.0	6.2	6.4	5.5	6.8	6.1	4.5	-	7.8
Connections	7.2	6.4	4.1	3.7	3.9	3.4	4.0	3.6	2.8	-	4.7
Instruments	10.1	10.7	7.7	5.8	5.9	5.7	7.4	7.2	5.9	-	7.7
Electrical Material	8.6	8.6	5.7	4.3	5.0	4.3	5.2	5.2	4.7	-	6.0
Others	14.8	18.5	8.0	6.0	8.7	9.7	7.4	10.2	32.6	76.9	11.1
Materials Equipment	69.2	69.7	42.3	34.5	39.1	36.4	39.9	40.5	58.0	76.9	48.2
Equipment and Materials Total	92.6	92.6	94.4	93.1	92.0	91.4	92.4	92.1	88.2	76.9	92.5
Engineering	7.4	7.4	5.6	6.9	8.0	8.6	7.6	7.9	11.8	23.1	7.5

SOURCE: Subdirección de Estudios Económicos y Planeación Industrial in respect to the desintegration of capital goods per families made at the Subdirección de Ingeniería de Proyecto.- I.M.P.

(*) It refers only to the more outstanding purchases of capital goods and intermediates.

TABLE C.VI.18

FORECAST INVESTMENTS SUMMARY ON THE MATERIALS, EQUIPMENT AND ENGINEERING ACQUISITION FOR THE PETROCHEMICAL SECTOR: 1977-1986 (*)

(1977's Thousand Pesos)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
Engineering, Equipment and Material Total	7.486,538	10.536,456	8.236,129	3.876,179	2.421,879	1.789,657	4.000,555	4.991,196	2.723,837	867,124	46.949,600
Furnaces	162,201	269,430	380,979	194,795	59,987	71,195	88,711	133,323	164,544	-	1.525,225
Towers	248,303	534,558	573,796	254,840	103,298	209,891	181,285	236,491	136,470	10.772	2.489,704
Towers Internals	30,840	45,279	25,172	12,647	10,346	16,994	18,627	21,122	1,414	-	182,441
Reactors	129,344	305,644	127,936	19,251	47,716	75,716	86,678	167,693	11,966	-	971,344
Exchangers	640,933	588,386	1.197.404	347,701	485,617	197,494	422,120	638,493	328,818	44,766	4.891,732
Air Coolers	146	-	-	-	23	23	-	-	-	-	192
Ejectors	93	-	8	9	12	13	-	-	-	-	135
Process Vessels	158,280	335,669	276,667	170,266	46,698	105,925	138,080	174,029	12,694	-	1.418,308
Storage Tanks	854	486	283	259	103	42	224	224	-	-	2,475
Vessels Internals	9,906	11,219	5,929	3,946	2,280	8,462	9,706	3,094	1,564	-	55,266
Pumps	312,451	350,530	266,707	100,776	139,649	60,261	165,140	207,260	59,294	51,773	1.704,841
Compressors	298,781	1.081,570	1.220,702	616,756	320,355	274,030	159,754	638,021	299,788	184,614	5.104,371
Special Equipments	227,425	348,394	47,746	30,398	11,093	29,288	66,949	46,469	9,425	8,140	825,327
Desuperheaters	4,513	-	-	926	1,555	629	-	-	-	-	7,623
Boilers	330,977	514,273	72.944	-	-	45,432	257,448	39,526	223,980	-	1.484,580
Cooling Towers	45,371	80,499	-	-	-	6.228	35,292	5,418	30,704	-	203,512
Vessels	118,201	99,344	-	-	-	7,686	43,554	6,697	37,691	-	313,173
Blowers	8,392	54,592	-	-	-	3,042	17,238	2,647	14,937	-	100,848
Internal Combustion Motors	9,195	9,475	5,474	-	-	720	1,680	3,026	1,462	2,088	33,120
Turbines	74,275	183,004	422,034	-	-	32,652	-	213,435	-	160,975	1.086,375
Water Treatment Plant	23,260	41,180	-	-	-	3,186	18,054	2,772	15,707	-	104,159
Equipment Total	2.832,846	4.853,532	4.623,781	1.752,570	1.219,732	1.148,919	1.720,640	2.539,860	1.350,918	463,128	22.505,926
Piping	1.092,575	1.051,978	567,810	382,755	210,762	77,636	461,785	469,173	223,609	44,976	4.583,059
Valves	785,603	754,139	415,570	279,524	155,523	55,577	360,226	336,928	157,418	33,199	3.333,707
Connections	471,908	454.765	244,073	164,076	90,343	33,266	198,673	201,407	96,500	19,562	1.974,573
Instruments	739,153	852,005	451,985	195,746	123,175	52,844	218,824	305,392	176,476	77,628	3.193,228
Electrical Material	576,779	636,770	371,104	218,040	122,423	58,974	236,749	282,275	142,309	41,089	2.686,512
Others	637,998	1.086,532	892,295	454,179	242,411	172,460	325,269	388,802	361,213	152,036	4.713,195
Materials Total	4.304,016	4.836,189	2.942,837	1.694,320	944,637	450,757	1.801,526	1.983,977	1.157,525	368,490	20.484,274
Equipment and Materials Total	7.135,862	9.689,721	7.566,618	3.446,890	2.164,369	1.599,676	3.522,166	4.523,837	2.508,443	831,618	42.990,200
Engineering	349,676	866,735	669,511	429,289	257,510	189,981	478,389	467,359	215,454	35,506	3.959,400

SOURCE: Subdirección de Estudios Económicos y Planeacion Industrial in respect to the desintegration of capital goods per families made at the Subdirección de Ingeniería de Proyecto. IMP.

(*) It refers only to the more outstanding purchases of capital goods and intermediates.

