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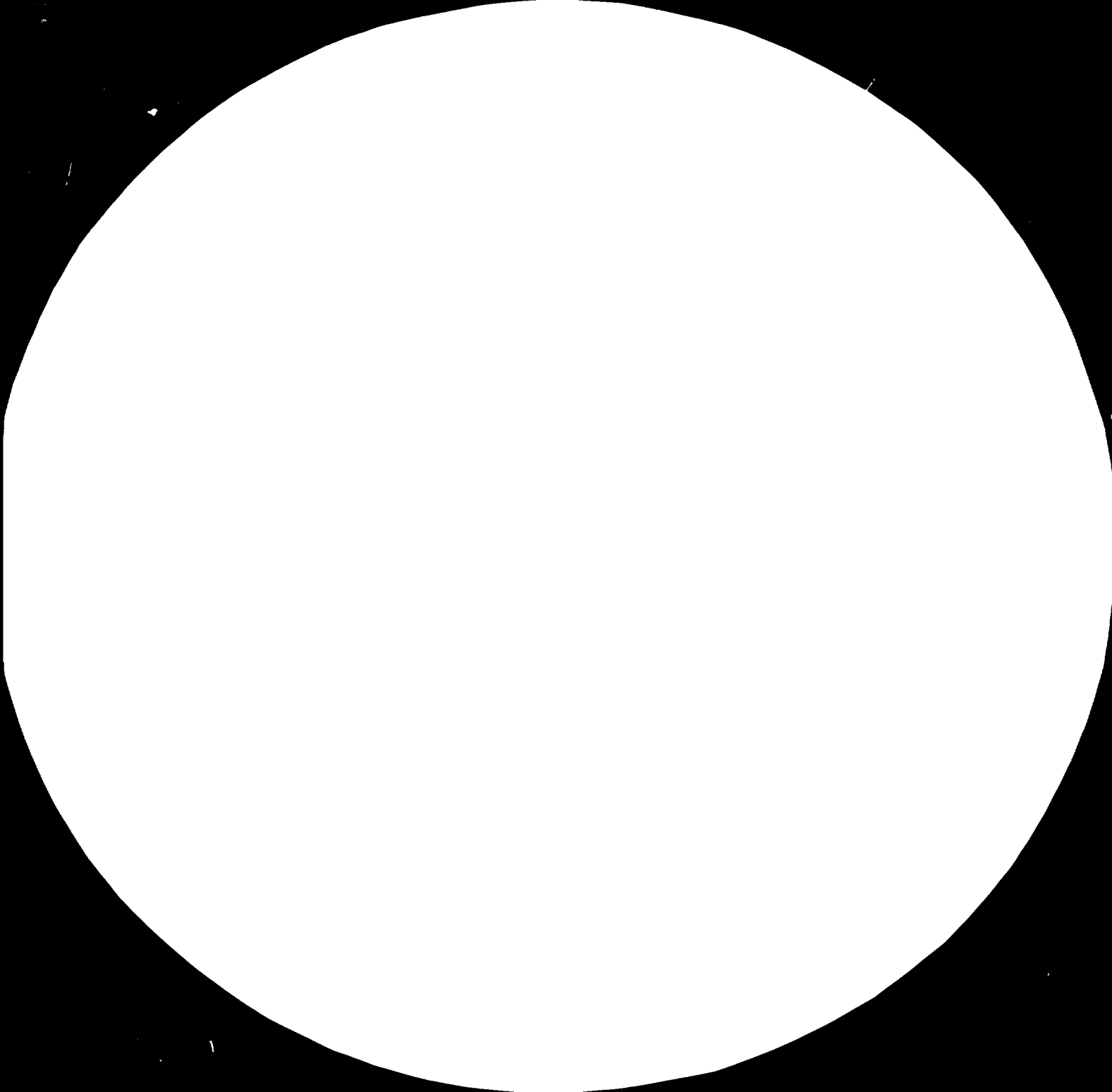

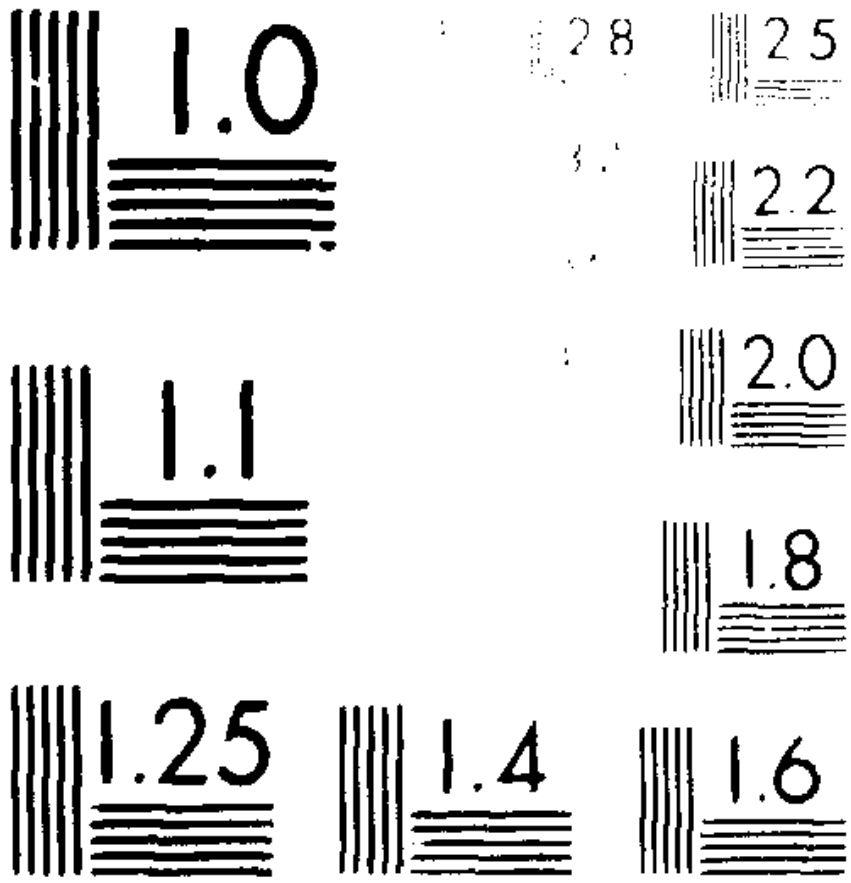
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15 May 1980
English

ESTABLISHMENT OF AMMONIA/UREA FERTILIZER MANUFACTURING FACILITIES IN THE PROVINCE OF NEUQUEN

SI/ARG/79/801

ARGENTINA

Terminal report*

Prepared for the Government of Argentina
by the United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Shohei Maeno, expert on fertilizers

United Nations Industrial Development Organization

Vienna

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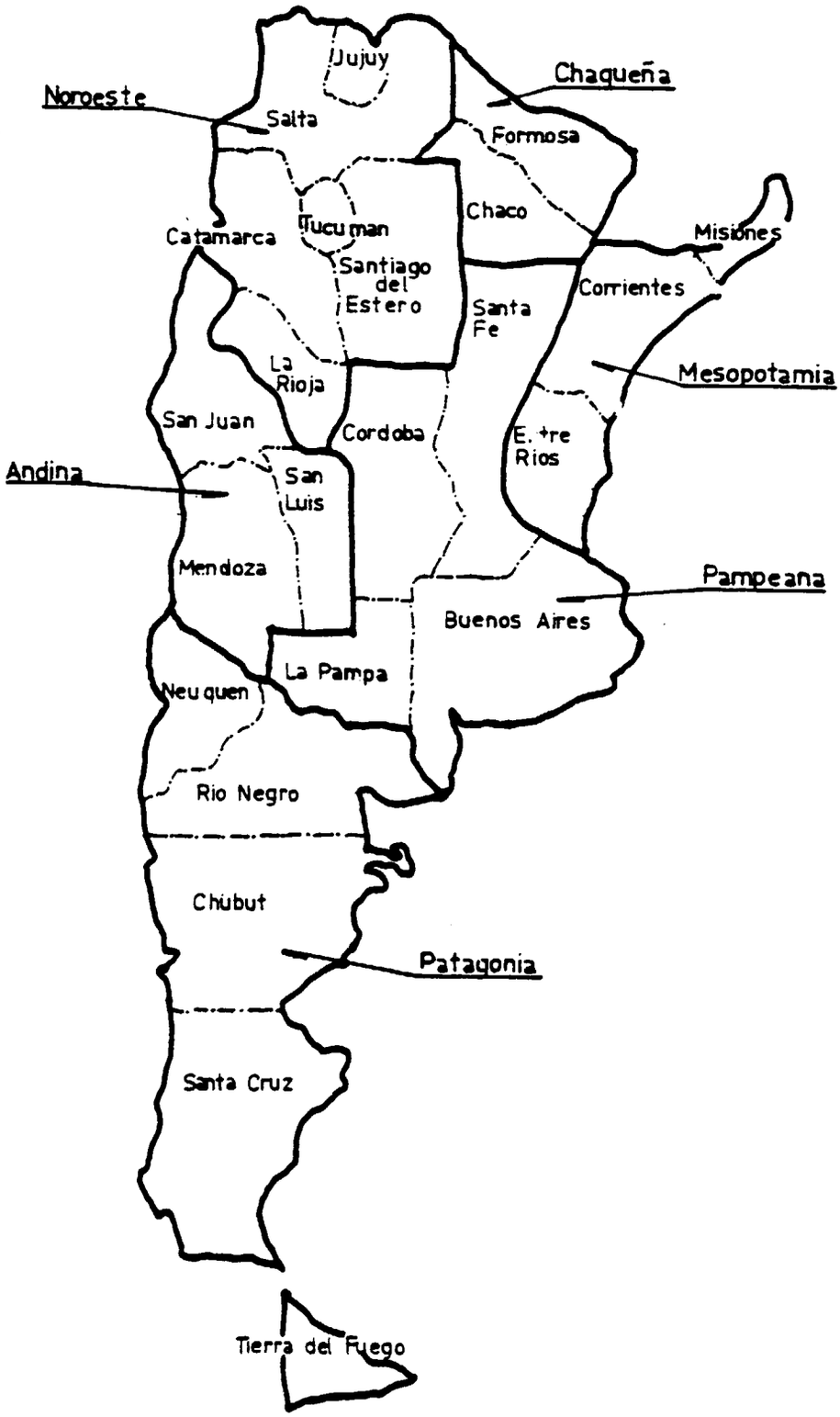
REGIONS AND PROVINCES



SUMMARY

1.0 General.

The Provincial Government of Neuquén, the Republic of Argentina envisages the establishment of an ammonia/urea complex (the fertilizer plant) based on natural gas which is abundantly available in the Province. With this objective, the United Nations Industrial Development Organization (UNIDO) has provided the Government with assistance by financing a pre-investment study for this project. The UNIDO has assigned the expert to carry out the study. The expert commenced the study on the 11th of February, 1980, and continued through three months.

During the period of stay at the duty station, the expert has conducted services and investigations, has collected necessary data and information, has had discussions with the authorities concerned, and also has made inspection field trips to several areas in the Province and the country. Thus, this report is compiled.

2.0 Market Aspect.

2.1 The Project area is located to the western most part of the intensive cultivation land formed by the valleys of the rivers Río Colorado, Río Neuquén, Río Limay and Río Negro.

2.2 It was found that the farmers in the Project area have been forced to purchase urea with extraordinary high price, which is approximately two times as much as the CIF urea price.

Thus, the growth of fertilizer consumption has been stagnant.

2.3 In due respect of the facts that the Project will produce urea with far lower cost than the presently prevailing price and the characteristics of agriculture in the area, the demand of urea is forecast:

1985	77,930 (t/y)
1990	147,490 (t/y)

2.4 In general, in Argentina, the agricultural extention services are found to be well established by both the public (INTA) and private (fertilizer distributors) sectors.

3.0 Technical Aspect.

3.1 Based on the forecast demand, the production capacity is set up to be:

Ammonia	240 t/d
Urea	400 t/d

3.2 Overviewing the local conditions, the plant site is recommended to be located in the vicinity of Senillosa.

3.3 The scope of the Project is proposed to be so called "Grass Root" basis, that the Project is to intake natural gas and water and to output urea as only final product, thus all of the facilities required for intermediate operations are considered to be facilitated by the Project expense.

4.0 Financial Aspect.

4.1 The total capital requirements are estimated as follows, including plant cost, pre-operating expenses, working capital and interest during construction:

Total Capital Requirements (1979 as erected price)	US$ 92,340 thousand

4.2 The total production cost is calculated to be US$ 239/t, with 10% of return on total capital requirements.

4.3 The resultant production cost is compared at the farmers' gate price to find that the Project will be able to supply the farmers with the price approximately US$ 100/t less than the presently prevailing price.

4.4 International market price of urea is projected to be US$ 220/t CIF Argentina in 1985 and approximately US$ 300/t in 1990. Under this price tendency, the Project will benefit the farmers in the area and thus, the viability of the Project should be confirmed through the financial and economic analysis.

5.0 Recommendations.

5.1 Formulation of the Project executing agency.

At present, no probable invester or proper agency exists for the planning and investigation of the Project materialization; it is, therefore, recommended to formulate a project team in order to call possible investors and for the possible investors to be properly guided.

5.2 Clarification of the available incentive facilities.

In Argentina, there are many incentives for the domestic and foreign investors especially in the industrial fields.

However, those incentive facilities are to be clarified only after the application is made for the certain investment project.

In order to induce the possible investors, it is recommended to clarify the important part of the incentives, such as gas price reduction, infrastructures and tax/duty incentives which are to be made available by the Federal government as well as the Provincial government.

UNITS AND ABBREVIATIONS

UNITS

Measuring units : Metric system.

Monetary units : United States Dollar at 1979 current price, unless otherwise noted.

Time : Fertilizer year is used for the market study, i.e., expressed as 77/78, which stands for July '77 to June '78.

ABBREVIATIONS

t/h : tons per hour.

t/d : tons per day.

t/y : tons per year.

ha : hectar = 10,000 m^2

M : thousand = 10^3

MM : million = 10^6

N : nitrogen.

INTA : Instituto Nacional de Tecnología Agropecuaria.

YPF : Yacimientos Petrolíferos Fiscales.

FOB : free on board.

CIF : cost, insurence and freight.

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PART I. INTRODUCTION.

1.0 Project Background.

The Government of the Province of Neuquén is considering the establishment of an ammonia/urea plant based on available natural gas feed stock, to satisfy the fertilizer needs of the region.
A study has been undertaken by the Planning and Developing Council. The Government of Argentina has thus requested UNIDO assistance in up-dating this study, as part of the Project titled PETROCHEMICAL INDUSTRY AND PRODUCTION OF FERTILIZERS (Whole Project).

2.0 Official Arrangements (Whole Project).

2.1 Origin and Date of Official Request.

Letter N° 817, Ministry of Foreign Affairs of 7 June 1979.

2.2 Contributions.

UNIDO	:	US$ 70,000	
Government	:	US$ 82,000	
		- Cost sharing	US$ 12,000
		- Contribution in kind	US$ 70,000.

