COMISION NACIONAL DE ENERGIA
TEATINOS 120 - SANTIAGO - CHILE

ARCHIVO

OF.ORD. Nº CSV/13 /

MAT. : Proyecto Gas Natural-Tocopilla.

13 AGO 1992

REF. : OF. Nº 3381, del 24 de julio de 1992, del H. Senado.

DE : MINISTRO PRESIDENTE COMISION NACIONAL DE ENERGIA

A : SEÑOR VICEPRESIDENTE DEL SENADO

1. En respuesta a su oficio de la REF. informo a US., para conocimento del Honorable Senado, que el proyecto al cual hace mención la H. Senadora Carmen Frei Ruiz-Tagle corresponde denominado "Norpacífico LNG Proyect", que fue elaborado por la empresa Argentina Upstream Services S.A.. Este proyecto consiste en utilizar las reservas de gas natural probadas y probables en el noroeste Argentino y, en una segunda instancia, las reservas de gas de Bolivia. Para esto se construiría un gasoducto de alrededor de 1000 km, desde la zona de Ramos, norte de Argentina, hasta Tocopilla, Chile. En esta ciudad chilena se instalaría una planta de gas natural licuado (GNL) para exportación, principalmenete a Japón, con capacidad de 2,75 millones de toneladas anuales de GNL, en una primera fase y 5,5 millones de toneladas, en una segunda fase. El trayecto del gasoducto permitiría abastecer de gas natural a los principales centros mineros del Norte Grande, incluyendo Chuquicamata y la ciudad de Calama, y su capacidad de transporte sería de 14,75 millones de m3 al día, pudiendo aumentarse a 26 millones de m3 al día, con la instalación de dos estaciones compresoras (el Norte de Chile podría llegar a consumir 5 millones de m3 al día).

2. Representantes de Upstream efectuaron ante esta Comisión una presentación del proyecto el 11 de junio pasado. En esta reunión se nos informó que en diciembre de 1991 se firmó un joint-venture entre Upstream Services y JAIDO de Japón, con el propósito de impulsar globalmente este proyecto. El estado de avance de proyecto, de acuerdo a la información proporcionada por Upstream Services, es el siguiente :

- Reservas de gas. Se han realizado esfuerzos "avanzados" por asegurar las reservas de gas necesarias para el éxito del proyecto. El joint-venture señalado ha calificado para la licitación de la cuenca noroeste de Argentina, a realizarse en septiembre de este año, y, actualmente, están preparando la oferta correspondiente. Upstream estima que los inversionistas japoneses aportarían hasta un 20% del capital en esta etapa del proyecto. Las reservas de gas probadas en el noroeste argentino son 149,75 billones de m3 y las reservas estimadas son del orden de los 300 billones de m3. Bolivia tiene reservas probadas en el sureste por 116,4 billones de m3.

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- Gasoducto Argentina-Tocopilla. Se dispone de una evaluación preliminar de su costo, aproximadamente 700/750 millones de dólares en la primera etapa y 70/80 millones de dólares cuando se agregan los compresores necesarios para la segunda etapa. Los representantes de Upstream consideran que la inversión japonesa sería del orden del 10 a 20%, debiendo el resto ser aportado por empresarios de los países involucrados (Chile, Argentina y Bolivia) o internacionales.

- Planta de licuefacción. La evaluación del costo de la planta es también preliminar y aproximada (750/800 millones de dólares la primera etapa y 700/750 millones de dólares adicionales la segunda etapa). Estiman que los inversionistas japoneses aportarían del orden del 50% y, el resto, empresarios como los señalados para el gasoducto.

- Transporte marítimo. Como en las unidades anteriores la evaluación de costo es aproximada, previéndose la construcción de 12 barcos, en dos etapas de 6 naves cada una, cuyo valor sería de 200 millones de dólares por embarcación, los cuales serían financiados por firmas japonesas.

En resumen, el gasoducto, la planta de licuefacción y los barcos representan una inversión estimada de US $ 4.620 a 4.980 millones, y supone la inversión de parte de empresas japonesas, argentinas, bolivianas, chilenas y de otros países.

3. Actualmente este proyecto está en etapa de idea avanzada, y mientras no haya certeza de éxito en la postulación de los campos petrolíferos de la cuenca noroeste de Argentina, de las firmas Upstream y JAIDO y, posteriormente, no se logre un preacuerdo de contrato de compra-venta de GNL con Japón, su viabilidad se estima baja. Lo concreto, ahora, es la licitación de las reservas de la cuenca noroeste de Argentina, anunciada para el 15 de Septiembre.

A su vez, debo informar a US. que, un proyecto de esta envergadura, tiene un período de maduración de a lo menos cinco años.

Saluda atentamente a US.,

REPUBLICA DE CHILE
MINISTRO PRESIDENTE
COMISION NACIONAL DE ENERGIA

JAIME TOHA GONZALEZ
Ministro Presidente
Comisión Nacional de Energía

EXECUTIVE SUMMARY

DECEMBER 1991

UPSTREAM SERVICES S.A.
ARGENTINA

JAIDO
JAPAN

INDEX

I.- FOCUS, SCOPE AND OBJECTIVES OF THE PROJECT

BRIEFING

This summary describes the concept and some of the principal characteristics of the Norpacifico Liquid Natural Gas Project ("The Norpacifico LNG Project").