TABLE C. VI. 19

FORECAST INVESTMENTS SUMMARY ON THE MATERIALS, EQUIPMENT AND ENGINEERING ADQUISITION FOR THE PETROCHEMICAL SECTOR: 1977 - 1986 (*)

(Percentages)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
TOTAL INVESTMENT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
FURNACES	2.2	2.6	4.6	5.0	2.5	4.0	2.2	2.7	6.0	-	3.2
TOWERS	3.3	5.1	7.0	6.6	4.3	11.7	4.5	4.7	5.0	1.2	5.3
TOWERS INTERNALS	0.4	0.4	0.3	0.3	0.4	0.9	0.5	0.4	0.1	-	0.4
REACTORS	1.7	2.9	1.6	0.5	2.0	4.2	2.2	3.4	0.4	-	2.1
EXCHANGERS	8.6	5.6	14.5	9.0	20.1	11.0	10.6	12.8	12.1	5.2	10.4
AIR COOLERS	-	-	-	-	-	-	-	-	-	-	-
EJECTORS	-	-	-	-	-	-	-	-	-	-	-
PROCESS VESSELS	2.1	3.2	3.4	4.4	1.9	5.9	3.5	3.5	0.5	-	3.0
STORAGE TANKS	-	-	-	-	-	-	-	-	-	-	-
VESSELS INTERNALS	0.1	0.1	0.1	0.1	0.1	0.5	0.2	-	0.1	-	0.1
PUMAS	4.2	3.3	3.2	2.6	5.4	3.4	4.1	4.2	2.2	6.0	3.6
COMPRESSORS	4.0	10.2	14.8	15.9	13.2	15.3	4.2	12.8	11.0	21.3	10.9
SPECIAL EQUIPMENTS	3.0	3.3	0.6	0.8	0.5	1.6	1.7	0.9	0.3	0.9	1.8
DESUPERHEATERS	0.1	-	-	-	-	0.1	-	-	-	-	-
BOILERS	4.4	4.9	0.9	-	-	2.5	6.4	0.8	8.2	-	3.2
COOLING TOWERS	0.6	0.8	-	-	-	0.4	0.9	0.1	1.1	-	0.4
VESSELS	1.6	0.9	-	-	-	0.4	1.1	0.1	1.4	-	0.7
BLOWERS	0.1	0.5	-	-	-	0.2	0.4	-	0.6	-	0.2
INTERNAL COMBUSTION MOTORS	0.1	0.1	-	-	-	0.1	-	0.1	-	0.2	0.1
TURBINES	1.0	1.7	5.1	-	-	1.8	-	4.3	-	18.6	2.3
WATER TREATMENT PLANT	0.3	0.4	-	-	-	0.2	0.5	0.1	0.6	-	0.2
EQUIPMENT TOTAL	37.8	46.0	56.1	45.2	50.4	64.2	43.0	50.9	49.6	53.4	47.9
AIPING	14.6	10.0	6.9	9.9	8.7	4.3	11.5	9.4	8.2	5.2	9.8
VALVES	10.5	7.1	5.0	7.2	6.4	3.1	9.0	6.8	5.8	3.8	7.1
CONNECTIONS	6.3	4.3	3.0	4.2	3.7	1.9	5.0	4.0	3.5	2.3	4.2
INSTRUMENTS	9.9	8.1	5.5	5.0	5.1	3.0	5.5	6.1	6.5	9.0	6.8
ELECTRICAL MATERIAL	7.7	6.0	4.5	5.6	5.1	3.3	5.9	3.7	5.2	4.7	5.7
OTHERS	8.5	10.3	10.8	11.7	10.0	9.6	8.1	7.7	13.3	17.5	10.0
MATERIALS TOTAL	57.5	45.8	35.7	43.7	39.0	25.2	45.0	30.7	42.3	42.5	43.6
EQUIP. AND MATLS. TOTAL	95.3	91.8	91.9	88.9	89.4	89.6	88.0	90.6	92.1	95.9	91.5
ENGINEERING	4.7	8.2	8.1	11.1	10.6	10.6	12.0	9.4	7.9	4.1	8.5

SOURCE: Subdirección de Estudios Económicos y Planeación Industrial in respect to the desintegration of capital goods per families **made at the Subdireccion** de Ingeniería de Proyecto. IMP.

(*) It refers only to the more outstanding purchases of capital goods and intermediates.

TABLE C.VI. 20
FORECAST INVESTMENTS SUMMARY ON THE MATERIALS AND EQUIPMENT ACQUISITION FROM THE TRANSPORT SECTOR
(1977's Millons Pesos)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
MATERIALS AND EQUIPMENT	1,599.6	9,482.4	2,412.1	3,146.2	252.9	424.8	995.2	2,903.5	2,604.6	509.5	24 330.8
PIPING	1,531.3	8,294.1	1,540.2	839.9	149.5	229.9	731.3	2,325.6	942.5	210.8	16,795.1
VALVES	16.9	407.0	120.7	315.8	19.2	27.6	37.1	103.4	260.1	43.9	1,351.7
CONNECTIONS	3.7	136.6	38.4	101.4	7.1	9.2	7.7	33.2	82.2	14.0	433.5
MOTOCOMPRESSORS	-	20.0	20.0	990.2	-	44.9	-	178.8	259.6	71.7	1,584.6
MOTOPUMPS	35.6	450.6	377.2	254.5	33.6	54.7	203.2	131.6	577.5	66.6	2,185.1
TANKS	2.4	25.2	47.0	14.2	6.4	5.0	5.4	7.2	45.6	5.0	163.4
INTRUMENTS	0.1	1.8	3.2	6.4	0.5	0.7	0.4	1.2	4.8	1.1	20.2
GENERAL MECHANICAL EQUIPMENT	9.6	147.1	265.4	623.8	36.6	52.8	10.1	122.5	432.3	97.0	1,797.2
ENGINEERING	73.9	531.7	25.3	109.8	14.6	24.8	28.5	96.1	80.9	20.9	1,006.5
TOTAL	1,673.5	10,014.1	2,437.4	3,256.0	267.5	449.6	1,023.7	2,999.6	2,685.5	530.4	25,337.3

SOURCE: Subdirección de Estudios Económicos y Planeación Industrial, IMP.