2.3 Schedule.

- Whole Project
  Scheduled Start : 1 January 1980.
  Schedeled Completion : 31 December 1980.
- Fertilizer Expert
  Appointment Effective Date : 11 February 1980.
  Appointment Termination Date : 10 May 1980.

3.0 Objectives of Project (Whole Project).

To advise on and assist in the development of petrochemical production facilities in the Province of Neuquén.

4.0 Acknowledgement.

With the fullest supports of counterparts, the expert accomplished the assigned job to his satisfaction.

The expert has to acknowledge the very kind co-operation extended by Minister Fernández and Minister Gutiérrez and their associates.
Furthermore, the expert must admit that, Miss Blanca C. Tirachini, without her extensive assistance as an interpreter, a secretary, a typist, an expert, and a very good friend of the expert's, any parts of this report would not have been written properly.

PART II FINDINGS

Chapter 1. GENERAL.

In order to investigate and examine the proposed Project in detail, the expert divided the Project into three elements, these are:

i. Market Aspect.

ii. Technical Aspect.

iii. Capital and Production Cost.

Therefore, the findings by the expert will be explained hereunder for each element of the Project.

Chapter 2. MARKET ASPECT.

2.1 Agriculture and Fertilizer Consumption in Argentina.

Although the ratio of agricultural production comprised in the gross domestic product is not very high (Table 2-1) and is decreasing year by year with the decline in the population in the agricultural sector (Table 2-2), agricultural products and processed commodities thereof are taking up an overwhelmingly high ratio in the total export (Table 2-3).

It clearly implies that the Argentine agricultural production is greatly contributing to the national economy.

The mainstay of the agricultural production of the country consists of grain production and cattle raising, both of which are for export.

Argentina depends these agricultural production activities on the natural conditions such as inherent productivity of soil itself, and weather, so that the cultivation status is unstable, thereby showing an extreme extent of fluctuation in production from year to year.

Under these circumstances, the fertilizer consumption in Argentina has been showing stagnant growth (Tables 2-4 and 2-5), and has been on a considerable low level in comparison with the consumption levels of the other countries in view of the vast agricultural land area available in Argentina (Table 2-6).

With this agricultural production system in Argentina, the soil productivity is gradually deteriorating.

Therefore, in order for Argentina to secure a stable position in the international market as an agricultural product exporting country, it would become necessary to effect investments for the improvement of soil productivity.

In this sense, the potential demand for fertilizer in the country is extremely high.

2.2 Influential Area by the Proposed Project.

2.2.1 General.

The Government of the Province of Neuquén is now plannig to install an ammonia/urea fertilizer plant in the Province, making use of abundant natural gas resources available in the Province in order to supply the product (urea*) to the valleys which are the irrigated area by the rivers, i.e., Río Negro, Río Neuquén, Río Limay, and Río Colorado.
The plant is considered to be located in the Province of Neuquén in view of maximum utilization of natural resources available in the Province and for the industrial development of the Province.
(* Justification is made in Chapter 3).

2.2.2 Physical Location of Neuquén Province.

The city of Neuquén is located 550 Km to the west of Bahía Blanca, which is one of the main international ports in Argentina, and 250 Km to the east of Andes mountains.
The city is connected to Bahía Blanca by a wide gauge railway (1.676 m) which extends to the west of the city until Zapala. Various highways run across the city, among others paved highways connect the city of Neuquén with the cities in the provinces of Mendoza, La Pampa, Buenos Aires (southern parts only), Río Negro, Chubut, and Santa Cruz.

2.2.3 Influential Area by the Project.

Since the product urea being bulky, the transportation of the product should rely on the surface transport such as railway wagons and trucks/lorries on the highways. (River transport might not be feasible due to the rapid current of the rivers.) In view of the product transportation and the physical location of the Province, the influential area (AREA) is set up to be as follows:

The AREA
(Influential Area (Province) by the Project)

- Neuquén
- Río Negro
- La Pampa* (*whole area of province is included in order to compensate the area of Southern Buenos Aires Province which is excluded from the influential area.)

-Mendoza*

-Chubut

-Santa Cruz.

2.3. Agriculture in the Influential Area (AREA).

2.3.1 General.

In view of annual precipitation, the land of Argentina can be classified into dry zone and wet zone (Figure 2-1). The major part of the AREA (influential area) lies in the dry zone; however, the agricultural activities in the AREA are dependant upon the irrigation water made available from the rivers, i.e., Río Colorado, Río Neuquén, Río Limay, and Río Negro. Thus, the AREA forms one of the most important agricultural areas specialized in the intensive cultivation in Argentina.

2.3.2 Cultivated Area by Each Crop in the AREA.

(Detailed information is attached as Appendix 4).

Among the AREA, the provinces of Neuquén, Río Negro, and Mendoza are mainly occupied (approximately 70% of cultivated area) by fruits, i.e., apples and pears for Neuquén and Río Negro, and grapes for Mendoza.

On the other hand, La Pampa is under extensive cultivation for grains and pastures.

Thus, the AREA has 4.1 million hectars of cultivated area, in which 58.3% for grains, 31.9% for pastures, 8.4% for fruits, and 0.9% for vegetables (Table 2-7).

2.4. Fertilizer Consumption in the AREA.

2.4.1 General.

In parallel with the past trend of fertilizer (especially nitrogen fertilizer) consumption of Argentina as a whole, the consumption in the AREA also remains stagnant growth.

Table 2-8 shows the past trend of nitrogen fertilizer consumption in Andina and Patagonia region, which is not exactly the same as the AREA however, it reflects almost directly the tendency of the AREA. From Table 2-8 and Appendix 4, it is calculated that, even at a peak consumption period, i.e., 1972/73, Andina and Patagonia region only consumed 20 kg of nitrogen per hectar of cultivated area (or 43 kg/ha of urea), although these regions covered by the intensive crops of fruits.

In this paragraph, analysis shall be made for the constraints which limited the growth of fertilizer consumption in the AREA.

2.4.2 Major Constraints for the Fertilizer Consumption in General.

Generally constraints for the fertilizer consumption are refered to the following factors.

a. Economic factors

i. fertilizer price.

ii. agricultural product price.

iii. crop response to fertilizer dosage
(This factor is mainly influenced by the characteristic of soil, rain fall, sun-shine, irrigation, and crop variety).

iv. value/cost ratio (price ratio between the increment of agricultural product and input).

b. Systematic factors

i. availability of fertilizer where and when needed.

ii. established system of agricultural product marketing and distribution.

iii. agricultural extention services
(To give the farmers the knowledge of fertilizers).

iv. agricultural credit system.

v. land ownership.

2.4.3 Analysis of the Past Fertilizer Consumption in the AREA.

1) General.

Figure 2-2 shows indicative (since there is time gap among data) trend of fertilizer consumption in the AREA versus trend of major factors in the constraints.

It should be noted from Figure 2-2 that the peak consumption in the AREA was recorded before oil crisis, when nitrogen fertilizers were excessively available with extraordinary low price in the world. And local production of urea by PETROSUR commenced in this period. Consequently, the urea price in the AREA recorded the lowest and availability was the highest. Another point in Figure 2-2 is that the big difference between the C.I.F. and the farmer's gate price of urea. In the following section this difference shall be analyzed.

2) Analysis of farmer's gate price of urea in the AREA.

a. Farmer's gate price of urea.

According to a distributor in the AREA, the price of urea at farmer's gate is quated to be as follows:
(Price as of March 1980).

Domestic produced urea:	348	$/ton.
Imported urea :	387	$/ton.

These are the prices on cash on delivery basis; however, with credit basis, imported urea price becomes as follows:

30 days' credit:	416	$/ton.
60 days' credit:	447	$/ton.

On the other hand, international market price of urea at the end of 1979 was approximately 180 to 190 $/ton C.I.F. at he port of major importing countries.

Comparison of these figures leads to the conclusion that farmers in the AREA have to buy very expensive urea.

Thus the consumption of urea in the AREA has been stagnant.

b. Transportation cost of urea.

According to the tariff of transportation, followings are the quated

cost for the transportation of cargo from Buenos Aires and Bahía Blanca, which are the major ports of entry to the city of Neuquén.

i. Trucks (including insurance charges)

- Buenos Aires to Neuquén 60 $/ton.
- Bahía Blanca to Neuquén 45 $/ton.

ii. Rail way

- Buenos Aires to Neuquén 19.4 $/ton.
- Bahía Blanca to Neuquén 33.9 $/ton.

However, as far as truck tariff is concerned, the AREA is producing approximately one million tons of fruits and other agricultural products, which are being transported mainly by trucks down to Buenos Aires and Bahía Blanca. Those trucks down to Buenos Aires province will come to the AREA with practically empty cargo. Taking advantage of this empty cargo, fertilizer distributors are transporting urea with the cost of approximately 35 $/ton from Buenos Aires to Neuquén.

c. Charges and handling cost of urea at Buenos Aires port.

According to recent date (end of 1979), those charges and costs are estimated to be as follows.

F.O.B. price	: 155	$/ton.
Freight	: 30	$/ton.
Charges and Handling Cost	: 99.9	$/ton.
Ex-Port Go-Down	: 284.9	$/ton.

d. The analysis.

As has been analyzed in the foregoing sections, the farmers' gate price of urea is extraordinary high.

The major causes of the expensive price are analyzed to be:

- high charges and handling cost at the port of entry
- high margins of importers and distributors
- high financial charges.

Therefore, if the Project is implemented and the resultant production cost is reasonable level, this price constraint will be removed to increase the consumption of urea, in addition to the benefit of the Project implementation for the timely availability of urea to the farmers.

2.5 Demand Projection of Urea in the AREA.

2.5.1 General.

The demand projection shall be made in this paragraph based on the following formula:

Urea demand= (Cultivated area x Ratio of fertilized area) x
(Optimum dosage x Ratio of actual dosage)

This formula is applied for each of the four major crops in the AREA, those are:

- Grains

  including wheat, rye, barleys, oats, maize, sorghum, sunflower, millets, etc.

- Fruits

  including apples, pears, peaches, grapes, etc.

- Vegetables

  including vegetables, tomato, potato, etc.

- Pastures

  including alfalfa, pastures, sudan grass, etc.

The cultivated area in the AREA in 1980 is estimated to be as shown in Table 2-7, based on the data compiled by Mr. Carlos Zárate (Appendix 4) According to Table 2-7, only the province of La Pampa in the AREA is cultivated with the extensive crops such as the grains and the pastures; other provinces in the AREA are mainly cultivated by the intensive crops such as fruits and vegetables. In view of availability of agricultural water, La Pampa is mainly relying on the natural rain and the other provinces are relying on the irrigated water.

On the basis of above mentioned formula, the demand of urea in the AREA shall be projected for the year of 1985, the preliminary target of commencement of production by the Project, and 1990.

2.5.2 Cultivated Area.

The government of Republic of Argentina has a plan to expand its irrigated area utilizing abundant water resources, among other provinces, the provinces in the Project AREA will be made available the irrigated land with figures shown in Table 2-9. Although the land will be made available in the year

of 1982 as shown in the table, it will take some time for farmers to settle in the new land before the land starts agricultural production. In view of these factors, the new area in Table 2-9 is projected to commence its agricultural production in the year of 1985 and the possible area in the table is projected to commence in 1990.

As for the alocation of the new land for the crops, the past trend of the cultivation as shown in Appendix 4, and the opinion of the local development authorities are taken into account to project future cultivated area for each crop as shown in Table 2-11.

2.5.3 Fertilized Area and Dosage.

In view of the fact that, after the Project is implemented and starts its production, urea will be made available to the farmers in the AREA with far less price than presently prevailing price and at the time of necessity with sufficient quantity, the fertilized area ratio and dosage ratio with the optimum dosage are forecasted in Table 2-10. Those ratio are drawn in due consideration of the ratio for 1980, which is estimated on the basis of discussions with INTA people and other articles (Appendix 5) and is quite fit to the peak consumption in the past when the price of urea is not expensive but the availability is limited.

As for the optimum dosage (recommended dosage), the following figures are taken with reference to the opinion of INTA and other articles listed in Appendix 5).

Crops	Optimum dosage	
	Nutrient N kg/ha	Urea kg/ha
Grains	80	174
Fruits	100	217
Vegetables	80	174
Pastures	10	20

2.5.4 Demand Projection of Urea in the AREA.

On the basis of above projected figures and the following formula, the demand of urea in the AREA is forecast as follows: (Table 2-11 and Figure 2-3)

Year	Forecast demand (urea t/y)
1985	77,930
1990	147,490

Table 2-1.

GROSS DOMESTIC PRODUCTS

(Argentina)

(Unit: MMpeso at 1960 price)

Year	1973	1974	1975	1976	1977
Agric.,Livestock,Forests & Fishing	1,979.2	2,101.6	2,029.0	2,099.0	2,238.2
Mining & Quarries	253.0	260.4	248.5	253.3	279.8
Manufacturing Ind.	6,151.6	6,326.0	6,324.9	6,058.9	6,313.7
Electricity, Gas & Water Works	413.2	440.0	468.1	484.2	508.0
Construction	649.0	728.3	658.6	585.3	643.6
Commerce, Hotels & Restaurants	2,843.3	3,122.9	3,081.2	2,898.4	3,088.3
Transport. & Communication	1,189.5	1,241.3	1,213.1	1,165.2	1,235.4
Finance, Insurence & Real Estate	563.7	595.4	634.5	657.0	653.2
Government & Other Services	2,147.4	2,228.1	2,337.0	2,342.2	2,333.6
G. D. P.	16,189.9	17,244.6	17,017.9	16,523.9	17,297.8

(Source: FIEL= Fundación de Investigaciones Económicas Latinoamericanas).

Table 2-2.