In its most essential part, "The Norpacifico LNG Project" consists on the extraction of gas from the northern region of Argentina and the southern of Bolivia, its transportation through a gas pipeline to the pacific coast in Chile, the gas liquefaction in a LNG plant and the transportation of the LNG to the Japanese market.

FUNDAMENTAL PREMISES

The following project has been conceived on the basis of three fundamental premises:

1.- The existence of a large gas consuming market (Japan and the Pacific Rim countries), with a good medium and long term perspectives of expansion.

2.- The confirmation of large natural gas reserves in northern Argentina and southern Bolivia, which are under discovered and sub-exploited at the present time and without any major probability of that being changed in the near future.

3.- The convenience for Japan to procure alternative energy sources, thus diversifying its suppliers; some of them at the present time are located within zones that could be called, in a political sense, conflicting.

PROJECT DEFINITION

The project, called "NORPACIFICO LNG PROJECT", was thought up on the basis of four stages, as follows:

1.- Use of the yet discovered and potential gas reserves in the Argentinian-Bolivian Knot.

2.- Construction of a gas pipeline from northern Argentina to the Chilean port of Tocopilla, on the Pacific Ocean coast.

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3.- Installation of a liquid natural gas (LNG) plant, which will be used, in a later stage, as a centre for petrochemical developments.

4.- The addition of a transportation fleet for delivery of LNG from Tocopilla to a port in Japan or any other within the Pacific Rim.

OBJECTIVES

The main objective of the project is to bring into reciprocal relation, in a commercial sense, the South American unexploited gas reserves with the far east markets.

Argentina has been trying, for more than a decade, to increase its economical ties, trading and investment with the Pacific Rim countries, especially Japan.

The political situation in the middle east and Japan's dependance on fuels of such origin, are strong points in favor of the proposed project.

This project will allow Japan to divert a portion of its energy needs to a source located in a stable region, with more than adequate means to transport the fuels from.

The "Norpacifico LNG Project" is also predicated upon principles of integration with Bolivia and Chile and its projection to the Pacific Rim region.

Furthermore the integration objectives, the project combines the strength of each participating country.

There are other objectives of secondary importance coming out from the work to be done in order to achieve the main object.

The supplying of natural gas to all the regions in the vicinity of the entire gas pipeline; the commercialization of ethane, propane, butane and gasolines and naphthas derived from the separation of the fuels and the petrochemical developments which will follow afterward, are some of the secondary objectives pursued in the materialization of this project.

The northwestern gas basin will go out on a bidding in an international tender expected to come out towards the beginning of 1992 and whoever obtains the rights to explore, develop and exploit the area, will have the right of free disposition of the fuels drawn out of the fields.

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Another objective of this project, is to secure the additional source of gas supply from Bolivia at a mutually accorded price by means of a signed long term contract or with a production sharing agreement concerted whith Yacimientos Petroliferos Bolivianos, the State owned Bolivian company.

One more objective is the development of the path that will be opened through The Andes mountains beside the pipeline; this path will joint the inside part of the subcontinent with maritime communications through the Pacific ocean.

MAIN MAGNITUDES

The confirmed natural gas reserves in the northwestern basin are 149.7 BILL m^3.

On the other side of the border, in southern Bolivia, the reserves are 116.4 BILL m^3.

The estimated global length of the gas pipeline from Campo Duran, in Argentina, to Tocopilla area in Chile, is 1002 km.

In its first stage, the liquefaction capacity of the projected plant will be in the order of 2.75 million tons per year, with a second stage that will allow to double this figures.

The six ships which will take over the necessary transportation fleet for the first stage of the project will have a capacity of 135/150,000 m^3 each.

BACKGROUND

In late 1987, a council of prominent people presided by the ex-prime minister of Japan, Mr. Saburo Okita, presented a list of recommendation to the president of Argentina at that time, Mr. Raúl Alfonsin. These recommendations are the result of a Japanese study over "economic development in Argentina" which is known today as the "Okita Report".

From this report derived two conclusions which deserve special attention:

- One of the most dynamic ways to reach a rapid economic development in Argentina is through the reactivation of the energy and petrochemical sectors.

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- One of the export difficulties is the lack of infrastructure in either the transportation or installation sectors or both, in addition to the high cost of handling vessels while in port.

The project fulfills the criteria for selection (Okita Report, point 2-4-1, page III-128 and III-130, vol. I-III industry), especially in regard to regional development considerations.

The Norpacifico pipeline tracing across the Jama pass through the Andes mountains is mentioned in the Okita report (vol. I-IV transportation, figure IV-5-2, page IV-179) as being advantageous over alternative tracings.

THE MARKET

The annual volume of Japanese liquid gas imports is about 35 million tons.