TABLE C.VI.21
FORECAST INVESTMENTS SUMMARY ON THE MATERIALS AND EQUIPMENT ACQUISITION FROM TRANSPORTS SECTOR
(Percentages)

CONCEPT	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1977-1986
Materials and Equipment	95.6	94.7	99.0	96.6	94.5	94.5	97.2	96.8	97.0	96.1	96.0
Piping	91.5	82.8	63.2	25.8	55.8	51.1	71.4	77.5	35.1	39.8	66.3
Valves	1.0	4.1	5.0	9.7	7.2	6.1	3.6	3.5	9.6	8.3	5.3
Connections	0.2	1.4	1.6	3.1	2.7	2.1	0.8	1.1	3.1	2.6	1.7
Motocompressors	-	0.2	0.8	30.4	-	10.0	-	6.0	9.7	13.4	6.3
Motopumps	2.1	4.5	15.5	7.8	12.6	12.2	19.9	4.4	21.5	12.6	8.6
Tanks	0.2	0.3	1.9	0.4	2.4	1.1	0.5	0.2	1.7	0.9	0.7
Instruments	-	-	0.1	0.2	0.2	0.2	-	-	0.2	0.2	-
General Mechanical Equipment	0.6	1.4	10.9	19.2	13.6	11.7	1.0	4.1	16.1	18.3	7.1
Engineering	4.4	5.3	1.0	3.4	5.5	5.5	2.8	3.2	3.0	3.9	4.0
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCE: Subdirección de Estudios Económicos y Planeación Industrial.- I.M.P.

TABLE C.VI.22

PETROLEOS MEXICANOS IMPORTS SUMMARY: 1972 - 1977
(CURRENT THOUSAND PESOS)

	CONCEPT	1972	%	1973	%	1974	%	1975	%	1976	%	1977	%
	PEMEX Total Imports	1,984,372		4,413,459		7,856,293		8,708,357		12,073,638		15,033,801	
	%	100.0		100.0		100.0		100.0		100.0		100.0	
	Machinery and Equipment (1) Total Imported by PEMEX	618,635		1,258,413		2,562,514		4,030,130		6,334,488		9,392,254	
	%	31.2	100.0	28.5	100.0	32.6	100.0	46.3	100.0	52.5	100.0	62.5	100.0
(2)													
73	Foundry, Iron and Steel	101,687	16.4	220,923	17.5	441,861	17.2	1,273,080	31.6	1,308,899	20.7	1,895,516	20.2
74	Cuprum	560	0.1	645	-	433	-	1,193	-	3,441	0.1	5,080	-
75	Nickel	399	0.1	1,532	0.2	3,147	0.1	5,408	0.1	4,855	0.1	9,568	0.1
76	Alumina	148	0.1	997	0.1	1,747	0.1	660	-	2,713	-	5,225	-
77	Magnesium, Beryllium	55	-	4	-	-	-	2,426	0.1	2,097	-	178	-
78	Lead	1	-	27	-	-	-	17	-	82	-	37	-
79	Zinc	1	-	-	-	-	-	-	-	80	-	35	-
80	Tin	2	-	-	-	-	-	-	-	7	-	13	-
81	Other Common Metals	23	-	608	-	717	-	1,008	-	10,470	0.2	10,352	0.1
82	Tools Common Metals Knives	12,433	2.0	37,981	3.0	53,936	2.1	47,116	1.2	88,856	1.4	44,364	0.5
83	Diverse Manufacture of Common Metals	925	0.1	1,177	0.2	1,155	0.1	1,360	-	6,929	0.1	10,380	0.1
84	Boilers Engines Mechanical Apparatus and Devices	384,505	62.2	636,225	50.6	960,208	37.5	2,029,559	50.4	3,783,309	59.7	5,342,970	56.9
85	Electrical Engines, Apparatus and Objects for Electronical Uses	47,437	7.7	102,933	8.2	126,952	4.9	167,334	4.2	664,649	10.5	847,938	9.0
86	Vehicles and Material for Rail-Roads Non Electrical Apparatus	30	-	679	-	73,057	2.9	33,922	0.8	90,637	1.4	62,774	0.7
87	Vehicles Cars Tractors Velocipedes and Other Vehicles	10,188	1.6	26,264	2.1	37,831	1.5	57,785	1.4	67,373	1.0	44,610	0.5
89	Marine and Fluvial Navegation	3,935	0.6	156,731	12.4	765,491	29.9	212,351	5.3	34,981	0.6	682,129	7.3
90	Movies, Photo and Optical Apparatus and Instruments	56,306	9.1	71,687	5.7	95,579	3.7	196,911	4.9	265,110	4.2	431,079	4.6

SOURCE: Dirección General de Aduanas, S.H.C.P.

(1) Includes parts, components, various.
(2) Chapters of the Comercio Exterior de los Estados Unidos Mexicanos Annuary.

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY
COMBINED UNIT, TULA, HGO.

REPORT: 1
E1045

Equipment	Cost in U. S. Dollars		Percentage	
	National	Foreign	National	Foreign
Furnaces	419,709.35	831,314.99	33.5	66.4
Desuperheaters	0.00	2,277.35	.0	100.0
Towers	1,069,069.69	0.00	100.0	.0
Towers Internals	471,989.55	0.00	100.0	.0
Exchangers	2,444,908.90	0.00	100.0	.0
Process Vessels	316,904.61	0.00	100.0	.0
Vessels Internals	0.00	1,920.00	.0	100.0
Pumps	168,622.54	624,664.24	21.2	78.7
Agitators	553.14	0.00	100.0	.0
Motors	28,392.07	102,491.23	21.6	78.3
Turbines	0.90	172,135.46	.0	100.0
Piping	0.00	629,674.96	.0	100.0
Valves	2,383.22	214,233.05	1.1	98.8
Connections	0.00	373,273.72	.0	100.0
Instruments	199,469.82	436,283.80	31.3	68.6
Special Equipments	57,446.84	449,527.68	11.3	88.6
	5,179,449.73	3,837,796.48	57.4	42.5

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY
NAPHTHA HYDRODESULFURIZATION PLANT, TULA, HGO.

REPORT: 1
E1047

Equipment	Cost in U. S. Dollars		Percentage	
	National	Foreign	National	Foreign
Furnaces	17,799.37	205,137.47	7.9	92.0
Towers	242,926.62	0.00	100.0	.0
Towers Internals	28,456.37	53,694.76	34.6	65.3
Reactors	0.00	160,538.94	.0	100.0
Exchangers	669,731.10	227,745.32	74.6	25.3
Ejectors	0.00	1,069.96	.0	100.0
Process Vessels	125,979.25	0.00	100.0	.0
Vessels Internals	0.00	963.53	.0	100.0
Pumps	17,700.88	213,523.81	7.6	92.3
Compressors	0.00	605,484.49	.0	100.0
Motors	7,954.16	108,737.14	6.8	93.1
Turbines	0.00	143,362.06	.0	100.0
Piping	0.00	80,648.02	.0	100.0
Instruments	88,193.16	80,352.36	52.3	47.6
	1,198,740.91	1,881,257.86	38.9	61.0

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY
NAPHTHA REFORMING PLANT, TULA, HGO.