CHANGE IN INDUSTRIAL STRUCTURE

(Argentine 1925/1977)

(Unit: %)

I. COMPOSITION OF GROSS DOMESTIC PRODUCT

Industrial Sector	1925 / 29 Avg.	1945 / 49 Avg.	1965 / 69 Avg.	1977
Agriculture	27.0	21.1	15.0	12.9
Manufacturing	23.8	30.3	34.2	36.5
Mining & Construction	2.1	2.2	2.6	5.3
Services	47.1	46.4	48.2	45.3

II. SECTORIAL DISTRIBUTION OF POPULATION

Industrial Sector	1925 / 29 Avg.	1945 / 49 Avg.	1965 / 69 Avg.	1970
Agriculture	35.9	26.0	16.8	14.8
Manufacturing	20.8	23.9	24.2	19.7
Mining & Construction	4.3	5.3	7.0	8.4
Services	38.4	44.8	52.0	57.1

III. COMPOSITION OF EXPORT

Industrial Sector	1925 / 29 Avg.	1945 / 49 Avg.	1965 / 69 Avg.
Agricultural Products	96.1	90.0	38.7
Forestry Products	2.3	2.2	1.0
Others	1.6	7.8	11.3

(Source: Argentina Economía y Social, DECEI-1978)

Table 2-3

TRADE STATISTICS

(Argentina)

(Unit: MMUS$)

Year	1973	1974	1975	1976	1977
EXPORT					
Agricultural Products *	2,166.6	2,605.2	1,963.2	2,517.5	3,549.5
Chemicals, Plastics & Rubber Products	243.1	356.3	214.3	319.4	548.3
Hides, Skins, Wool etc	387.2	302.8	249.8	447.1	717.0
Metals, Machineries, Equipment etc	401.0	559.3	468.8	549.2	622.7
Others	68.3	106.5	59.3	32.9	213.7
TOTAL EXPORT	3,266.2	3,930.7	2,961.3	3,816.1	5,651.3
IMPORT					
Minerals	211.5	607.0	637.1	650.6	809.5
Chemicals, Plastics & Rubber Products	373.6	812.1	804.3	845.0	738.9
Wood & Cellulose Products	172.3	303.1	301.0	175.5	211.7
Metals, Machineries, Equipment, etc.	1,196.4	1,603.4	1,383.3	1,311.7	2,073.6
Others	281.5	309.3	320.3	250.2	334.6
TOTAL IMPORT	2,235.3	3,634.9	3,946.6	3,033.0	4,163.3

* Agricultural products incldg livestocks and forestry products

(Source: Made from FIEL)

Table: 2-4

SUPPLY OF NITROGEN FERTILIZER (ARGENTINE)

Year	72/73	73/74	74/75	75/76	76/77	77/78
LOCAL PRODUCTION						
Anhydrous Ammonia * 2	878	4,068	1,350	2,592		
Ammonium Sulfate * 3	56,821	50,621	37,396	32,947	N. A.	N.A.
Urea * 3	36,330	39,633	22,024	25,467		
IMPORT					* 1	* 1
Ammonium Sulfate	9,934	- - -	3,000	- - -	- - -	- - -
Urea	7,000	10,000	16,130	6,068	20,808	7,358
Ammonium Chloride	150	187	225	65	- - -	- - -
Ammonium Sulfate Nitrate	2,751	5,478	3,876	2,250	2,391	2,394
Sodium Nitrate	14,600	14,268	7,820	8,724	1,690	5,020
Nitric Carbide	- - -	- - -	- - -	1	601	399
Anhydrous Ammonia	2,000	- - -	- - -	- - -	- - -	- - -

* 1. Calender year
* 2. Excluding ammonia used for the production of ammonium sulfate and urea
* 3. Excluding those used for the production of complex fertilizer
N.A.: Not Available

Table: 2-5

PRODUCTION AND CONSUMPTION OF

NITROGEN FERTILIZERS IN ARGENTINA

(1978 / 1979)

(Unit: Tons)

ORIGIN	Urea	Ammonium Sulphate
Production	65,000	39,000
Imports	20,000	- - -
USE		
Wheat	16,000	- - -
Sugar Cane	24,000	4,000
Maize	2,000	- - -
Tea, Tobacco	4,000	- - -
Pastures	- - -	- - -
Potato	1,000	4,000
Horticulture	4,000	6,000
Top Fruits & Grape	5,000	16,000
Citrus	5,000	- - -
Industrial Use	20,000	6,500
Captive Use	1,500	2,000
Export	2,500	500
T O T A L	85,000	39,000

(Source: 17 Oct. 79 PETROSUR)

Table: 2-6

CONSUMPTION OF FERTILIZERS PER HA, OF

ARABLE LAND AND PERMANENT CROPS. IN 1971 AND 1976

(Unit: Kg/ha)

		N	P_2O_5	K	TOTAL
Argentina	1971	1.3	0.7	0.2	2.3
	1976	1.1	0.8	0.1	2.1
Brazil	1971	8.1	13.0	10.2	31.2
	1976	12.4	32.0	18.5	63.0
Chile	1971	9.0	18.1	2.8	29.9
	1976	8.2	8.2	2.3	18.9
Bolivia	1971	1.2	0.4	0.1	1.8
	1976	0.4	0.4	0.0	0.8
Paraguay	1971	1.3	2.0	1.6	4.8
	1976	0.5	0.2	0.2	0.8
Uruguay	1971	10.0	21.0	3.5	34.4
	1976	11.2	19.3	2.4	32.8
S.America	1971	6.2	7.3	4.7	18.2
Average	1976	9.1	14.3	7.9	31.3
Australia	1971	2.1	17.3	1.7	21.7
	1976	4.7	16.4	2.5	23.5
New Zealand	1971	11.9	416.0	139.5	567.4
	1976	23.7	459.4	160.7	643.8
Japan	1971	125.4	122.7	107.2	355.4
	1976	146.8	146.8	137.4	430.5
U. S. A.	1971	38.1	23.1	20.6	81.9
	1976	51.3	27.1	28.1	106.5
Canada	1971	8.0	7.7	4.4	20.1
	1976	13.8	12.1	5.8	31.8
World	1971	22.8	14.4	12.0	49.2
Average	1976	30.3	17.8	15.5	63.6

(Source: FAO "Annual Fertilizer Review, 1977")

Table: 2-7

ESTIMATED CULTIVATED AREA BY CROPS

(1980)

(M ha)

	Neuquén	Mendoza	Río Negro	Chubut	Santa Cruz	La Pampa	Total
Grains	4.5	39.3	10.0	2.3	0.3	2,354.0	2,411.5
Fruits	22.0	258.0	60.0	2.5	0.1	- - -	342.6
Vegetables	1.9	21.5	7.5	6.3	0.65	0.1	37.95
Pastures	3.5	44.0	20.0	28.0	7.0	1,207.0	1,309.5
Province Total	31.9	363.3	97.5	39.1	8.65	3,561.1	4,101.55

Grains	Fruits	Vegetables	Pastures
Wheat	Fruit	Vegetable	Alfalfa
Rye	Grape	Tomato	Pasture
Barleys		Potato	Sudan Grass
Oats			
Maiz			
Sorghum			
Sunflower			
Millet			

(Source: Appendix 4)

Table 2-8

NITROGEN FERTILIZER CONSUMPTION

(ANDINA AND PATAGONIA REGION)

(Unit: t/y)

YEAR	NUTRIENT	UREA EQUIVALENT
66/67	7,054	15,335
67/68	6,546	14,230
68/69	5,097	11,080
69/70	7,041	15,307
70/71	9,036	19,643
71/72	10,924	23,748
72/73	10,961	23,828
73/74	9,041	19,654
74/75	3,728	8,104

Table: 2-9

EXPANSION OF IRRIGATED AREA BY PROVINCES

(Unit: M ha)

Provinces	Irrigated Area (1979)	New Project Area (By 1982) Rehabilitation	New Project	New Area Total	Possible Area	Total Possible Area
Neuquén	31.0	- - -	7.0	38.0	2.8	40.8
Río Negro	134.3	82.6	11.5	228.4	117.8	346.2
Mendoza	348.0	264.9	- - -	612.9	70.0	682.9
Chubut	21.0	20.9	- - -	41.9	68.0	109.9
Santa Cruz	4.0	0.2	1.5	5.7	3.5	9.2
La Pampa	3.5	3.5	5.7	12.7	48.6	61.3

Source: Información Económica de la Argentina, March 1979.

Table 2-10

FERTILIZED AREA AND DOSAGE

(Unit: Ratio)

CROPS	Fertilized Area Ratio			Dosage Ratio			Recommended Dosage kg/Ha
	1980	1985	1990	1980	1985	1990	Urea
Grains	0.01	0.10	0.20	0.10	0.30	0.50	174
Fruits	0.60	0.80	0.90	0.50	0.80	0.90	217
Vegetables	0.30	0.70	0.80	0.50	0.70	0.80	174
Pastures	0.01	0.015	0.02	0.01	0.01	0.01	20

Table: 2-11

DEMAND FORECAST OF UREA

	1980 AREA (Mha)	1980 Dosage (kg/ha)	1985 AREA (Mha)	1985 Dosage (kg/ha)	1990 AREA (Mha)	1990 Dosage (kg/ha)
Grains	2,411.5	0.17	2,484.5	5.22	2,516.0	17.4
	(410)		(12,969)		(43,778)	
Fruits	342.6	65.10	415.6	138.88	514.0	175.77
	(22,303)		(57,719)		(90,346)	
Vegetables	39.15	26.10	84.9	85.26	120.0	111.36
	(1,022)		(7,239)		(13,363)	
Pastures	1,304.0	0.002	1,511.9	0.003	1,621.4	0.004
	(3)		(5)		(6)	
TOTAL DEMAND (t/y)	23,738		77,932		147,493	

Note:

AREA= Cultivated area in the AREA
DOSAGE = kg/ha of Urea
DEMAND= t/y of Urea in Parentheses

Figure 2-1.

ANNUAL PRECIPITATION
IN ARGENTINA

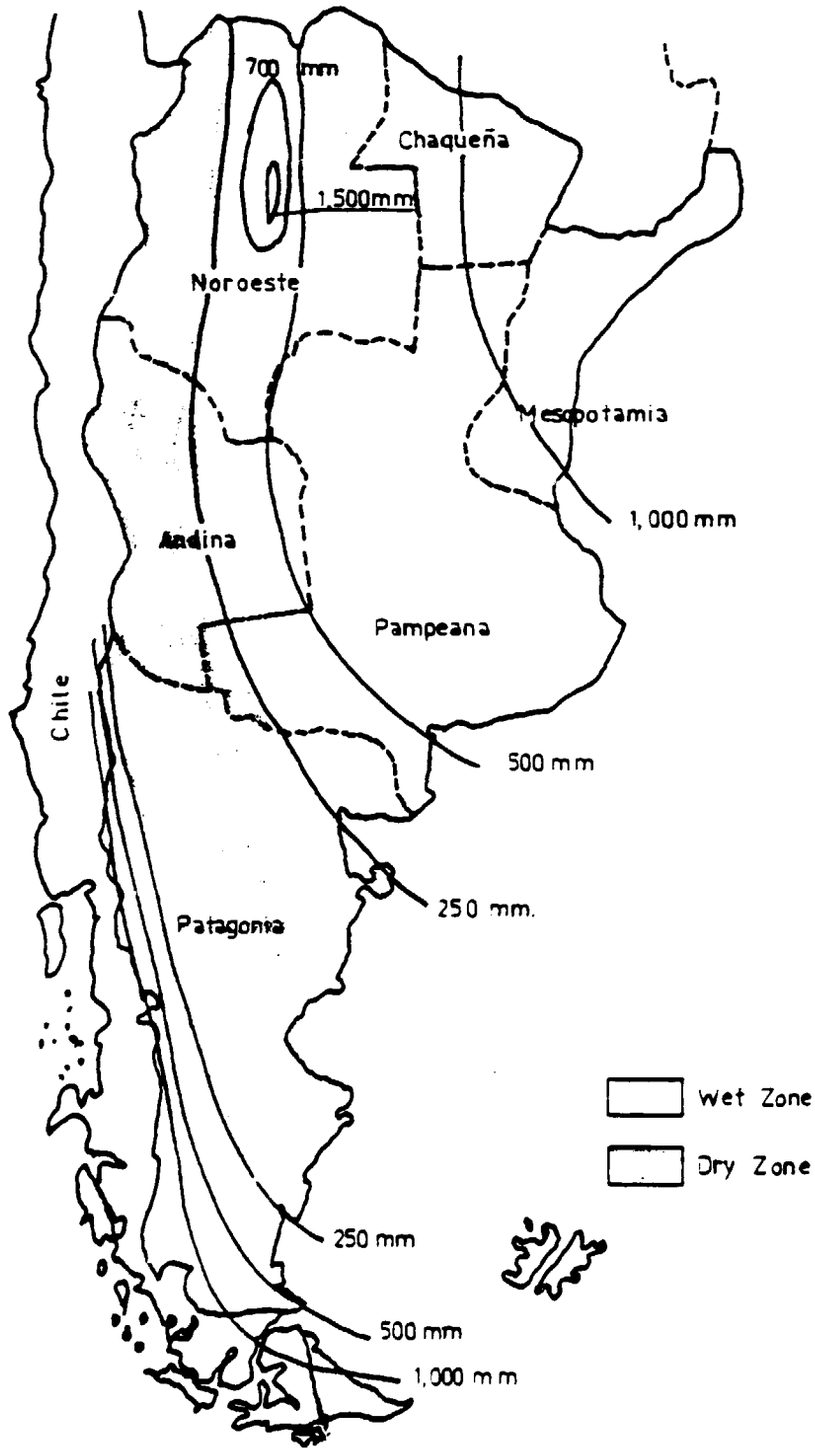
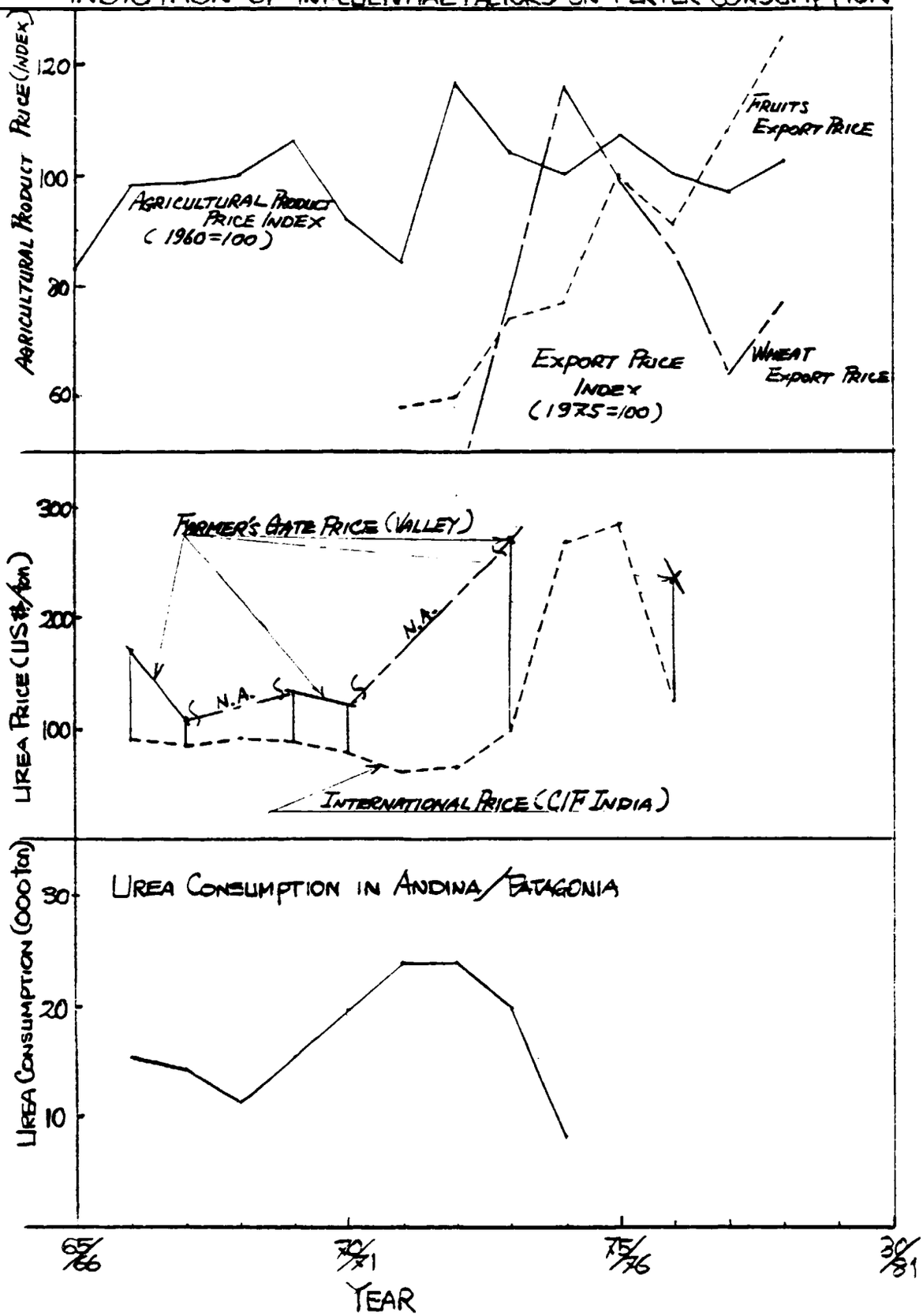


Figure 2-2.