Without taking into consideration the gas consumption in other countries in the area, which have high deficits in the energy sector, this project aims at the supply of about 7% of the Japanese LNG purchases.

In Japan (year 1988), the gas used mainly for distribution to residential and commercial areas for domestic use adds to 6.8 million tons, to generate electricity: 23.6 million tons, and for other uses: 800,000 tons.

The participation of LNG in Japan's total primary energy supply is about 10%. The project covered by this report would be able to supply, in its first stage, 0.7% of the total primary energy consumption.

THE POLITICAL CIRCUMSTANCES

However, the most interesting aspects of the commercial perspective of the project are referred to Japan's interest in diversifying its sources of energy supply.

Considering the Persian Gulf crisis, the political instability of this region and the Japan's dependence level on its present supply sources (Malaysia and Indonesia supply around 75% of the total LNG consumption in Japan), it seems obvious to point out Japan's interest in finding alternate supply sources coming from non-conflicting areas.

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Also, from a geopolitical standpoint, it is convenient to emphasize the advantages of having a maritime line with "point to point" characteristics in which, the crossing of territory or territorial waters of other countries is not necessary.

WORKING HYPOTHESIS

The following working hypothesis have been taken into account in the configuration of this initiative:

1.- The proven reserves in the Argentine-Bolivian area have a potential which is capable to fulfill all the long term requirements of the "LNG" plant.

2.- It is possible that the price of a barrel of oil will remain stable or will increase in the future in relation to the present level.

3.- The demand for LNG will increase in the far east, specially in countries such as Japan, Taiwan and Korea.

4.- Due to the insufficient possibilities for the Argentinian northwestern and Chilean northern areas to grow, in terms of economic development, it is plausible that the project will have a solid and vigorous support from the authorities of both countries.

5.- A tacit Bolivian support to this initiative is discounted, due to Bolivia´s mediterranean geographic condition, which makes difficult for the country to commercialize its enormous gas fuel potential.

6.- At present values , LNG exports guarantees repayment of the investment and a very attractive rate of return.

7.- Taking into consideration the present cost values for production, transportation, industrialization and shipping charges to its final destination, it is possible for this product to be in the Japanese market at very reasonable and acceptable prices.

Probably, this initiative will be handle as an integral project (all the steps belong to the same group); for this reason, prices will be in relation with I.R.R. and not necessarily with oil prices.

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SUPPLEMENTARY ADVANTAGES

In addition to the central objective of the project, which is the industrialization of the immense gas fuel potential of the combined Argentine/Bolivian region, a multiple set of other advantages can be mentioned, such as:

* - To supply the needs of gas fuel to the northwest and north of Argentina and Chile, respectively, where it is impossible to have this fuel at the present time.

* - Gas utilization will help in the oil extraction process.

* - Goods and services investment will have a multiplying effect in the context of regional economies.

* - It promotes the creation of new jobs in border regions where the unemployment level is high at the present time.

* - Trade between the countries on both sides of the Andes will be increased.

* - It will be possible to improve significantly the efficiency and cost of copper production in Chile through the use of natural gas. (Japan has important investments in copper mining areas).

* - This project will be a firm step forward towards the sub-regional integration, which is beginning to take the shape of a "common market" in the southern tip of this hemisphere.

* - It creates a valuable precedent in the "door to the Pacific" issue, which was the subject of many initiatives in the past, without any positive results up to now.

* - It establishes the ways and means to consider opposite realities, such as how to reconcile one country's abundance with the necessities of another and vice-versa. These are the basis for integration.

IMPLEMENTATION

This project has the following four units of development, which have to be considered separately as independent economic units.

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A. - Exploitation of the gas reserves.

B. - Gas pipeline installation.

C. - LNG plant installation.

D. - Shipping.

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NORPACIFICO LNG PROJECT

II.- SYNTHETIC DESCRIPTION OF THE UNITS

UNIT A - GAS RESERVES

The studies made about the Argentine gas reserves, indicate that the proven and probable reserves in the Northwestern Basin are sufficient to guarantee the long term supply of gas to the LNG plant without risking the country's own supply for domestic consumption, at the present time or, even, at any time in the foreseeable future.

According to official figures made known by Y.P.F., the total gas reserves in Argentina, as of 12-31-90, were as follows:

In billions of m^3		
BASIN	**PROVEN**	**PROBABLE**
Northwest	149,750	-------
Cuyana	1,290	-------
Neuquina	432,786	51,802
San Jorge	33,709	4,660
Austral	155,475	71,480
T O T A L	**773,010**	**127,222**
(In 10^{12}Cuf)	**(27,4)**	**(4,49)**

The Campo Durán field, which is being exploited since the beginning of 1960, is now being re-injected with gas coming from the Agüaragüe fields, in order to maintain these reserves for future consumption.

The proven reserves of Ramos fields at 06-30-90 are 80.41 BILL m^3, the Agüaragüe reserves are 59.24 BILL m^3, Campo Durán reserves are 8.80 BILL m^3 and others 1.30 BILL m^3. These volumes give a total sum of 149.75 BILL m^3 of proven gas reserves in the area.