REPORT: 1
E1048

Equipment	Cost in U. S. Dollars		Percentage	
	National	Foreign	National	Foreign
Furnaces	84,618.61	828,659.32	9.2	90.7
Towers	119,714.77	0.00	100.0	.0
Towers Internals	36,373.57	0.00	100.0	.0
Reactors	0.00	990,313.52	.0	100.0
Exchangers	59,715.87	892,881.60	6.2	93.7
Air Coolers	0.00	477,500.64	.0	100.0
Ejectors	0.00	1,822.00	.0	100.0
Process Vessels	124,813.13	0.00	100.0	.0
Pumps	17,031.89	25,305.37	41.0	58.9
Compressors	0.00	1,486,800.90	.0	100.0
Motors	615.03	227,039.38	.2	98.7
Turbines	0.00	254,068.01	.0	100.0
Piping	0.00	143,639.75	.0	100.0
Instruments	69,435.24	167,230.80	29.3	70.6
Special Equipments	210,043.44	0.00	100.0	.0
	722,961.55	5,495,262.09		

MEXICAN PETROLEUM INSTITUTE

UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT

CAPITAL GOODS STUDY REPORT: 1

PLANT: TREATERING AND FRACTIONATING PLANT. TULA, HGO.

E 1050

EQUIPMENT	COSTS IN US DLLS.		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
DESUPERHEATER	0.00	2132.04	.0%	100.0 %
TOWERS	448921.01	0.00	100.0%	.0 %
INT. TOWERS	3119.07	132151.55	2.3%	97.6 %
CHANGERS	1045427.57	0.00	100.0%	.0 %
PROCESS TANKS	99832.73	0.00	100.0%	.0 %
INT. TANKS	10726.56	2500.56	81.0%	18.9 %
PUMPS	51726.61	190330.63	21.3%	78.6 %
MOTORS	2144.33	36316.26	5.5%	94.4 %
INSTRUMENTS	80107.78	138731.18	36.6%	63.3 %
SPECIAL EQUIPMENTS	70794.89	0.00	100.0%	.0 %
	1812800.55	502163.12	78.3%	21.6 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1
PLANT: VISCOSITYBREAKING PLANT. TULA, HGO.
E 1053

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	99990.87	1084703.81	8.4 %	91.5 %
TOWERS	114501.45	0.00	100.0 %	.0 %
INT. TOWERS	32511.78	0.00	100.0 %	.0 %
CHANGERS	64111.49	732521.97	8.0 %	91.9 %
PROCESS TANKS	126060.37	0.00	100.0 %	.0 %
INT. TANKS	0.00	922.45	.0 %	100.0 %
PUMPS	33196.75	272832.36	10.8 %	89.1 %
COMPRESSORS	0.00	398172.96	.0 %	100.0 %
MOTORS	4022.40	21477.99	15.7 %	84.2 %
TURBINES	0.00	249052.24	.0 %	100.0 %
PIPES	0.00	1411.52	.0 %	100.0 %
VALVES	0.00	57550.54	.0 %	100.0 %
CONNECTIONS	0.00	30407.08	.0 %	100.0 %
INSTRUMENTS	96694.56	177170.92	35.3 %	64.6 %
SUBSTATIONS	28991.37	0.00	100.0 %	.0 %
TRANSFORMERS	9309.98	0.00	100.0 %	.0 %
SPECIAL EQUIPMENT	18249.18	10231.97	64.0 %	35.9 %
	627640.20	3036455.81	17.1 %	82.8 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY . REPORT: 1
PLANT. KEROSENE HYDRODESULFURIZATION PLANT
F 1066

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	20656.83	352397.62	5.5 %	94.4 %
TOWERS	86281.35	0.00	100.0 %	.0 %
INT. TOWERS	21279.73	0.00	100.0 %	.0 %
REACTORS	0.00	675819.96	.0 %	100.0 %
CHANGERS	158819.05	1027278.03	13.3 %	86.6 %
EJECTORS	0.00	859.60	.0 %	100.0 %
PROCESS TANKS	125894.62	0.00	100.0 %	.0 %
INT. TANKS	2465.66	0.00	100.0 %	.0 %
PUMPS	0.00	124623.74	.0 %	100.0 %
COMPRESSORS	0.00	574745.35	.0 %	100.0 %
MOTORS	0.00	47274.49	.0 %	100.0 %
TURBINES	0.00	301890.33	.0 %	100.0 %
PIPES	0.00	63616.18	.0 %	100.0 %
INSTRUMENTS	70234.67	87656.32	44.4 %	55.5 %
	485631.91	3256161.62	12.9 %	87.0 %

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1
PLANT: GAS OIL HYDRODESULFURIZATION PLANT
TULA, HGO. E 1069

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	20656.83	351151.66	5.5 %	94.4 %
TOWERS	86281.35	0.00	100.0 %	.0 %
INT. TOWERS	21279.73	0.00	100.0 %	.0 %
REACTORS	0.00	675819.96	.0 %	100.0 %
CHANGERS	778709.62	1027278.03	43.1 %	56.8 %
EJECTORS	0.00	859.60	.0 %	100.0 %
PROCESS TANKS	108058.91	0.00	100.0 %	.0 %
INT. TANKS	2465.66	0.00	100.0 %	.0 %
PUMPS	0.00	124575.01	.0 %	100.0 %
COMPRESSORS	0.00	575314.64	.0 %	100.0 %
MOTORS	0.00	47274.49	.0 %	100.0 %
TURBINES	0.00	301748.97	.0 %	100.0 %
PIPES	0.00	63616.18	.0 %	100.0 %
INSTRUMENTS	70349.13	87656.32	44.5 %	55.4 %
	108701.23	3255294.86	25.0 %	74.9 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1
PLANT: GENERAL COMMON WORKS, TULA, HGO.
E 1072