INDICATION OF INFLUENTIAL FACTORS ON FERTER CONSUMPTION



Note: N.A. = Not Available

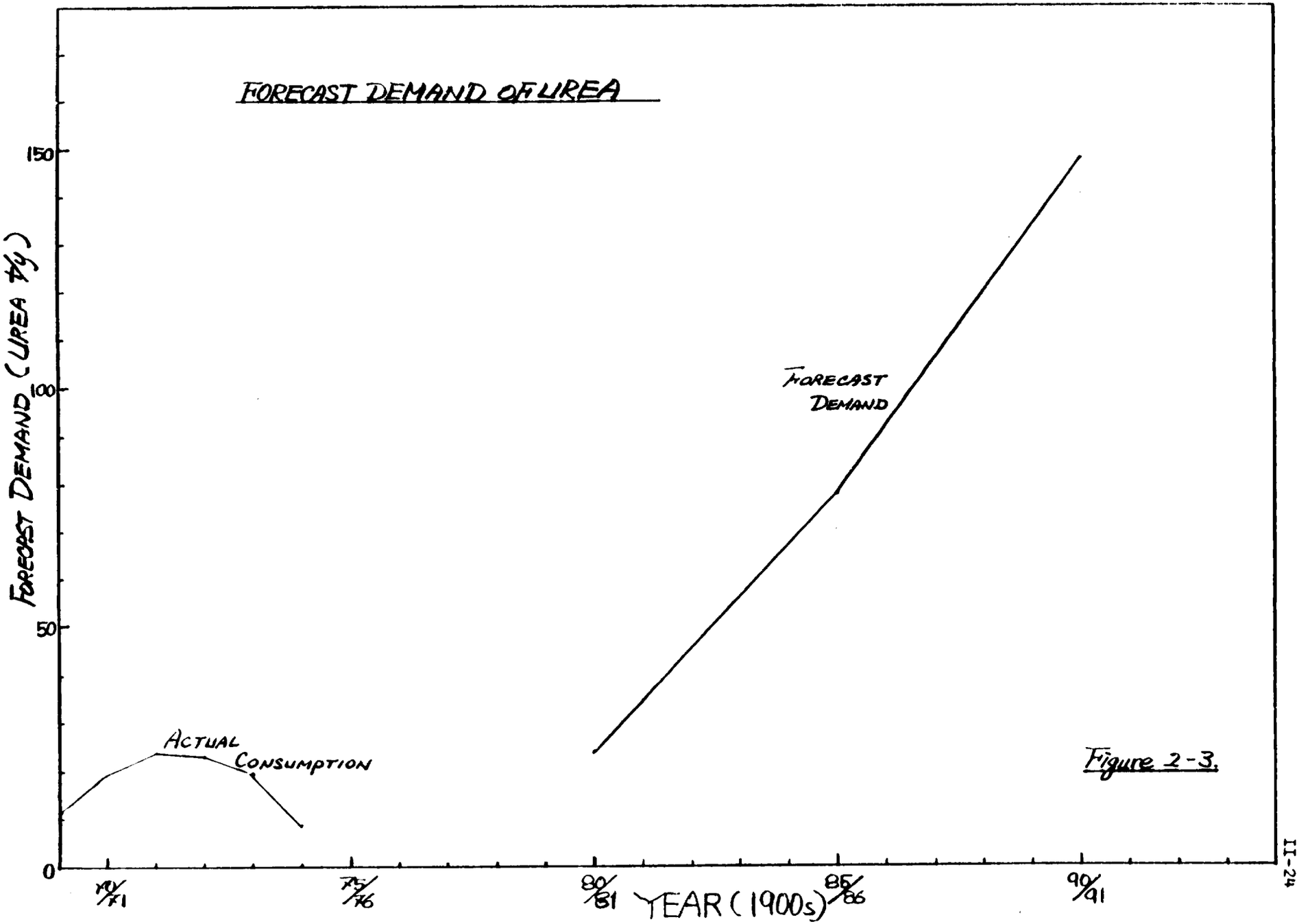

FORECAST DEMAND OF UREA
FORECAST DEMAND (UREA Mty)
150
100
50
0
ACTUAL CONSUMPTION
FORECAST DEMAND
70/71
75/76
80/81
85/86
90/91
YEAR (1900s)

Figure 2-3.

Chapter 3. TECHNICAL ASPECT.

3.1 General.

Technical aspect in the project comprises such studies as:

-production capacity study

-natural gas study

-utilities study

-site location study.

The resultant study for above defines the project scope by which the investment cost for the project shall be estimated.

3.2 Production Capacity Study.

3.2.1 Product identification.

With the natural gas as raw material, for the production of nitrogen fertilizer, one must go through the production of ammonia by-producing carbon dioxide.

The ammonia is to be fixed as solid status, unless liquid ammonia directly applied to the soil with expensive apparatus, for the economic application of fertilizer.

In order to fix ammonia as solid status, there are, among others, three ways, i.e.:

i. To produce urea by combining ammonia with by-produced carbon dioxide.

ii. To produce ammonium sulfate by combining ammonia with sulfuric acid.
   - in this process, another raw material, sulfur, is required to produce sulfuric acid, thus the total process plant facilities are ammonia plant, sulfuric acid plant, and ammonium sulfate plant.

iii. To produce ammonium nitrate by combining ammonia with nitric acid which is also produced from ammonia.
   - in this process, the total plant facilitated are ammonia plant, nitric acid plant, and ammonium nitrate plant.

Among three alternatives discussed above, urea route is identified to be the simplest in the technic, and the cheapest in the economics.

In addition to these aspects, urea contains highest nutrient nitrogen (46% minimum) among three products.

Agronomically, for the crops grown in the AREA, there is no difference in the response of soils among three fertilizers.

Under these circumstances, the product from the Project is identified to be urea.

3.2.2 Identification of production capacity.

The market study concluded that the project demand of urea in 1985 is 78,000 t/y. On the basis of the operating days per year of 330, this is the capacity of urea plant of 240 t/d (ammonia 145 t/d). Under approximate of this capacity, there is no break even capacity in view of technoeconomics, such as 600 t/d of ammonia plant is break even capacity for the employment of centrifugal compressors. Therefore, the capacity of the Project should be bigger the better in accordance with the economics of scale. However, the market for the Project is limited as discussed in the foregoing Chapter, at least, no possibility to export due to the physical location of the Project, and the Project is capital intensive, so that the lower capacity utilization will result in the higher production cost. (Chapter 4)
Under these circumstances, the production capacity should be set up as per the curves for the demand forecast (Figure 2-3).
In order to set up the capacity, following capacity utilization rate for beginning years shall be based in view of the difficulties of technology transfer:

1st year	60%
2nd year	75%
3rd year	90%

Therefore, the production capacity of the Project is identified to be as follows.

Urea production capacity:

$$\frac{78,000}{330 \times 0.6} \fallingdotseq 400 \text{ t/d} = 132,000 \text{ t/y.}$$

Ammonia production capacity:

$$400 \times 0.59 \fallingdotseq 240 \text{ t/d.}$$

3.3. Natural Gas Study.

3.3.1 Availability of natural gas in Neuquén basin.

The Province of Neuquén occupies 36% of natural gas reserves and 34% of natural gas production in Argentina (Table 3-1). The Province is the largest producer of natural gas in the country and, with the largest reserves, remains so for some decades to come. (Total Reserve in the basin = Approximately 340,000 MMm^3).

At present, the produced gas is being sent to the coastal area through the following pipe-lines for the industrial and domestic energy uses in Buenos Aires and Bahía Blanca areas.

Pipe-lines	Neuquén-Bahía Blanca	Plaza Huincul-Conesa
Rated Capacity (Mm^3/d)	8,500	500
Pipe size (inches)	24	8
Length (km)	570	460

In addition to these existing pipe-lines, the government of Argentina is under construction of a pipe-line (center-west) to transport the natural gas from the Neuquén basin to the provinces of Mendoza, San Juan, San Luis, Córdoba and Santa Fe through a 30 inches pipe-line with the supplying capacity of 10 MMm^3/d.

There is a plan to lay a pipe-line from Neuquén basin to San Carlos de Bariloche. However, the plan is not concrete yet.

As for local consumption in the Province, an ammount of approximately 250 Mm^3/d is utilized, in which 230 Mm^3 for industrial use, and 20 Mm^3 for domestic use.

Taking 25 MMm^3/d (= 8.5 + 0.5 + 10.0 + new plans and local use) as gas demand for the Neuquén basin, the required gas reserve volume should be 180,000 MMm^3 for 20 years supply.

Thus, two figures are compared:

Total Gas Reserves in the Neuquén basin

340,000 MMm^3

Preliminary Gas Demand for 20 years

180,000 MMm^3

Therefore, the availability of gas in the Province of Neuquén is qualitatively confirmed.

3.3.2 Availability of natural gas for the Project.

In the Neuquén basin, there are two natural gas resources, i.e., associated gas and non-associated gas. However, associated gas is being produced from small oil wells, except some big reserves, with the average production capacity of 14 $m^3/d/well$ of oil, and the produced gas has low pressure near to the atmospheric..
Therefore, the Project is unable to depend upon these resources without excessive investment for the facilities of collection and compression.

As for non-associated gas, there are two fundamental classifications of gas fields in the Neuquén basin, those are the fields of dry gas (gas contains mainly methane) and the fields of wet gas (gas contains heavier hydrocarbons than methane).
The dry gas fields lie in Plaza Huincul and Cutral-Có area, and the wet gas fields are in the vicinity of Centenario (Figure 3-1).

Although all these fields are interconnected each other by pipe-lines, the wet gas is being allocated for Liquefied Petroleum Gas (LPG) and Petrochemical production, and the residual gas for the pipe-lines described in the foregoing paragraph. The dry gas is being primarily allocated for local use including fertilizer production.

Among other dry gas fields, Sierra Barrosa field will be especially allocated for the local use and for the fertilizer production, according to Y.P.F. in Plaza Huincul.
The Sierra Barrosa field has the following specifications:

Original Reserve: 15,000 MMm^3

Present Reserve : 4,600 MMm^3
(This reserve remains as it is now, until the proper allocation is identified

Available at : Either at the well head or through existing

pipe-lines.

(i.e., gas from this field is made available either Plaza Huincul or Centenario through existing pipe-lines).

Composition of Gas: Shown in Table 3-2 as a typical example. (Source: Y.P.F.).

There are many fluctuating factors to decide the exact gas field on which the Project should rely, because it takes a few years before the Project is implemented.

Under these circumstances, this report will hypothetically set Sierra Barrosa field as natural gas source for the Project.

The gas will be made available for the Project, either branching from the existing pipe-lines or taking directly from the well head.

3.4. Utilities Study.

3.4.1 General.

Utilities required for the Project are industrial water and electric power. The Project will consume(at the production capacity set up in the foregoing paragraph) 240 t/h of water and 13,000 kwh/h of electric power. In this paragraph, availability of these utilities shall be discussed.

3.4.2 Availability of water.

The Province of Neuquén, especially in view of the implementation of fertilizer plant project (the Project), is located in the valley formulated by two rivers, i.e., Río Limay and Río Neuquén. The flow rates of these rivers are regulated by recently built dams, and the average minimum flow rates for the two rivers are controlled to be 600 m^3/sec for Río Limay and 450 m^3/sec for Río Neuquén. And from these rivers, water is taken for irrigation purpose and is distributed by the networks of canals. The industrial water can be taken from either of these rivers, or from the irrigation canals, at any point as per the standard practice employed by the provincial authority (Provincial Direction of Water and Energy).

However, in Plaza Huincul and Cutral-Có area, there is a 600 mm diameter water pipe-line (proposed capacity of 6,000 m^3/h) connected with the river Río Neuquén, although the water treatment plant is yet to be installed for the appropiate use of the pipe-line.

3.4.3 Availability of electric power.

In the Province, there are three major hydroelectric power plants which are generating the power for the Buenos Aires metropolitan area, as well as for the local consumption. These plants are:

Name of ... plant	Generating Capacity (MW)
El Chocón	1,200.
Arroyito	120.
Banderita	450.

From these plants, the power is transmitted through the 500 kw lines for the metropolitan area and the 132 kw for the local consumption (Figure 3-2). The 132 kw line is further decreased the tension for domestic (220 v) and

industrial (13,000 v) uses. However, the big user of the power like a fertilizer project has to rely on the highest tention available (i.e., 132 kv line) in view of usage and reliability.

For the plant capacity as the Project, reliability of the power is the most crucial.

The quality of power for a fertilizer plant is generally specified to be as follows:

i. Voltage fluctuation: within $\pm$ 5% of rated voltage.
ii. Cycle fluctuation : not more than 0.5 Hz.
iii. Power failure : not more than 2-3 times a year.

As for the reliability of the power available in the Province, especially 132 kv line, there are no definitive data in order to judge the reliability. However, the Plaza Huincul refinery is dependant upon the power from the 132 kv line and, when visiting the plant, the major pumps in the refinery have been run by steam turbines. Although there are two major reasons to run the pumps by steam turbines, those are plant economics and the reliability. On the other hand, industrialists in the Province reported two to three times-a-month's frequency of power failure on the 13,000 v line which is connected with the 132 kv line. This fact may lead to the conclusion that the 132 kv line will be affected by the lower tention lines failure as the voltage dip or the change in the frequency of the power in 132 kv line, because the major users of the 132 kv line are, at present, those industrialists using the decreased tention at 13,000 v.

Under these circumstances, the Project is better installed with a thermal power plant within the scope of the Project.

3.5. Site Location Study.

3.5.1 General.

In this paragraph, firstly, the requirement of plant site for the Project shall be defined as the site selection criteria. Then, overviewing the physical and infrastructure conditions in the Province, two alternative sites are selected for further comparison using the above established criteria.

Thirdly, basic design criteria will be presented for the candidate site. However, the selected site is not definite one, but it is only an identified area, i.e., in the vicinity of the township, etc.