Future incorporation of gas reserves to the Northwestern Basin is closely related to the explorations taking place in the area such as CNO-3 (Río Seco) as well as in the regions east and west of the Subandean mountains, where reserves are estimated to be around 300.00 BILL m^3 of gas. All these explorations are being carried out under the risk contract regime.

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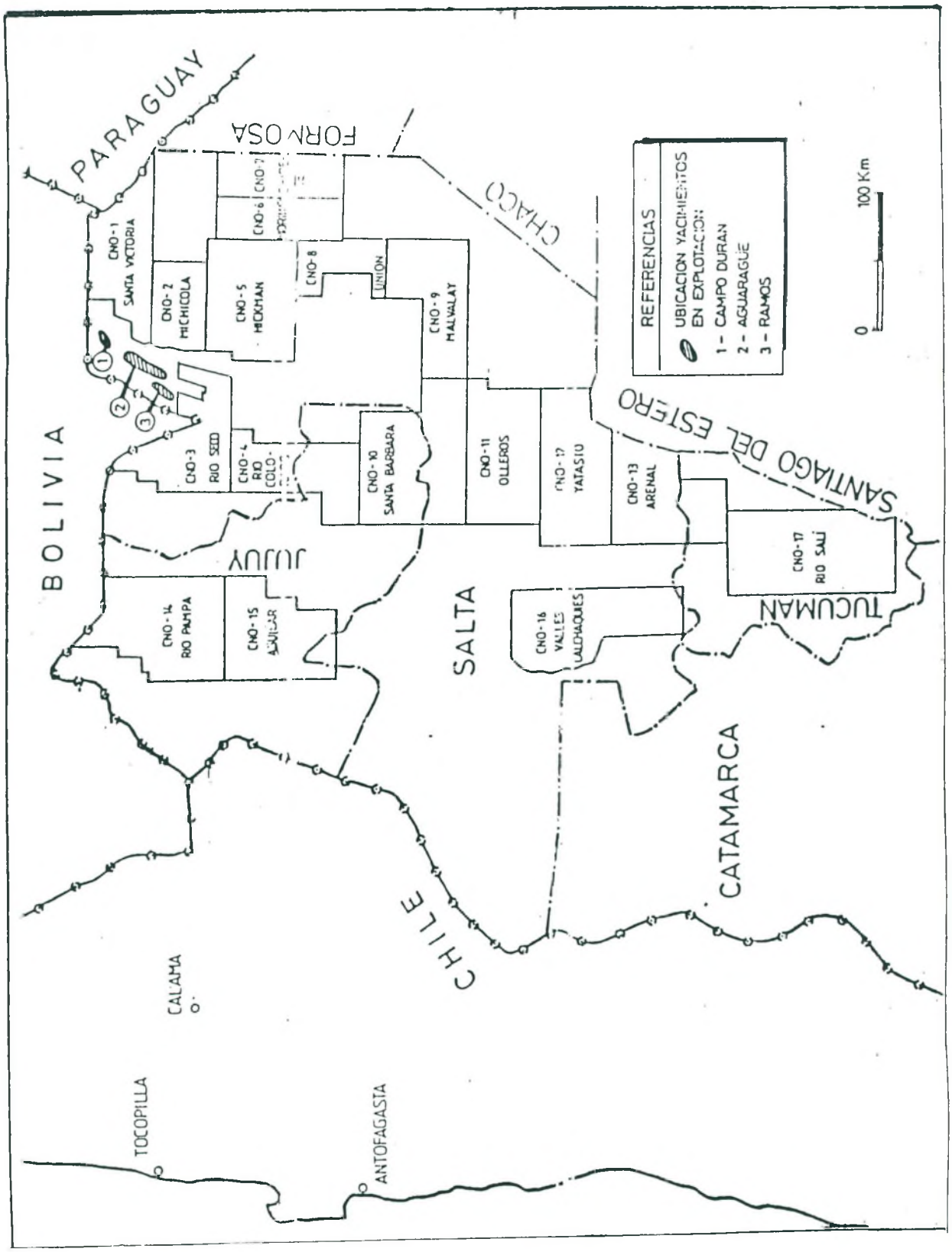

NORTHWEST FIELDS

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These reserves should be essentially situated at estratigraphic units of Devonian and Pre-Devonian Ages, similar to the Ramos and Aguaragüe gatherings.

The gas reserves in Bolivia, of about 116.40 MM m^3, have to be increased due to the recent announcement by the Bolivian government of the discovery of new gas sources in Tarija.

Other exploration activities have to be taken into consideration, such as those which are being carried out in Argentina by private companies in other areas of the Basin.