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
CHANGERS	128303.18	0.00	100.0 %	.0 %
PROCESS TANKS	77264.03	0.00	100.0 %	.0 %
PUMPS	0.00	78140.30	.0 %	100.0 %
MOTORS	0.00	7035.94	.0 %	100.0 %
TURBINES	0.00	8055.99	.0 %	100.0 %
PIPES	0.00	17037.85	.0 %	100.0 %
VALVES	0.00	24195.68	.0 %	100.0 %
CONNECTIONS	0.00	17690.53	.0 %	100.0 %
INSTRUMENTS	40877.10	644613.98	5.0 %	94.0 %
SUBSTATIONS	305065.36	0.00	100.0 %	.0 %
TRANSFORMERS	29623.23	0.00	100.0 %	.0 %
SPECIAL EQUIPMENT	335888.25	0.00	100.0 %	.0 %
	917021.15	796770.27	53.5 %	46.4 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: FURNACES REFINING

PLANT	INLAND	ABROAD
1045	33.5	66.4
1047	7.9	92.0
1048	9.2	90.7
1053	8.4	91.5
1066	5.5	94.4
1069	5.5	94.4

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: DESUPERHEATER REFINING

PLANT	INLAND	ABROAD
1045	0.0	100.0
1050	0.0	100.0

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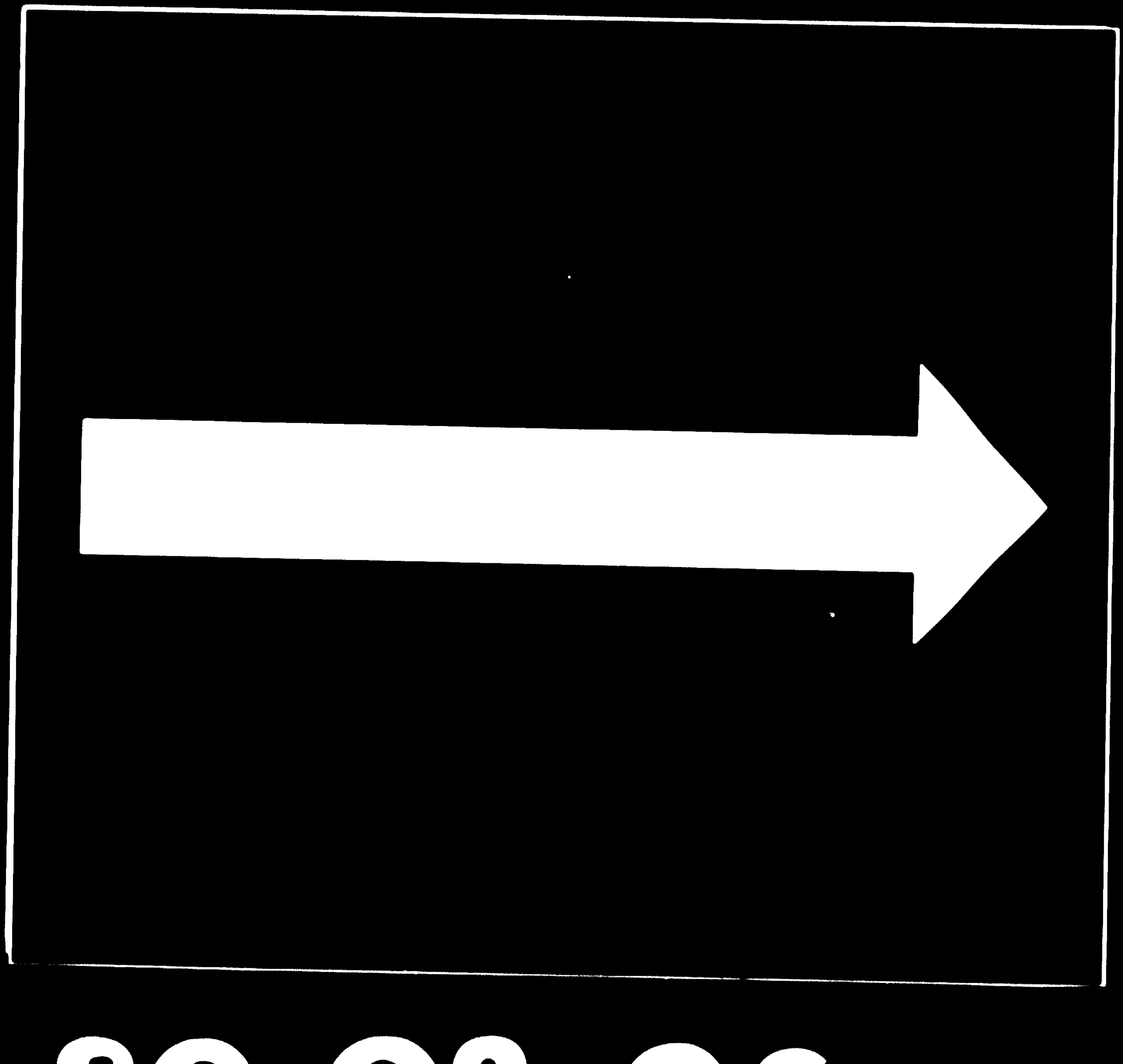

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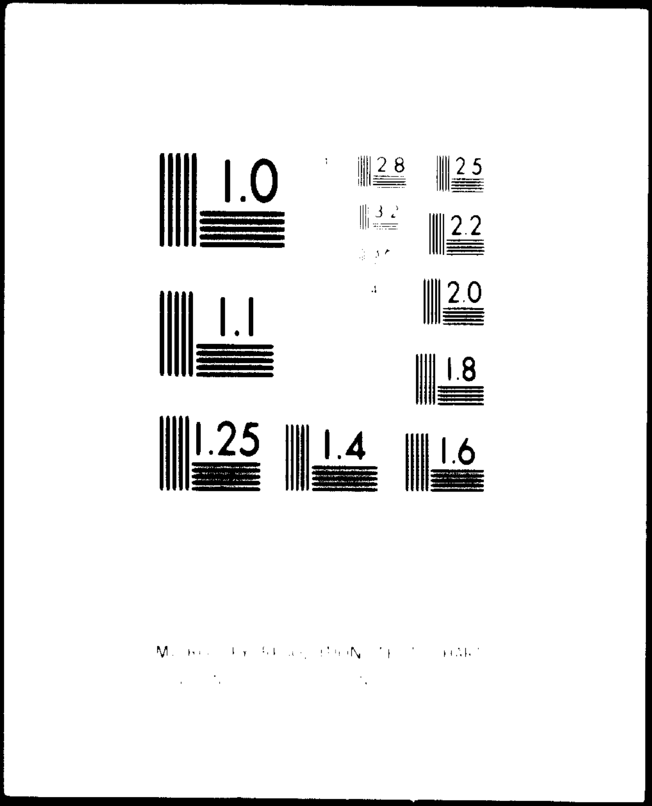