3.5.2 Site selection criteria.

The Project is to produce urea as final product using natural gas as feed stock and fuel, and water for process use and utilities. The final product, urea, is to be transported down to the market through the railway and the highway.

Under this project scheme, the selection site must have the specification which is to fulfill the following selection criteria.

CRITERIA FOR THE SELECTION OF THE PLANT SITE

1. Proximity to the feed stock natural gas.
   - length of gas pipe-line.
   - reserve volume and deliverability of source well(s).
2. Proximity to water resources.
   - length of water pipe-line.
   - necessity of water intake facilities.
   - quality of water.
3. Proximity to the product market.
   - access to the railway
     (Is the railway siding required).
   - access to the highway
     (Is the access road required).
4. Physical conditions of the candidate sites.
   - soil bearing capacity.
   - climatic conditions.

- earthquake factor.
- drainage.

5. Incentives / Promotion Law.
   - Tax and duties.
   - Land cost.
   - Depreciation, etc.

Among above listed criteria, 4. and 5. are not applicable so far as the site is selected in the eastern part of the Province (area called Confluencia).

3.5.3 Selection of candidate sites.

In view of 1., 2. and 3. of the criteria and Figure 3-2, two alternative sites are selected for further investigation; those are:
Site 1: Cutral-Có / Plaza Huincul area.
Site 2: Senillosa area.

3.5.4 Comparison of candidate sites.

Two candidate sites are compared in Table 3-3, based on the criteria set up in the foregoing section.
There are two basic stand points to assess the site comparison, those are the one to minimize the ex-factory production cost, and the other to minimize the farmer's gate price of urea.
Analyzing Table 3-3, it is sure that the ex-factory cost is lower in Site 1 (Cutral-Có / Plaza Huincul area). However, in view of the farmer's gate price of the product, Site 2 is more advantageous than Site 1. Because the transportation cost of the total product urea for 80 km (the difference of the distance to the product market between the two sites) will be more than the transmission costs of natural gas for 10 km.
As it has been discussed in Chapter 2. (Market Aspect), one of the most crucial factors for the Project is to minimize the price of the product urea at farmer's gate.

Thus, the plant is identified to be better located in the vicinity of Senillosa.

3.5.5 Basic design condition of the selected site.

There are no industrial plants comparable to the fertilizer plant project

in the Province; therefore, no complete data for design condition are available for the Project.

Table 3-4 is provided by the climatic condition for Cipolletti, which is about 30 km to the east of Senillosa and by the soil condition for the Plaza Huincul refinery, which is located about 80 km to the west of Senillosa.

3.6. Scope of the Project.

3.6.1 General.

In this paragraph, facilities required for the Project are defined as the scope of the Project.

Facilities are divided into the following three categories:

i. Process plants.

ii. Utilities plants.

iii. Offsite facilities.

3.6.2 Process plants.

The proposed Project is to manufacture ammonia and prilled urea. The process plants will consist of 240 t/d ammonia and 400 t/d urea plants. (The annual production capacity corresponds to 132,000 t/y of urea on the basis of 330 annual on-stream days).

The ammonia will be manufactured by one of the commercialy proven steam reforming processes. (Evaluation of processes for the production of ammonia and urea is considered to be too early to be made at this stage of the Project).

Natural gas will be the feed stock and fuel.

The ammonia produced will be entirely converted into urea through chemical reaction with carbon dioxide gas through one of typical total recycle processes. The carbon dioxide will be produced as required by the removal of carbon dioxide in ammonia synthesis gas. Prilled urea will be the only final product to be turned out by the Project.

The raw material and utilities consumption figure of these process plants are hypothetically set as shown in Table 3-5.

3.6.3 Utilities plants.

a. Electric power.

The required electric power for the operation of the plant will be supplied by gas turbine power plant to be built in side the battery limit of the Project, and in order to cope with emergencies, small power generators will also be installed.

b. Water.

The total volume of the necessary raw water will be taken from an irrigation canal and used as cooling water, process water, boiler feed water, potable water, fire-fighting water, etc., after going through adequate treatment to control the water quality.

c.Steam.

In addition to a water heat boiler to be installed inside the ammonia plant, an auxiliary boiler will be built for starting up the ammonia plant and for the operation of the urea plant.

d.Natural gas receiving unit.

Natural gas is required for the production of ammonia as feed stock, as well as fuel, for the production of steam, and for the generation of power. Natural gas, thus required, should be taken from the existing pipe-line (8" inches) at the Project cost to lay intake pipe-line and to install metering devices.

e.Instrument and plant air facilities.

In view of economy and eases of operation, it is assumed that the air-type instrumentation system will be adopted. An air system will be designed for both instrument and plant air.

3.6.4 Offsite facilities.

a.Treatment of air and water effluents.

As the natural gas produced in the Neuquén basin is sulfur free, no special facilities will be installed for the prevention of air pollution. The effluent water will be disposed of in the river (Río Limay) after passing through the sedimentation of suspended solids and a neutralization process.

b.Shipment of product urea.

As it will be discussed in the later Chapter, the Project is to sell the product urea to the distributors at the factory gate. And the plant will be built in the vicinity of the product market, so that conventional methods may be employed for the distribution of urea to farmers, such as with one ton or 500 kg bags, instead of with 50 kg. bags. Because the farmers

in the AREA are well facilitated with the equipment for handling these sizes of cargo.

In view of possibility to employ these larger sized bags (one ton or 500 kg), which are considered to be durable for a year or so, the Project is assumed not to include the cost of bag materials, however, which is to be borne by the distributors.

As for the transportation of urea, the product will be shipped out from the plant by road trucks or the railroad lorries, so that the Project should include the loading facilities of urea to the lorries and/or the trucks; however, the Project will **exclude those facilities as the lorries,** the trucks, and intermediate warehouses from the scope.

c. Ammonia reservoir.

The ammonia plant and the urea plant are mutually integrated, and the produced ammonia will be totally converted into urea without carrying out any external sale of ammonia as such. Thus, the capacity of intermediate reservoir for ammonia may be the bare minimum.

d. Product urea storage.

The maximum capacity of the storage house shall be 60 days worth of production in the form of bulk urea.

The storage house shall be facilitated with two units of bagging machines for one ton and/or 500 kg bags.

e. Maintenance and repair shop.

The maintenance and repair shop will have sufficient facilities and systems to enable operation 330 days/year at the design capacity of the production facilities without relying on outside shop except in cases of serious mechanical break down. The maintenance and repair shop will consist of a mechanical workshop, and various inspection facilities.

f. Laboratory.

A laboratory will be established in which facilities, apparatus necessary for process control, for analysis of raw materials and auxiliary materials and for trouble shootings, shall be included.

The facilities will also include analyzing devices such as gas chromatography equipment.

g. Warehouse for chemical and spare parts.

It is assumed that two years' supply of spare parts, one year's supply of chemicals, and catalysts to accomodate one charge will be constantly kept on hand, and a warehouse necessary for storing these items will be included in the Project scope.

h. Buildings.

Buildings for the following purposes are provided in the scope of the Project with appropiate facilities and equipment.

- Administration office.
- Control room.
- Lockers and shower rooms.
- Cafeteria.
- First aid room.
- Gate and gate houses.
- Fire-fighting facilities.

i. Housing colony.

The Project has to rely on the engineers and skilled labor for the efficient management of the plant. However, all of these experts may not be available from the AREA, so that the housing colony, for 50% of the employees of the proposed organization (Table 3-6) should be provided by the Project for the accomodation of the experts from other parts of the country.

3.7. Technical Requirements and Preliminary Implementation of the Project.

3.7.1 General.

As per the scope of the Project defined above, technical requirements such as raw materials and utilities requirement by the Project will be estimated and the staffing and organization of the Project will be preliminarily established. Thereafter, the preliminary implementation schedule will be drawn for the Project.

3.7.2 Technical requirements.

The overall material balance is illustrated in Figure 3-3.

3.7.3 Preliminary organization of the Project.

The overall staffing schedule is preliminarily estimated as shown in Table 3-6. The schedule is drawn on the basis of following conditions.

i. direct operationla forces.
   - plant operation.
   - maintenance and repair.

ii. indirect forces.
   - personnel control.
   - accounting control.
   - administration control.

However, the marketing and distribution of the product urea is considered to be handled by external forces, such as private distributors, etc., therefore, only the delivery control personnel are included in the staffing schedule.

3.7.4 Tentative timetable of the Project implementation.

At present, no particular project execution agency exists, therefore in the timetable (Figure 3-4) a period of one year is provided for the investors' and/or financers' investigation of the project.
After the proper project owner is identified, the plant construction schedule including the work pertaining to the selection of a contractor is greatly affected by the selection of the method of procuring equipment and materials, and the mode and nature of the contracts to be concluded pertaining to the construction.

For the construction of the Project, in view of the size of plant and nature of the Project, it is recommended that the Project should be implemented by a prime contractor on the basis of the lump-sum turn-key contract basis.

Figure 3-4 is a tentative project schedule formulated on the basis of this concept.

Table: 3-1

NATURAL GAS RESERVES AND

PRODUCTION IN ARGENTINA

Province	Reserves (MMm^3)		Production (Mm^3/d)	
Neuquén *	89,210	(36)	9,182	(64)
Santa Cruz	74,542	(30)	4,326	(39)
Río Negro	27,924	(11)	- - -	
Chubut	5,428	(2)	- - -	
Mendoza	3,594	(1.5)	42	(0.3)
La Pampa	- - -		763	(5)
ARGENTINA	246,176	(100)	1 4,313	(100)
DATA	As of Dec. 1978		As of Jun. 1979	

* In addition to figure above, new gas field was found.

i.e., Name of field	Estimated Reserve
Loma de la Lata	250,000 MMm3

(Source: Y.P.F.)

Table: 3-2

A TYPICAL GAS COMPOSITION

(Sierra Barrosa Field)

(Unit: mol.%)

	Data 1	Data 2	
N_2	1.59	0.57	
CO_2	0.51	1.30	
C_1	92.62	96.56	
C_2	3.29	1.19	
C_3	1.29	0.24	
iC_4	0.23	0.03	
nC_4	0.29	0.06	
iC_5	0.09	0.02	
nC_5	0.09	0.01	
C_6^+	0.03	0.02	
Sp.Gr.	0.6056	0.5795	
N.H.V.	9379	8992	($kcal/m^3$)

Table 3-3.

COMPARISON TABLE OF TWO CANDIDATE SITES

CRITERIA	Site 1 Cutral Co / Plaza Huincle	Site 2 Benillosa
1. Proximity to Natural Gas		
1.1. Length of Pipe Line req'd	- within 5 Km to gathering lines and/or 8" existing lines	- 10 Km to the 8" line and 20 Km to the 24" line (approximately)
1.2. Proximity to Gas Fields	- in the vicinity of gas fields	- far from gas fields
2. Proximity to Water		
2.1. Water intake	- by the Provincial govt incldg. treatment	- by the Project
2.2. Length of Pipe Line req'd	- within 1 Km to the pipe line by the Province	- within 1 Km to the river Rio Limay or the main irrigation canal
2.3. Quality of Water - Reliability	- no difference - less reliable due to approximately 40 Km of pipe line operation by the public electric power	- no difference - secured by the Project installation
3. Proximity to Product Market	Note: (Principally, the highways connecting the plant and the market, start from the city of Neuquen, located most eastero part of the Province.)	
3.1. Access to Neuquen City	- 100 Km by railway or highway	- 20 Km by railway or highway
4. Others		
4.1. Population & Social	- thinly populated oil town.	- a suburb of provincial capital / Neuquen and an agricultural town (fruits).

Table 3-4

BASIC DESIGN CONDITION

1) Climatic Condition

		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Barometric Press.	mb	978.7	980.1	981.0	983.4	983.1	984.9	984.6	984.7	984.6	983.9	981.0	979.5	982.5
Avg. Temp.	°C	21.3	20.4	17.7	12.4	9.1	5.4	5.8	8.2	11.0	14.6	18.9	20.9	13.8
Abs. Max. Temp.	°C	39.5	39.2	35.7	33.2	29.3	27.0	25.5	30.2	31.8	32.8	38.4	38.6	89.5
Abs. Min. Temp.	°C	2.8	1.6	-0.2	-4.0	-5.9	-9.9	-10.4	-7.9	-6.2	-2.2	1.3	-0.7	-10.4
Avg. Vap. Press.	mb	11.6	11.7	11.5	9.2	8.0	6.7	6.1	6.0	6.0	7.5	9.5	11.1	8.8
Avg. Rel. Humid.	%	46	52	60	68	72	76	70	59	52	51	47	46	58
Avg. Precipitation	mm	10	8	18	20	16	24	16	12	14	28	21	22	209
Avg. Wind Veloc.	Km/h	12	9	7	7	6	6	7	8	8	9	11	12	9

- Wind Direction (Annual %)
  - Prevailing
    - SW & W 35.4%
    - Calm 36.2%
- Gust
  - Max. Recorded 95 Km/h in '75
  - Avg. Max. 76 "

(Source ; Cipolleti)

2) Soil characteristics

- Surface to -3~4m ; Clay Sand or Silty Sand
- -5m below ; Fine/Coarse Sand
- N value (Penetration Test for 30cm) more than N=30 at the depth below -5m

(Data from Plaza Huincle Refinery)

Table 3-5

UNIT CONSUMPTION OF RAW MATERIALS AND UTILITIES

		Ammonia Plant		Urea Plant
		(Unit/t of Product)		
Raw Mat'l				
	N G	7.8 MMkcal	NH_3	590 kg
			CO_2	760 kg
Utilities				
	Power	750 Kwh		180 kwh
	Process Water	1.0 m^3		-0.5 m^3
	Cooling Water	170 m^3		100 m^3
	Steam	-0.82 ton		1.00 ton

Note:

NG = Natural Gas

Cooling Water = Circulation

\- = Export

Table 3-6

PRELIMINARY ORGANIZATION SCHEDULE

Designation	Number
President Director	1
Directors	3
Production Manager	1
- Ammonia Section Mgr.	1
Process Engineer	2
Operators	30
- Urea Section Mgr.	1
Process Engineer	2
Operators	32
- Utilities Section Mgr.	1
Utilities Engineer	3
Operators	40
- Maintenance Mgr.	2
Engineers	5
Technicians	100
- Delivery Control Mgr.	1
Clerks	15
Administration Manager	1
- Personnel Section Magr.	1
Clerks	10
- Accounting Section Mgr.	1
Clerks	10
- Off Site Control Mgr.	1
Clerks	10
- General Labourers	26
T O T A L	300