Considering Aguaragüe field as an average regional basin, the gas chromatographic composition, Gas Oil Relation (GOR) and its production are as follows:

	%
C_1	88.27
C_2	4.69
C_3	1.83
C_4	0.19
nC_4	0.52
iC_5	0.19
nC_5	0.15
C_6	0.10
N_2	0.56
CO_2	3.50

The Gas Oil Relation

$$GOR = \frac{5000\ m^3\ Gas}{1\ m^3\ oil}$$

An average well produces:
1×10^6 m^3/day at the initial production

(35×10^6 CFD)
And 200 m^3 of oil with 34° API density

Leasing out can be negotiated in different areas of this region. This could be an important business in itself.

The new policy about deregulation of the oil sector, allows private companies to participate, in association with Y.P.F., in the exploration and exploitation of the Northwestern Fields.

Y.P.F. will open an International Bidding for leasing out their reserve areas in the Northern Basin during 1992.

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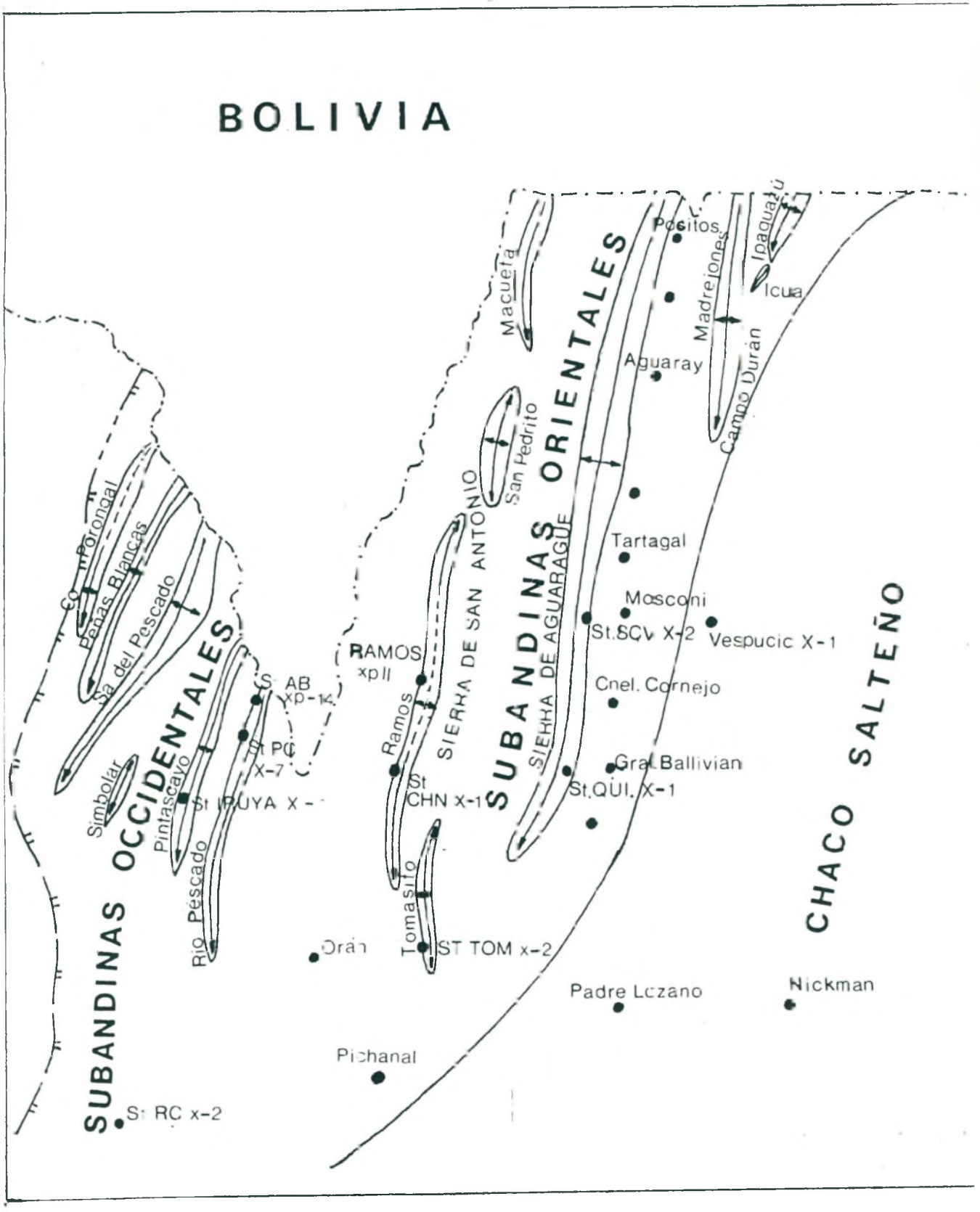

EXPLORATION AND EXPLOITATION AREAS

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NORPACIFICO LNG-PROJECT

UNIT B - THE PIPELINE

The gas pipeline head will be located at the Ramos area with connections to the other gas fields in the region, in the province of Salta, and in Bolivia.

The pipeline head will be on top of San Antonio mountain and the installations for gas production will be at 950 m (above sea level). This plant is considered to be the beginning of the gas pipeline.