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: TOWERS REFINING

PLANT	INLAND	ABROAD
1045	100.0	0.0
1047	100.0	0.0
1048	100.0	0.0
1050	100.0	0.0
1053	100.0	0.0
1066	100.0	0.0
1069	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: INT. TOWERS REFINING

PLANT	INLAND	ABROAD
1045	100.0	0.0
1047	34.6	65.3
1048	100.0	0.0
1050	2.3	97.6
1053	100.0	0.0
1066	100.0	0.0
1069	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: REACTORS REFINING

PLANT	INLAND	ABROAD
1047	0.0	100.0
1048	0.0	100.0
1066	0.0	100.0
1069	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: CHANGERS

PLANT	INLAND	ABROAD
1045	100.0	0.0
1047	74.6	25.3
1048	6.2	93.7
1050	100.0	0.0
1053	8.0	91.9
1066	13.3	86.6
1069	43.1	56.8
1072	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: AIR COOLERS REFINING

PLANT	INLAND	ABROAD
1048	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT

CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: EJECTORS REFINING

PLANT	INLAND	ABROAD
1047	0.0	100.0
1048	0.0	100.0
1066	0.0	100.0
1069	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: PROCESS TANKS REFINING

PLANT	INLAND	ABROAD
1045	100.0	0.0
1047	100.0	0.0
1048	100.0	0.0
1050	100.0	0.0
1053	100.0	0.0
1066	100.0	0.0
1069	100.0	0.0
1072	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: INT. TANKS REFINING

PLANT	INLAND	ABROAD
1045	0.0	100.0
1047	0.0	100.0
1050	81.0	18.9
1053	0.0	100.0
1066	100.0	0.0
1069	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: PUMPS REFINING

PLANT	INLAND	ABROAD
1045	21.2	78.7
1047	7.6	92.3
1048	41.0	58.9
1050	21.3	78.6
1053	10.8	89.1
1066	0.0	100.0
1069	0.0	100.0
1072	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: COMPRESSORS

PLANT	INLAND	ABROAD
1047	0.0	100.0
1048	0.0	100.0
1053	0.0	100.0
1066	0.0	100.0
1069	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT

CAPITAL GOODS STUDY REPORT: 1A

EQUIPMENT: AGITATORS REFINING

PLANT	INLAND	ABROAD
1045	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT

CAPITAL GOODS STUDY REPORT: 1A

EQUIPMENT: MOTORS REFINING

PLANT	INLAND	ABROAD
1045	21.6	78.3
1047	6.8	93.1
1048	0.2	99.7
1050	5.5	94.4
1053	15.7	84.2
1066	0.0	100.0
1069	0.0	100.0
1072	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: TURBINES REFINING

PLANT	INLAND	ABROAD
1045	0.0	100.0
1047	0.0	100.0
1048	0.0	100.0
1053	0.0	100.0
1066	0.0	100.0
1069	0.0	100.0
1072	0.0	100.0

MEXICAN PETROLEUM INSTITUTE
UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: PIPES REFINING

PLANT	INLAND	ABROAD
1045	0.0	100.0
1047	0.0	100.0
1048	0.0	100.0
1053	0.0	100.0
1066	0.0	100.0
1069	0.0	100.0
1072	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: VALVES REFINING

PLANT	INLAND	ABROAD
1045	1.1	98.8
1053	0.0	100.0
1072	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: CONNECTIONS REFINING

PLANT	INLAND	ABROAD
1045	0.0	100.0
1053	0.0	100.0
1072	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT

CAPITAL GOODS STUDY REPORT: 1A

EQUIPMENT: INSTRUMENTS REFINING

PLANT	INLAND	ABROAD
1045	31.3	68.6
1047	52.3	47.6
1048	29.3	70.6
1050	36.6	63.3
1053	35.3	64.6
1066	44.4	55.5
1069	44.5	55.4
1072	5.9	94.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: SUBSTATIONS REFINING

PLANT	INLAND	ABROAD
1053	100.0	0.0
1072	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: TRANSFORMERS REFINING

PLANT	INLAND	ABROAD
1053	100.0	0.0
1072	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: SPECIAL EQUIPMENT REFINING

PLANT	INLAND	ABROAD
1045	11.3	88.6
1048	100.0	0.0
1050	100.0	0.0
1053	64.0	35.9
1072	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1
E 1041
PLANT: CRYOGENICS PLANT POZA RICA, VER.

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	0.0	181421.16	.0 %	100.0 %
TOWERS	387915.16	0.00	100.0 %	.0 %
INT. TOWERS	78613.24	1062.07	98.6 %	1.3 %
CHANGERS	1432530.41	0.00	100.0 %	.0 %
AIR COOLERS	182674.38	36334.05	83.4 %	16.5 %
PROCESS TANKS	1153286.36	0.00	100.0 %	.0 %
INT. TANKS	0.00	8018.10	.0 %	100.0 %
PUMPS	60781.74	28154.16	68.3 %	31.6 %
COMPRESSORS	0.00	2726607.35	.0 %	100.0 %
TURBOEXPANDER	0.00	632994.17	.0 %	100.0 %
MOTORS	13569.97	0.00	100.0 %	.0 %
TURBINES	0.00	2280707.36	.0 %	100.0 %
PIPES	0.00	757308.82	.0 %	100.0 %
VALVES	0.00	496035.20	.0 %	100.0 %
CONNECTIONS	0.00	186269.37	.0 %	100.0 %
INSTRUMENTS	416129.68	361977.21	53.4 %	46.5 %
SUBSTATIONS	143950.06	0.00	100.0 %	.0 %
TRANSFORMES	15141.67	0.00	100.0 %	.0 %
SPECIAL EQUIPMENT	92437.42	0.00	100.0 %	.0 %
	3977030.09	7696889.02	34.0 %	65.9 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1
E 1083
PLANT: CRYOGENICS PLANT. CACTUS, CHIS.