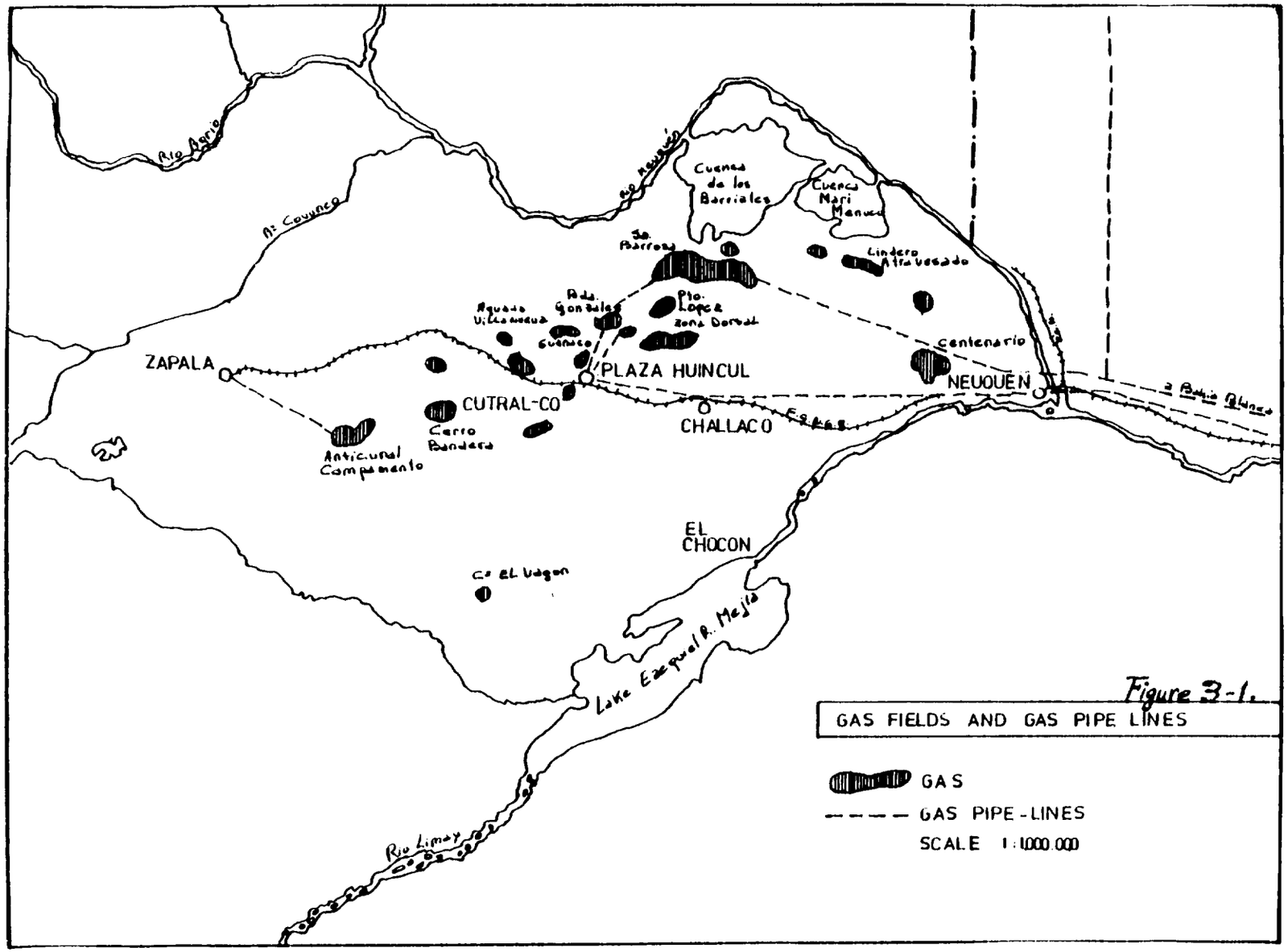

Río Agrio
Río Neuquén
Cuenca de los Barriales
Cuenca Mari Menuco
Lindero Atravesado
Pto. Lopez
Zona Dorsal
Centenario
ZAPALA
PLAZA HUINCUL
NEUQUEN
CUTRAL-CO
Cerro Bandera
CHALLACO
Anticlinal Campamento
EL CHOCON
Lago El Chocon
Río Limay
GAS FIELDS AND GAS PIPE LINES
GAS
GAS PIPE-LINES
SCALE 1:1000.000

Figure 3-1.

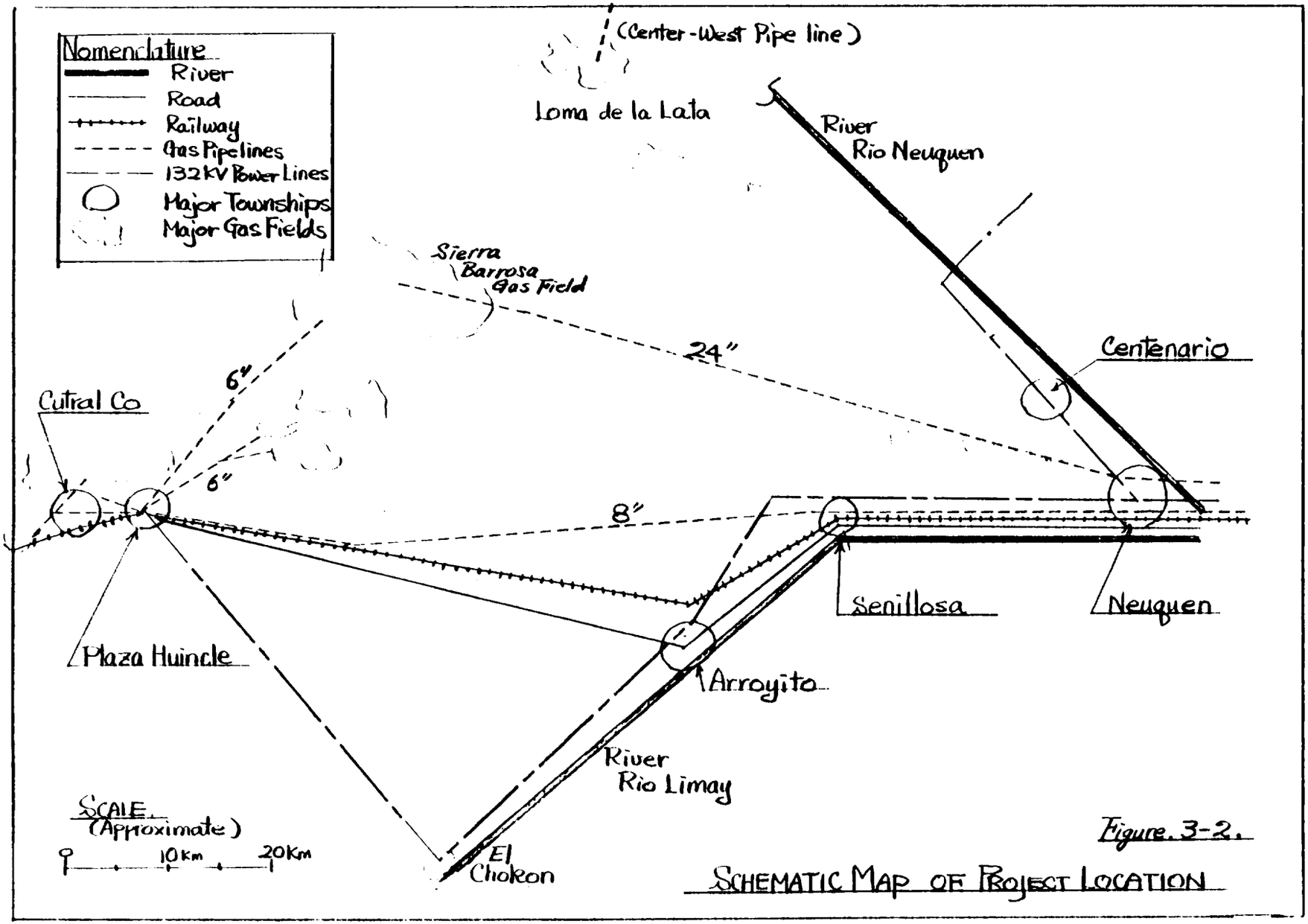
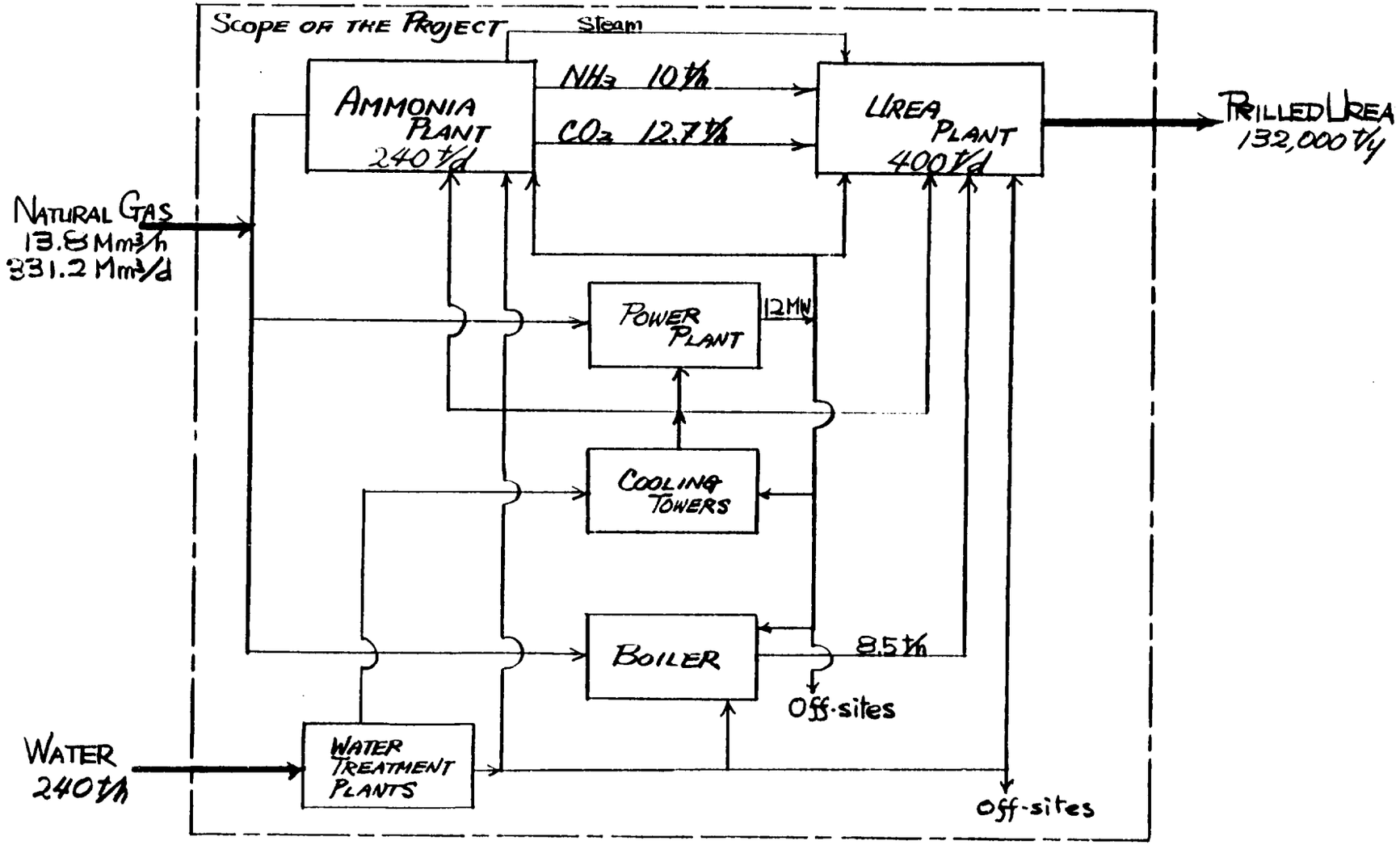


Figure. 3-2.

SCHEMATIC MAP OF PROJECT LOCATION

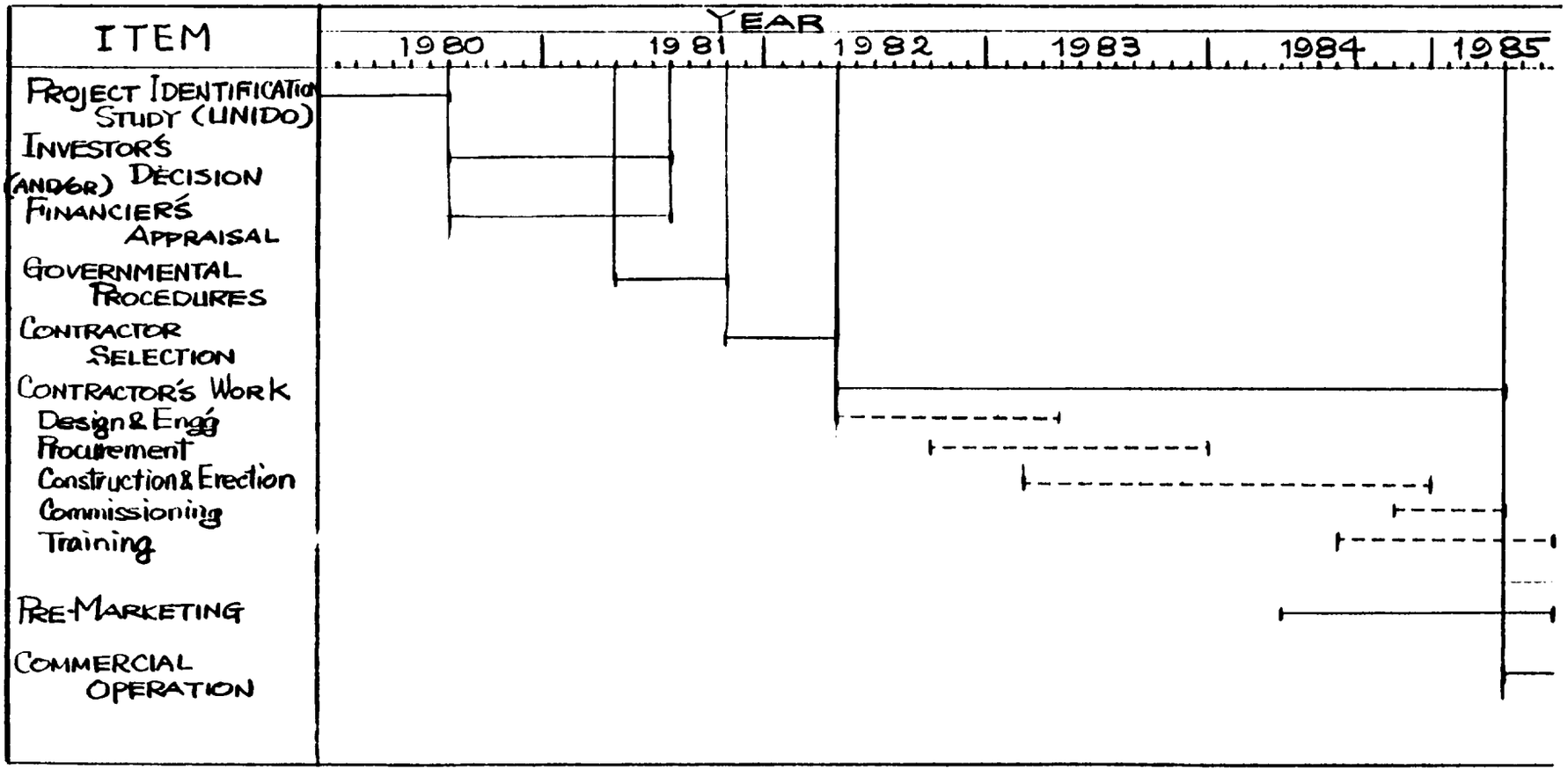
Overall Material Balance of the Project

Figure 3-3



PRELIMINARY PROJECT IMPLEMENTATION SCHEDULE

Figure 3-4.