The tracing crosses San Antonio mountain and reaches the locality of El Pichanal, which is at 370 m above sea level. In that first stretch, which is 104 km long, the pipeline crosses five summer rivers. From this point on, the pipeline runs south, parallel to route 34, up to La Mendieta at 600 meters above sea level, crossing three rivers and a 2 km swampy terrain, passing by the localities of San Martín and San Pedro. This second stretch is 134 km long.

From La Mendieta, in this 120 km long third stretch, the path of the pipeline changes direction, goes north through San Salvador de Jujuy at 1259 m above sea level, which is the capital of Jujuy province, to head alongside route 49 towards the locality of Purmamarca (2275 m above sea level) after going across four summer rivers, the Río Grande slopes valley and the villages of Yala, León, Volcán and Tumbaya.

From Purmamarca, it turns west, towards the Chilean border and the start of the difficult Andes crossing. On the way, the pipeline lays across the Salar Grande salt pit, at 3700 m above sea level and goes through Susques (4300 m. above sea level) to reach Paso de Jama (Jama Pass) at the same height exactly on the border limit between Argentina and Chile. In this 201 km stretch the tracing climbs up the Cuesta del Lipán slope which goes from 2200 to 4200 m above sea level in a short length and through two salt deserts.

Crossing on to Chile, the pipeline lays through the localities of San Pedro de Atacama (2436 m above sea level), Calama and Chuquicamata (2814 m above sea level), ending at Tocopilla city at the coast line on the Pacific Ocean. This point marks the end of the pipeline which in its last leg of 443 km had to go across some salt pits of different sizes and around some small lakes.

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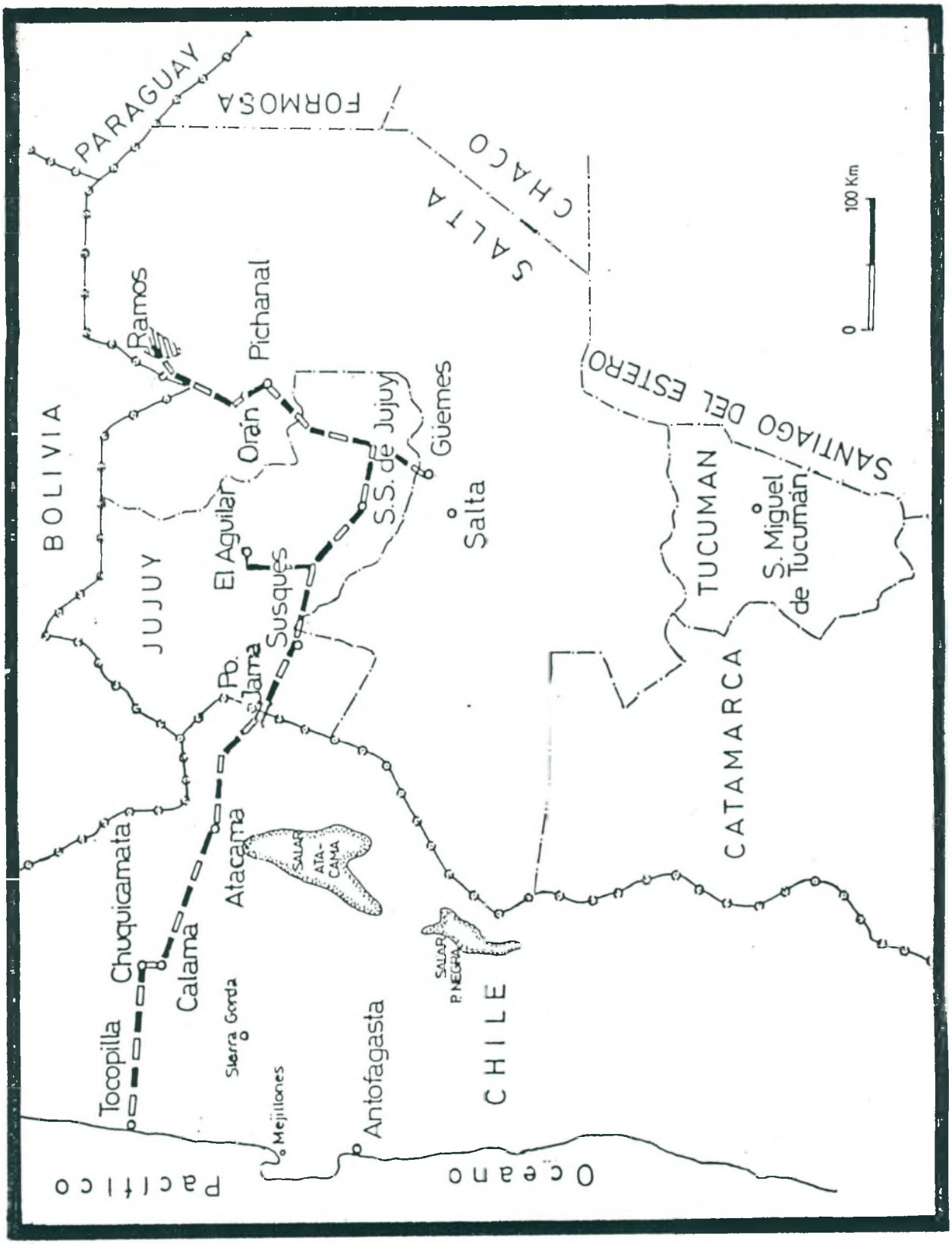

PIPELINE SCHEMATIC TRACE

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The gas Pipeline is projected to have a total extension of 1002 km (623 miles) with a diameter of 36 inch. This projected diameter allows the maximum transportation of 14.75 x 10^6 m^3/day of fluid.