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	0.00	111507.94	.0 %	100.0 %
TOWERS	733493.04	1780793.86	29.1 %	70.8 %
INT. TOWERS	30524.75	0.00	100.0 %	100.0 %
CHANGERS	0.00	5046930.13	.0 %	0.0 %
AIR COOLERS	0.00	430147.14	.0 %	100.0 %
PROCESS TANKS	1344254.49	678864.83	66.4 %	33.5 %
INT. TANKS	0.00	13875.31	.0 %	100.0 %
PUMPS	1580.56	203558.02	.7 %	99.2 %
COMPRESSORS	624996.10	6644945.84	8.5 %	91.4 %
MOTORS	14129.20	44058.26	24.2 %	75.7 %
TURBINES	0.00	6483830.25	.0 %	100.0 %
VALVES	0.00	25679.69	.0 %	100.0 %
INSTRUMENTS	476057.12	332234.57	58.8 %	41.1 %
SUBSTATIONS	146799.80	0.00	100.0 %	.0 %
TRANSFORMERS	33305.15	0.00	100.0 %	.0 %
SPECIAL EQUIPMENT	53471.77	454556.32	10.5 %	89.4 %
	3458611.98	22251082.16	13.4 %	86.5 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1
PLANT: ETHYLENE PLANT. LA CANGREJERA, VER.
E 1085

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	178935.93	3816834.56	4.4 %	95.5 %
DESUPERHEATER	0.00	3550.30	.0 %	100.0 %
TOWERS	1279743.50	3331579.33	27.7 %	72.2 %
INT. TOWERS	428669.49	0.00	100.0 %	.0 %
REACTORS	0.00	326657.86	.0 %	100.0 %
CHANGERS	2023045.51	9796208.94	17.1 %	82.8 %
DEAERATORS	0.00	95440.53	.0 %	100.0 %
PROCESS TANKS	1072311.24	1500049.95	41.6 %	58.3 %
INT. TANKS	19183.41	21241.88	47.4 %	52.5 %
GASDRYERS	14555.18	363293.14	3.8 %	96.1 %
PUMPS	68116.87	723329.93	8.6 %	91.3 %
COMPRESSORS	10203.26	5817916.84	.1 %	99.8 %
AGITATORS	7748.44	0.00	100.0 %	.0 %
MOTORS	0.00	184802.14	.0 %	100.0 %
TURBINES	0.00	7033668.24	.0 %	100.0 %
INSTRUMENTS	604587.60	2648482.97	18.5 %	81.4 %
SUBSTATIONS	177164.26	29694.11	85.6 %	14.3 %
TRANSFORMERS	30219.56	0.00	100.0 %	.0 %
SPECIAL EQUIPMENT	347543.71	612625.41	36.1 %	63.8 %
	6262027.96	36305376.13	14.7 %	85.2 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1 E 5999
PLANT: ETHYLENE PLANT. PAJARITOS, VER.

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	26408.90	473373.53	5.2 %	94.7 %
WATER TREATING EQ.	10121.66	0.00	100.0 %	.0 %
DESUPERHEATER	1964.55	27096.61	6.7 %	93.2 %
TOWERS	368514.95	57153.33	86.5 %	13.4 %
INT. TOWERS	83110.26	0.00	100.0 %	.0 %
CHANGERS	656477.85	1161926.96	36.1 %	63.8 %
EJECTORS	0.00	1179.87	.0 %	100.0 %
DEAERATORS	11836.74	0.00	100.0 %	.0 %
PROCESS TANKS	451333.50	480488.91	48.4 %	51.5 %
STORAGE TANK	13209.33	0.00	100.0 %	.0 %
INT. TANKS	25779.04	0.00	100.0 %	.0 %
PUMPS	46609.40	384993.71	11.4 %	88.5 %
COMPRESSORS	11483.90	1714334.66	.6 %	99.3 %
TURBOEXPANDER	0.00	208820.64	.0 %	100.0 %
AGITATOR	0.00	3370.65	.0 %	100.0 %
MOTORS	22156.77	178555.16	11.0 %	88.9 %
TURBINES	10093.23	883802.85	1.1 %	98.8 %
PIPES	0.00	754144.43	.0 %	100.0 %
VALVES	5029.11	627147.09	.7 %	99.2 %
CONNECTIONS	0.00	526436.87	.0 %	100.0 %
INSTRUMENTS	22179.48	83606.69	20.9 %	79.0 %
SUBSTATIONS	162042.29	0.00	100.0 %	.0 %
TRANSFORMERS	31908.84	0.00	100.0 %	.0 %
SPECIAL EQUIPMENT	99637.92	615305.24	13.9 %	86.0 %
	2062897.72	8181737.20	20.1 %	79.8 %

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT

CAPITAL GOODS STUDY REPORT: 1

PLANT: ETHYLENE PLANT. POZA RICA, VER. E 6113

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	0.00	1520424.91	.0 %	100.0 %
DESUPERHEATER	0.00	30997.65	.0 %	100.0 %
TOWERS	516213.21	0.00	100.0 %	.0 %
INT. TOWERS	139625.93	0.00	100.0 %	.0 %
CHANGERS	1473229.16	303756.55	82.9 %	17.0 %
EJECTORS	0.00	8198.69	.0 %	100.0 %
DEAERATORS	22836.52	0.00	100.0 %	.0 %
PROCESS TANKS	1131950.65	38816.95	96.6 %	3.3 %
INT. TANKS	0.00	7604.99	.0 %	100.0 %
PUMPS	41151.36	339900.00	10.7 %	89.2 %
COMPRESSORS	0.00	2636529.34	.0 %	100.0 %
TURBOEXPANDER	0.00	119459.20	.0 %	100.0 %
AGITATORS	5303.08	0.00	100.0 %	.0 %
MOTORS	2436.66	45626.39	5.0 %	94.9 %
TURBINES	0.00	1172353.90	.0 %	100.0 %
PIPES	0.00	433199.00	.0 %	100.0 %
VALVES	0.00	283219.52	.0 %	100.0 %
CONNECTIONS	0.00	130709.76	.0 %	100.0 %
INSTRUMENTS	665844.30	432683.63	60.6 %	39.3 %
SUBSTATIONS	185407.64	28083.22	86.8 %	13.1 %
TRANSFORMERS	30177.82	0.00	100.0 %	.0 %
SPECIAL EQUIPMENTS	136895.73	316345.80	30.2 %	69.7 %
DRUMS	16671.78	0.00	100.0 %	.0 %
	4367743.84	7847909.50	35.7 %	64.2 %

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CAPITAL GOODS STUDY REPORT: 1

PLANT: CRYOGENICS PLANT. LA VENTA, TAB. E 6417.