10 Mar. 1980
S. MAENO

Chapter 4. CAPITAL AND PRODUCTION COST.

4.1 General.

On the basis of the scope of the Project, as is stated in Chapter 3, the total capital requirements for the Project are estimated.
Because the project owner and the source of finance for the Project are not yet determined, some of the basic conditions for estimation of capital requirements are unknown yet. Nevertheless, the following conditions have been assumed as the bases for the estimation.

i. Accuracy.
Order of magnitude basis, which may be the accuracy within plus-minus 20 %.

ii. Type of contract.
Turn-key, lump-sum contract with a single contractor; i.e., the contractor to design, engineer, procure, erect, construct, and commission of the total Project plant and to train and supervise the engineers and operators.

iii. Procedure for the award of contract.
Presumed to be by competitive bidding.

iv. Basis for prices and costs.
All the prices and costs indicated hereinafter are end of 1979 as erected basis, so as to estimate the capital cost requirements and/or production cost for 1985, the projected commissioning year, proper escalation factors should be employed.
And all the capital cost requirements are estimated on the basis of US$ taking account of the local factor similar to Neuquén, Argentina.
As for the local cost, especially in the estimate of production cost, the available data were projected to the prices prevailing at the end of year 1979 in terms of US$ using proper price index and exchange rate.

v. Import duty and taxes.
In the Republic of Argentina, there are a few industrial and foreign investment promotion laws.
The definitive incentives to be given to the Project will only be clarified at the time of implementation; however, it is considered to

be possible that the Project will be exempted from any duties and taxes.

vi. Interest on long term debt.

In view of the economic growth of Argentina and the Project to be implemented by the ownership of private sector, the interest rate for the long term debt is assumed to be 10 % per annum.

vii. Debt/equity ratio.

The ratio of debt versus equity is assumed to be 60/40, i.e., 60 % of total capital requirements is to be dependant upon long term debt.

4.2 Total Capital Requirements.

4.2.1 Total plant cost.

The total plant cost for the Project is estimated on the basis of the as-erected plant cost at the end of 1979, with the similar local condition to Neuquén, Argentina, and the similar production capacity, as follows:

(Unit: MUS$)

Ammonia plant	34,210
Urea plant	21,800
Utilities and offsite	24,020
TOTAL PLANT COST	80,030

The total plant cost should include followings:

i. Site preparation.

ii. Plant direct cost
- plant equipment and materials.
- spare parts.
- catalyst and chemicals.
- civil materials.
- construction labour.

iii. Construction equipment.

iv. Ocean freight, marine insurence, and local handling cost.

v. Indirect field expenses.

vi. Services.
- licence and know-now fee.
- engineering fee.
- procurement services.
- inspection.
- documentation services.
- provision for bonus.
- supervision fee.

4.2.2 Pre-operating expenses.

In this cathegory, those expenses are included as labor cost before the commercial operation, loss of raw materials and chemicals during the test

run, fees and costs for the establishment of company. The pre-operating expenses are estimated on the lump sum basis as follows:

PRE-OPERATING EXPENSES 1,600 (MUS$)

4.2.3 Initial working capital.

The working capital should be provided initially for the expenses such as product inventory, account receivable and payables.
The initial working capital is also estimated on the lump sum basis as follows:

INITIAL WORKING CAPITAL 2,400 (MUS$)

4.2.4 Interest during construction.

The interest during construction should be calculated by the following equation.
Interest during construction
= Total capital requirements
x ratio of long term debt (60%)
x 1/2 (At the half point of construction period)
x 10% (Interest rate per annum)
x 3 (Years of construction period).
Thus, the interest during construction is calculated to be as follows:
INTEREST DURING CONSTRUCTION 8,310 (MUS$)

4.2.5 Total capital requirements.

Based on the above estimated costs, the total capital requirements are estimated to be as shown in Table 4-1.

TOTAL CAPITAL REQUIREMENTS 92,340 (MUS$)

(Note: Land cost is not included, because the fiscal price of land is estimated to be approximately US$ 300 per ha).

4.3 Production Cost Estimate.

4.3.1 General.

Based on the total capital requirements estimated in foregoing paragraph, the production cost is estimated on the stamdard basis, i.e., 100% capacity utilization, the cost prevailing at the end of year 1979, and the total Project scope discussed in Chapter 3.
Then, the sensitivity of production cost is to be analyzed for the variation of gas price, total capital requirements, capacity utilization rate, interest rate on the long term debt, etc.

4.3.2 Variable costs.

1) Natural gas.

Price:

- Standard case as per Gas del Estado tariff for Neuquén province: 0.0666 US$/$m^3$.
- However, there is a possibility for the Project to receive the incentive gas price as gas producing province; in this case: 0.0499 US$/$m^3$. (60% of the tariff applicable to Buenos Aires area).

Requirement: 109.3 MMm^3/y.

2) Catalyst and chemicals.

- US$ 1.0 per ton of urea.

4.3.3 Fixed cost.

1) Depreciation.

Twelve years straight line method for the total capital requirements.

2) Maintenance cost.

3 % of the total plant cost.

3) Insurence.

1 % of the total plant cost.

4) Labour cost and overhead.

US$ 4,000/person x 300 persons.

5) Interest on long term debt.

= 0.6 (ratio of debt)

x total capital requirements

x 0.5 (half of reimbursement)

x 0.1 (interest rate).

6) Return of investment.

For standard case, 10% of total capital requirements.

4.3.4 Production cost.

On the basis of above mentioned calculation method, the production cost is estimated to be as shown in Table 4-2.

The resultant production cost is:

Without R.O.I.	169 US$/t
With 10% R.O.I.	239 US$/t

These compare with following figures:

Ex-port godown price (Buenos Aires)	284.9 US$/t
Price at farmers' gate (Neuquén/Río Negro)	386.5 US$/t (Imported) 348 US$/t (Domestic)

Even, the transportation cost US$/t 20, may be less, because the Project plant is in the vicinity of the market, is added to get the farmers' gate, the price from the Project will be US$ 255/t. This is approximately, US$ 100/t less than prevailing price in the AREA.

4.4 Sensitivity Analysis on Production Cost.

4.4.1 General.

The total production cost for the standard case is estimated in the foregoing paragraph, based on above figures, the sensitivity analysis is made for the production cost varying the following cost factors:

i. Natural gas price.
ii. Capital requirements.
iii. Capacity utilization.
iv. Return on investment.

The results are shown in Figure 4-1.

4.4.2 Natural gas price variation.

If the incentive for the natural gas producing provinces is applied, even if the gas is taken from the existing pipeline, (The original regulation states that the incentive is only applicable when the gas is taken before compression.) the price of natural gas becomes 60% of tariff price of Capital, Buenos Aires, area.
With this incentive, gas price is US$ 0.0499/m^3, thus the production cost becomes US$ 226/t.

4.4.3 Capital requirement.

If the capital requirement varies from the standard case for plus-minus 10%, the resultant production cost becomes:

minus 10%	US$ 221/t
plus 10%	US$ 256/t

4.4.4 Capacity utilization.

Capacity utilization (%)	Production cost (US$/t)
100	239
90	259
80	284
70	317

4.4.5 Return on investment (R.O.I.).

The standard R.O.I. is hypotnetically set as 10% on total capital

requirements, however, if this has to change, the resultant production cost becomes:

R.O.I. (%)	Production cost (US$/t)
7	218
10	239
13	260
15	274

4.4.6 Sensitivity analysis.

As it is clear from Figure 4-1 and above discussion as well, the most influential factor to the production cost is the rate of capacity utilization. Therefore, it is the most crucial for the implementation of the Project to select the commercially proven process and to endow the engineering and construction work to the experienced and qualified contractor.

The capital requirement will affect the production cost next to the capacity utilization rate.

As for this, although, in this report, the power generation plant is included in the Project scope, not relying on the public power which is abundantly available in the Province, however, of which stability and reliability for the Project is overviewingly suspected. Therefore, it is worth while for the Project owner to look into the reliability in detail before the Projecct is implemented, because, if the power generation plant in the Project can be deleted from the scope, the capital requirements will be saved by approximately 7%.

As for the price of natural gas, it does not affect too much for the production cost, however, the incentive mentioned in the section 4.4.2 should be clarified in order to minimize the production cost.

4.4.7 Interest rate.

If the interest rate on long term debt is assumed to be 1% less, i.e., 9%, the production cost is less US$ 3.54/ton, and becomes US$ 235/ton..

Table: 4-1

TOTAL CAPITAL REQUIREMENTS

(Unit: MUS$)

TOTAL PLANT COST *	80,030	
Ammonia Plant		34,210
Urea Plant		21,800
Utilities and off-site		24,020
PRE OPERATING EXPENSES	1,600	
INITIAL WORKING CAPITAL	2,400	
INTEREST DURING CONSTRUCTION	8,310	
TOTAL CAPITAL REQUIREMENTS	92,340	

(Note: * As erected price at the end of year 1979)

II-60

Table: 4-2

PRODUCTION COST

(Standard Case)

	Annual Cost (MUS$/y)	Unit Cost (US$/ton)
VARIABLE COST		
- Natural Gas	7,279	55.14
- Chemicals	132	1.00
FIXED COST		
- Depreciation	7,695	58.30
- Maintenance Cost	2,401	18.19
- Insurence	800	6.06
- Labour Cost & Overhead	1,200	9.09
- Interest on Debt	2,770	20.98
PRODUCTION COST	22,279	168.78
R.O.I. (10%)	9,234	69.95
TOTAL PRODUCTION COST	31,513	238.73

(End 1979 Price)

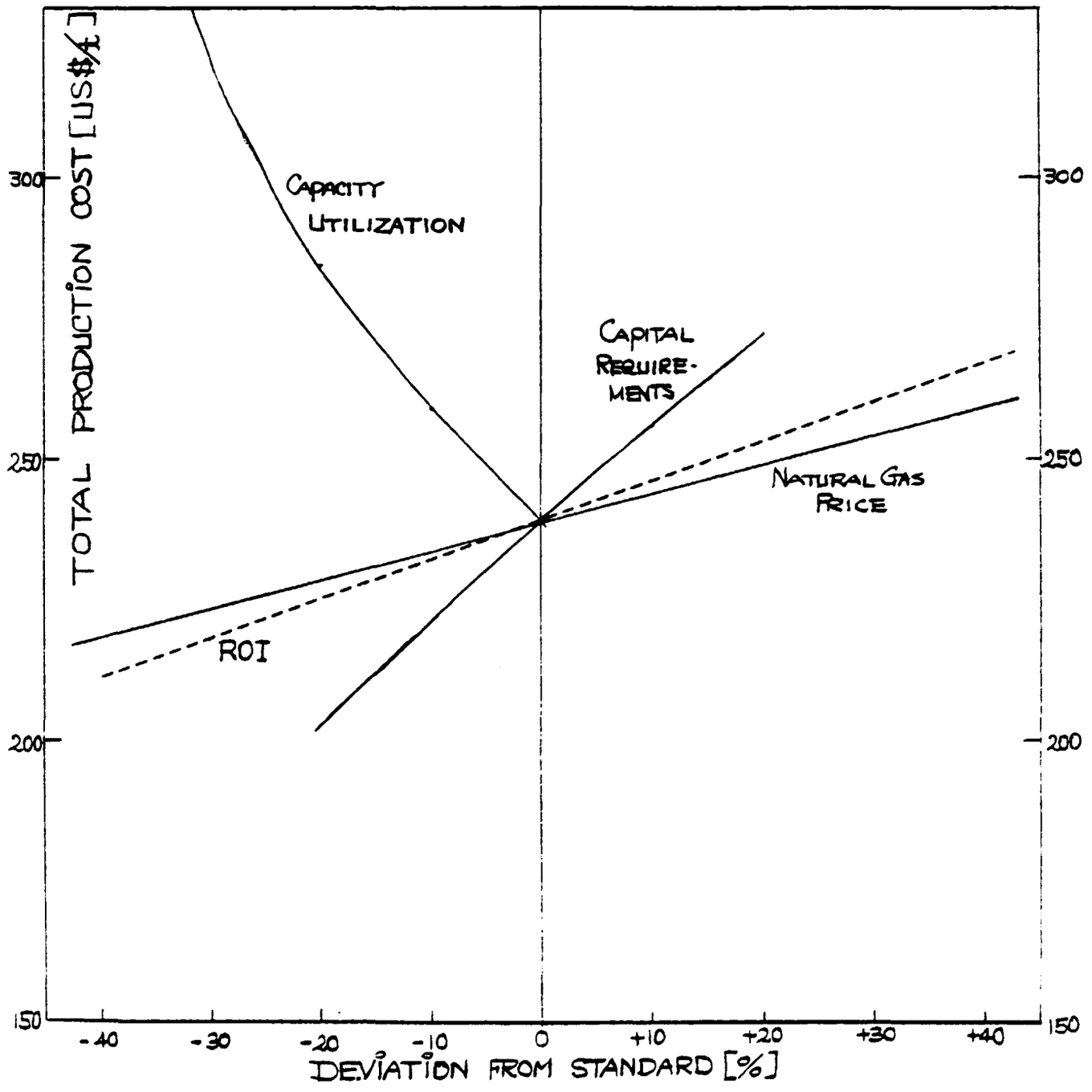
11-61

Figure 4-1

SENSITIVITY ANALYSIS OF PRODUCTION COST

STANDARDS

NG PRICE	0.0666 US$/m³
CAPITAL	92,340 MUS$
CAPACITY UTILIZATION	100 % (132,000 t/y)
R.O.I	10% ON TOTAL CAPITAL



JOB DESCRIPTION

1. Purpose of the project.

To advise on, and assist in the development of petrochemical production facilities in the Province of Neuquén, Republic of Argentina.

2. Duties.

The expert will be attached to the Secretary of Planning and Development Council (COPADE) of the Province of Neuquén. In close co-operations with counterparts, he will be expected to:

(1) Up-date the existing study for the establishment of an ammonia/urea plant;

(2) Reassess the projected market demand for nitrogen fertilizer in the area;

(3) Reassess and confirm the availability of the feed stocks for the planned production of urea;

(4) Establish capital and production costs;

The expert will also be expected to prepare a final report, setting out the findings of his mission and his recommendations to the Government on further action which might be taken.

APPENDIX 2: LIST OF PROJECT COUNTERPARTS.