The quantity of gas going through could easily grow to 26 x 10^6 m^3/day with the installation of two compression stations in the pipeline.

The budget for the pipeline construction is in order to 700/750 million dollars in the first stage, with an additional 70/80 million dollars when the compression stations are added in a second stage.

The estimated construction time for the first stage is 24 months.

The pictures of the next page are showing different aspects of the "Puna de Atacama", a large landing of a staircase that should be crossed by the pipeline following the tentative path drawed in the feasibility report.

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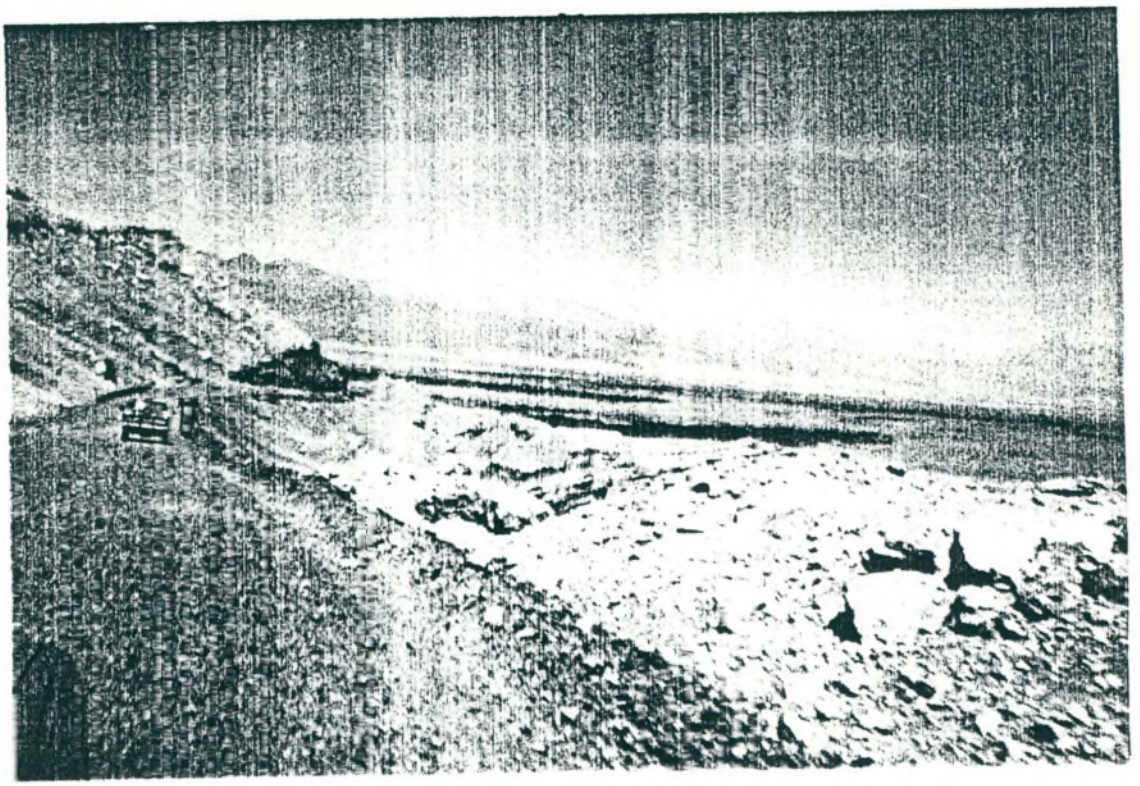