EQUIPMENT	COSTS IN US DOLLARS		INDEX OF COSTS	
	INLAND	ABROAD	INLAND	ABROAD
FURNACES	42766.56	0.00	100.0 %	.0 %
TOWERS	0.00	117404.38	.0 %	100.0 %
INT. TOWERS	20709.04	0.00	100.0 %	.0 %
CHANGERS	201532.87	344300.43	36.9 %	63.0 %
AIR COOLERS	0.00	20645.77	.0 %	100.0 %
PROCESS TANKS	244868.01	182919.87	57.2 %	42.7 %
INT. TANKS	480.26	13682.26	3.3 %	96.6 %
PUMPS	0.00	45798.36	.0 %	100.0 %
COMPRESSORS	17695.54	1065954.80	1.6 %	98.3 %
TURBOEXPANDER	0.00	384144.51	.0 %	100.0 %
MOTORS	0.00	407811.04	.0 %	100.0 %
PIPES	0.00	157468.01	.0 %	100.0 %
VALVES	0.00	102742.30	.0 %	100.0 %
CONNECTIONS	0.00	49308.89	.0 %	100.0 %
INSTRUMENTS	83007.55	298555.65	21.7 %	78.2 %
SUBSTATIONS	144205.03	0.00	100.0 %	.0 %
SPECIAL EQUIPMENTS	36158.86	56295.38	39.1 %	60.8 %
	791423.72	3247031.65	19.5 %	80.4 %

T O T A L	INLAND	20919735.31	ABROAD	85530025.66
%	INLAND	19.6 %	ABROAD	80.3 %

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: FURNACES PETROCHEMISTRY.

PLANT	INLAND	ABROAD
1041	0.0	100.0
1083	0.0	100.0
1085	4.4	95.5
5999	5.2	94.7
6113	0.0	100.0
6417	100.0	0.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: WATERTREATING EQ. PETROCHEMISTRY.

PLANT	INLAND	ABROAD
5999	100.0	0.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: DESUPERHEATER PETROCHEMISTRY

PLANT	INLAND	ABROAD
1085	0.0	100.0
5999	6.7	93.2
6113	0.0	100.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: TOWERS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	100.0	0.0
1083	29.1	70.8
1085	27.7	72.2
5999	86.5	13.4
6113	100.0	0.0
6417	0.0	100.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: INT. TOWERS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	98.6	1.3
1083	100.0	0.0
1085	100.0	0.0
5999	100.0	0.0
6113	100.0	0.0
6417	100.0	0.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: REACTORS PETROCHEMISTRY.

PLANT	INLAND	ABROAD
1085	0.0	100.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: CHANGERS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	100.0	0.0
1083	0.0	100.0
1085	17.1	82.8
5999	36.1	63.8
6113	82.9	17.0
6417	36.9	63.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: AIR COOLERS PETROCHEMISTRY.

PLANT	INLAND	ABROAD
1041	83.4	16.5
1083	0.0	100.0
6417	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: EJECTORS PETROCHEMISTRY

PLANT	INLAND	ABROAD
5999	0.0	100.0
6113	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: DEAERATORS PETROCHEMISTRY.

PLANT	INLAND	ABROAD
1085	0.0	100.0
5999	100.0	0.0
6113	100.0	0.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: PROCESS TANKS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	100.0	0.0
1083	66.4	33.5
1085	41.6	58.3
5999	48.4	51.5
6113	96.6	3.3
6417	57.2	42.7

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: STORAGE TANK PETROCHEMISTRY

PLANT	INLAND	ABROAD
5999	100.0	0.0

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: INT. TANKS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	0.0	100.0
1083	0.0	100.0
1085	47.4	52.5
5999	100.0	0.0
6113	0.0	100.0
6417	3.3	96.6

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: GAS DRYER PETROCHEMISTRY

PLANT	INLAND	ABROAD
1085	3.8	96.1

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: PUMPS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	68.3	31.6
1083	0.7	99.2
1085	8.6	91.3
5999	11.4	88.5
6113	10.7	89.2
6417	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: COMPRESSORS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	0.0	100.0
1083	8.5	91.4
1085	0.1	99.8
5999	0.6	99.3
6113	0.0	100.0
6417	1.6	98.3

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CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: TURBOEXPANDER PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	0.0	100.0
5999	0.0	100.0
6113	0.0	100.0
6417	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: AGITATORS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1085	100.0	0.0
5999	0.0	100.0
6113	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: MOTORS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	100.0	0.0
1083	24.2	75.7
1085	0.0	100.0
5999	11.0	88.9
6113	5.0	94.9
6417	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: TURBINES PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	0.0	100.0
1083	0.0	100.0
1085	0.0	100.0
5999	1.1	98.8
6113	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY
EQUIPMENT: PIPES

REPORT: 1A
PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	0.0	100.0
5999	0.0	100.0
6113	0.0	100.0
6417	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: VALVES PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	0.0	100.0
1083	0.0	100.0
5999	0.7	99.2
6113	0.0	100.0
6417	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: CONNECTIONS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	0.0	100.0
5999	0.0	100.0
6113	0.0	100.0
6417	0.0	100.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: INSTRUMENTS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	53.4	46.5
1083	58.8	41.1
1085	18.5	81.4
5999	20.9	79.0
6113	60.6	39.3
6417	21.7	78.2

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: SUBSTATIONS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	100.0	0.0
1083	100.0	0.0
1085	85.6	14.3
5999	100.0	0.0
6113	86.8	13.1
6417	100.0	0.0

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: TRANSFORMERS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	100.0	0.00
1083	100.0	0.00
1085	100.0	0.00
5999	100.0	0.00
6113	100.0	0.00

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: SPECIAL EQUIPMENTS PETROCHEMISTRY

PLANT	INLAND	ABROAD
1041	100.0	0.0
1083	10.5	89.4
1085	36.1	63.8
5999	13.9	86.0
6113	30.2	69.7
6417	39.1	60.8

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UNITED NATIONS ORGANIZATION FOR INDUSTRIAL DEVELOPMENT
CAPITAL GOODS STUDY REPORT: 1A
EQUIPMENT: DRUMS PETROCHEMISTRY

PLANT	INLAND	ABROAD
6113	100.0	0.0

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