Government of the Province of Neuquén:

- State Secretary of COPADE (Council of Planning and Action for the Development)
  Lic. ALBERTO M. FERNANDEZ.
- Minister of Public Works and Services
  Ing. RICARDO N. GUTIERREZ.
- Subsecretary of COPADE
  Cr. MANUEL ROJO
- Provincial Director of Project Programming and Evaluation
  Cr. JUAN R. GARCIA.
- COPADE Tecnnical Advisors
  Ing. LUIS A. DIAZ.
  Cr. NESTOR A. RODRIGUEZ.
  Ing. RICARDO MENDEZ.
  Ing. JOSE LUIS HOLLMAN.
  Ing. CARLOS ROMERO ONETO.
- Provincial Direction of Water and Electrical Power
  Principal Director
  Ing. JULIO C. ROMANO.
  Director of Works
  Ing. DANIEL M. ARIAS.

Y.P.F. (Yacimientos Petrolíferos Fiscales) in Plaza Huincul

- Department Chief of Reservoir Engineering and Geology
  Dr. ANTONINO M. SALLEO.
- Division Chief of Reservoir Control
  Ing. ENRIQUE LAGRENADE.
- Administrator Chief of Plaza Huincul Distillery
  Ing. VICENTE POCCIONI.

INTA (Instituto Nacional de Tecnología Agropecuaria) in General Roca (Río Negro)

- Chief of Laboratory of Vegetable Nutrition
  Ing. CARLOS R. BESTVATER.
- Department Chief of Economics
  Ing. ALDO BONGIORNO.

INTA (Instituto Nacional de Tecnología Agropecuaria) in Anguil (La Pampa)

- Tecnnical Advisor in Pastures

  Ing. ROMERO.

Ente Provincial del Río Colorado, in 25 de Mayo (La Pampa)

- General Administrator

  Dr. MARIO R. GIL ACOSTA.

- Legal Advisor

  Dra. MONICA IVANI.

- Coordinator Section I

  Ing. RAUL GIAI.

Hidronor (Central El Chocón), in El Chocón (Neuquén)

- Chief of Electrical Maintenance

  Ing. CARLOS GALLASTEGUI.

SI/ARG/79/801/11-02

Appendix 3-1

1

UNDERSTANDING ON THE PROJECT

Date: 28 February 1980.
Country: Argentina.
Project: Assistant to petroquemical and fertilizer industry, Province of Neuquén.
By: S. MAENO, Advisor on Fertilizer Production.

1. General.

The Government of the Province of Neuquén prepared a feasibility report, summarizing their past work and various aspects of nitrogenous fertilizer project, titled as

Informe de la Comisión Mixta (Integrada por YPF y la Provincia del Neuquén)
Proyecto Planta de Fertilizantes Nitrogenados a radicarse en la Provincia del Neuquén.

In order to establish an ammonia/urea plant based on available natural gas in the Province of Neuquén, the Government of Argentina, for the sake of the Government of the Province of Neuquén, has requested UNIDO assistance in up-dating the study.

2. Advisor's Duty.

Advisor's duty is, based on the above mentioned study, to assess the following aspects:

1) Market aspect.

- To set up a marketable region for the proposed plant in view of transportation costs, available infrastructures, etc.
- To analyze the past trend of fertilizer consumption in the region.
- To analyze the agricultural activities in the region, in view of cultivated area, agricultural production/income, fertilized area, etc.
- To analyze the structure of farmers' gate price of fertilizer and agricultural products.
- To assess the demand forecast of urea based on the analysis on constraints made above.
- To recommend the policy or issue to be taken for the increase of fertilizer consumption.

2) Technical aspect.

I. Natural gas study.

- To analyze the availability of NG.
- To analyze tne NG utilization scheme.
- To assess the availability and proximity of NG to the Project, including pricing policy of NG.

II. Utilities study.

- To analyze the availability and proximity of water and electric power including quality and price.

III. Plant site location.

- To set up alternative locations.
- To recommend the suitable location for the project in view of proximity to market, NG, utilities and infrastructure.
- To establish a design criteria.

IV. Project scope.

- To establish a project scope.
- To estimate NG, power, water requirements.

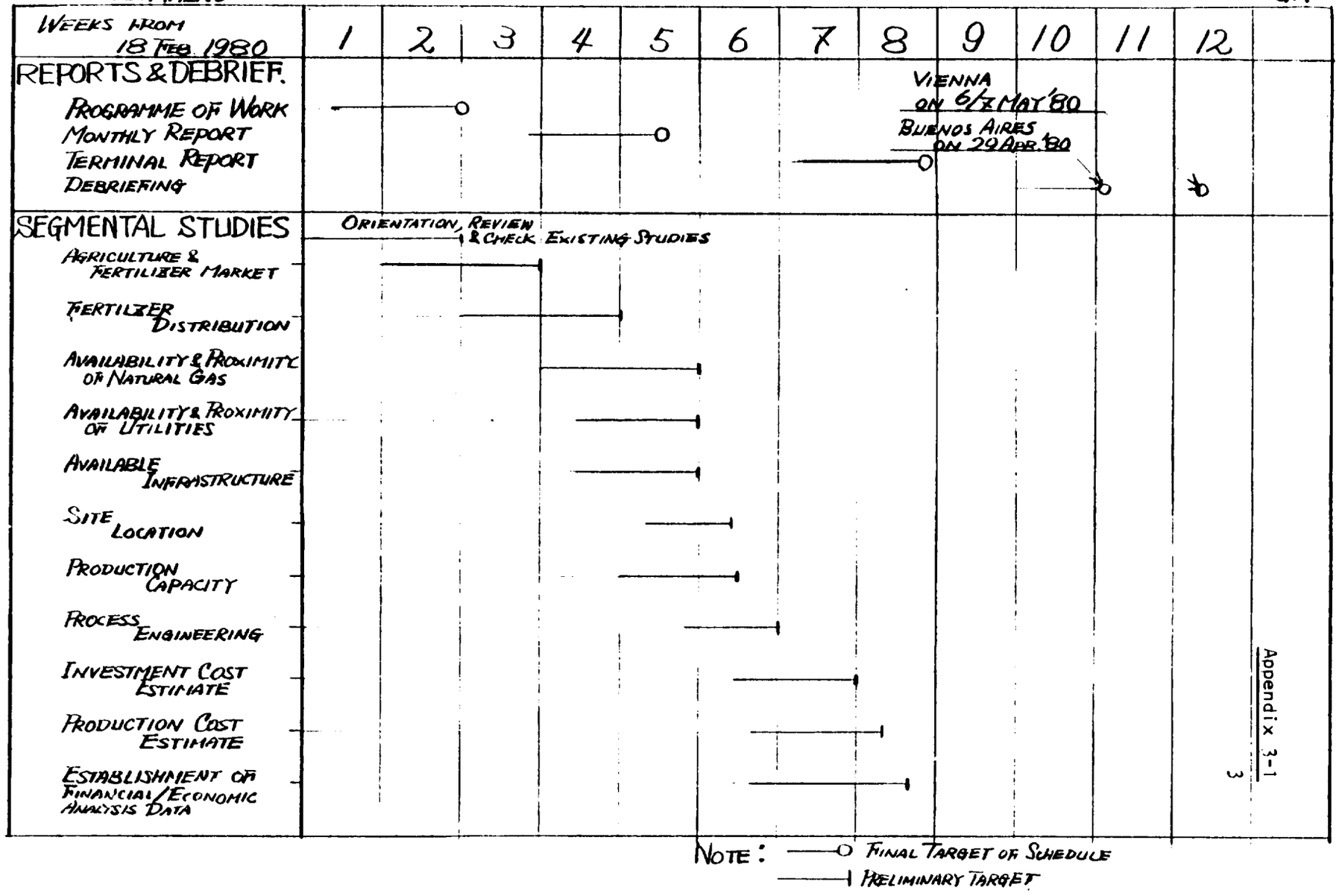
3) Finacial aspect.

- To establish capital and production cost.
- To establish financial/economic analysis data for the Economist to analyze.

SI/ARG/79/801/11-02
S. MAENO

PROGRAMME OF WORK

28 FEB 1980



Appendix 3-1
3

Appendix 3-2

1

SI/ARG/79/801/11-02

PROGRESS REPORT

Date: 17 March 1980.

Country: Argentina.

Project: Assistant to petrochemical and fertilizer industry, Province of Neuquén.

By: S. MAENO, Advisor on Fertilizer Production.

1. General.

With the good coordination extended by the counterparts, the expert is making progress as per scheduled in the programme of work.

Major progress achieved in the past one month, after the expert arrived to the duty station, was in the market aspect and some progress started in the technical aspect.

2. Market Aspect.

2.1. Basic data were collected for:

- Cultivated area
- Agricultural production statistics
- Past trend of fertilizer consumption
- Recommended dosages of fertilizer for each crop
- Fertilizer price in the region
- Agricultural product price in the region

etc.

2.2. Analysis and projection are being made for

- Constraints for the growth of fertilizer consumption
- Fertilized area
- Demand forecast.

2.3. Major findings are:

1) Stagnant growth of fertilizer consumption in the region has been caused by, among others,
   - high fertilizer prices at the farmer's gate
   - availability of fertilizer in time and in quantity for the farmer's need
   - fluctuation of agricultural product price.
2) Agricultural extention service system seems to be well established in both

Appendix 3-2

public and private sectors, and those are 2

- INTA (Instituto Nacional de Tecnología Agropecuaria)
- Private agro-chemicals and fertilizer distributors with well qualified agricultural engineers and agronomists.

3. Technical Aspect

3.1. Feed stock

In the Neuquén basin, there are two natural gas resources, i.e. associated gas and non-associated gas. However, associated gas is being produced from the oil wells with the average production capacity of 14 m^3/day/well of oil in the atmospheric pressure, so that the project is unable to depend upon these resources without excessive investment for the collection and the compression installment.

As for non-associated gas, there are basically two fundamental classification of gas wells in the Neuquén basin, those are the wells of dry gas (gas contains mainly methane) and the wells of wet gas (gas contains heavier hydrocarbons than methane).

The dry gas wells lie in the Plaza Huincul and Cutral-Có area and the wet gas wells are in the vecinity of Centenario.

The wet gas is being allocated for LPG (Liquefied Petroleum Gas) production and Petrochemicals, and the residual dry gas for the pipe-lines to Bahía Blanca, etc.

The dry gas is being primarily allocated for regional use including fertilizer production.

3.2. Site location

Since the primary feed stock source is being identified, the site selection criteria is being established for the recommendation of the plant site location.

Appendix 4-1

INFLUENTIAL AREA BY PROJECT

Province	Total Area (ha)	Cultivated Area (ha) *	Population (persons) **
Neuquén	9,407,300	31,900	163,400
Río Negro	20,301,300	97,550	262,500
Mendoza	15,083,900	363,300	973,100
La Pampa	14,344,000	3,561,100	172,000
Chubut	22,468,600	39,100	193,000
Santa Cruz	24,394,300	8,650	81,900
T O T A L	105,999,900	4,101,600	1,845,900

* From Appendix 4.

** 1970 Census

Appendix 4-2

N E U Q U E N

CROPS	Cultivated Area (ha) 1955/65 Average	1969/70	1965/75 Max	Projection 1980
Maize	400	900	1,300	1,000
Potato	270	300	400	400
Fruit	4,400	11,000	11,000	20,000
Grape	360	1,200	1,200	2,000
Vegetables	370	750	750	1,500
Alfalfa	5,000	3,000	3,500	3,500
Grains *	980	2,400	2,400	3,500
TOTAL (Cultivated)	12,280	19,550	20,550	31,900

* Incldg.

Wheat (Trigo)
Animal Barley (Cebada Forrajera)
Oat (Avena)

Appendix 4-3

R I O N E G R O

CROPS	1955/65 Average	CULTIVATED AREA (ha) 1969/1970	1965/75 Max.	Projection 1990
Maize	1,740	2,200	2,300	3,500
Potato	1,800	1,500	1,800	1,500
Fruit	24,400	38,000	38,000	40,000
Grape	13,900	18,100	13,700	20,000
Vegetable	7,300	5,300	5,300	6,000
Alfalfa	27,430	13,600	19,800	20,000
Grains *	2,540	5,000	5,500	6,500
TOTAL (Cultivated)	79,110	83,700	91,300	97,500

* Incldg.
Wheat (Trigo)
Rye (Centeno)
Animal Barley (Cebada Forrajera)
Oat (Avena)

Appendix 4-4

M E N D O Z A

CROPS	1955/65 Average	CULTIVATED AREA (ha) 1969/70	1965/75 Max.	Projection 1980
Maize	4,950	7,200	8,200	8,500
Potato	8,200	7,000	7,900	6,500
Fruit	47,000	46,000	47,000	48,000
Grape	162,000	209,600	232,000	210,000
Vegetables	25,200	12,400	25,673	15,000
Alfalfa	53,000	45,900	49,400	44,000
Grains *	24,300	29,900	30,600	31,300
TOTAL (Cultivated)	324,650	358,000	400,773	363,300

* Includ.
Rye (Centeno)
Animal Barley (Cebada Forrajera)
Beer Barley (Cebada Cervecera)
Oat (Avena)

Appendix 4-5

L A P A M P A

	1955/65 Average	Cultivated Area (ha) 1969/70	1965/75 Max.	Projection 1980
Sorghum * *	57,730	285,500	478,500	300,000
Maize	63,380	262,800	273,000	270,000
Grains *	1,365,880	1,709,500	1,745,000	1,763,000
Alfalfa	429,200	566,600	566,600	600,000
Sudan Grass	8,300	5,900	12,000	7,000
Sun Flower	8,930	4,500	13,100	5,000
Vegetables	220	- - - -	2,830	100
Millet	5,030	15,000	27,300	18,000
Pastures	618,220	550,000	550,000	600,000
TOTAL (Cultivated)	2,556,890	3,399,300	3,668,330	3,561,100

* Incldg.

Wheat (Trigo)
Rye (Centeno)
Animal Barley (Cebada Forrajera)
Beer Barley (Cebada Cervecera)
Oat (Avena)

** Incldg.

(Sorgo Granifero)
(Sorgo Azucarado)

Appendix 4-6

C H U B U T

CROPS	1955/65 Average	Cultivated Area (ha) 1969/70	1965/75 Max.	Projection 1980
Grains *	1,500	2,000	2,000	2,300
Alfalfa	8,380	9,100	9,200	10,000
Vegetables	2,390	4,200	4,200	4,500
Potato	1,410	1,600	1,700	1,300
Pasture	13,500	13,000	- - -	19,000
Fruit	1,660	2,000	2,000	2,500
TOTAL (Cultivated)	33,840	36,900	- - -	39,100

* Incldg.
Wheat (Trigo)
Rye (Centeno)
Barley (Cebada F)
Oat (Avena)

Appendix 4-7

S A N T A C R U Z

	1955/65 Average	Cultivated Area (ha) 1969/70	1965/75 Max.	Projection 1980
Grains *	730	700	900	900
Alfalfa	4,730	4,500	4,500	4,500
Vegetables	65	20	20	50
Potato	460	500	500	600
Pastures	2,000	2,500	2,500	2,500
Fruits	195	- - -	100	100
TOTAL (Cultivated)	8,180	8,220	8,520	8,650

* Incldg.

(Trigo)

(Centeno)

(Cebada Forrajera)

(Avena)

Appendix 5.

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