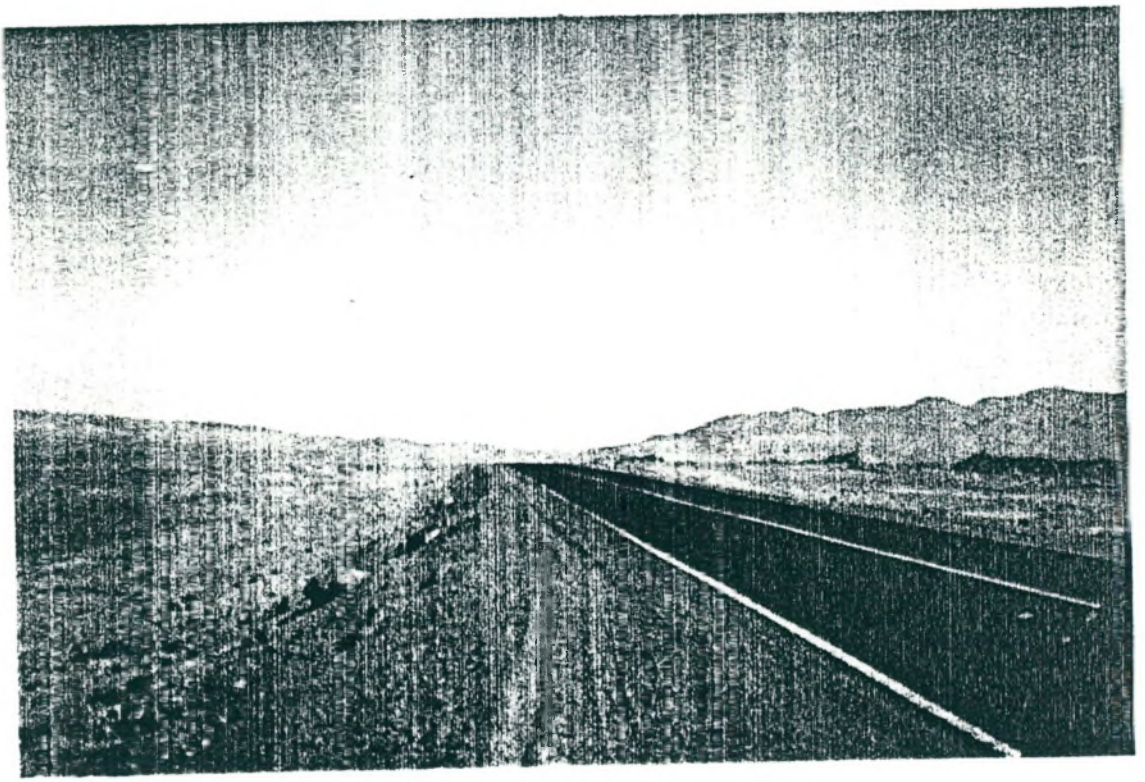

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NORPACIFICO LNG PROJECT

UNIT C - THE LNG PLANT

Possible construction sites for LNG plant were studied for 50 km along the seacoast of Tocopilla City (at 22° south latitude) in Chile. The next three sites are supposed to be most suitable for LNG plant location, judging from flatness of land and harbor conditions standpoints:

- Playa Brava (near Tocopilla bay)
- Punta Ampa (30 km to the South of Tocopilla city)
- Punta Gatico (45 km to the South of Tocopilla city)

TWO STAGES

This study is based on the condition that the project will be carried out in two stages, with a LNG production capacity of 2.75 million tons per year by two process trains (1.38 MMT/train) for each stage so as to reach the total capacity of 5.5 million tons per year, to load the LNG carriers of 135,000 m^3 class.

DIFFERENT PLANT TYPES

In order to select the most suitable type of construction, the following three basic plans are considered for the cost estimation:

Case a: A floating platform mounted plant, including process unit, storage tanks, loading facilities, utility facilities, etc. to be located off-shore.

Case b: A floating process unit platform, moored at a dock, connected to land-based storage tanks, loading facilities, administration building, etc.

Case c: A land-based plant; modular shop-made process units grounded at the site with conventional storing and loading facilities and off-site plant.

SIZE AND TECHNICAL CHARACTERISTICS OF THE UNITS

These are also very important factors that affect the investment, operational cost and reliability of the system.

Particularly the number of compression/liquefaction trains is directly connected with the first and the last of

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those factors, while the type of compressors (centrifugal vs. axial), with the first and the second ones.

A production of 2.75 MMT/year of LNG requires the treatment of about 14 MM m^3/day of natural gas.

The total amount of natural gas to be compressed, which is about 14 MM m^3/day, falls within the range of a single train of axial compressors. Double train however, has to be considered because of operational flexibility and reliability and this could result in the convenience of using centrifugal compressors.

PROCESS

The conditions of gas feed to LNG Plant are deduced as follows from the supplied data for gas composition and production rate of natural gas in Ramos and Bolivia fields.

Number of process trains to produce 2.75 MMTn/year of LNG in 1st. Stage would be two (1.38 MMTn/year by train), considering a flexible production management and reliability on the plant operation.

For global cost reduction, it is possible to install a 2.75 MMTn/year capacity train in 2nd. Stage. However a detailed study concerning equipment capacity, etc. is required for the installation of such a big capacity train.

A production of 2.75 MMTn/year of LNG requires the treatment of about 14 MM m3/day of natural gas according to the composition of gas feed to LNG plant, including consumption of fuel gas and refrigerant and without separation of ethane and LNG components as by-products.

Expected surface area for each of the three plant types is approximately as follows. These figures include the area required for 2nd. Stage:

- Floating platform.	300,000 m^2 - sea area
- Floating process unit platform.	240,000 m^2 - sea area 380,000 m^2 - ground area
- Land-based plant	270,000 m^2 - sea area 460,000 m^2 - ground area

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TYPE OF CONSTRUCTION

To export 2.5 MMTons of LNG per year (CIF base) to Japan, the production rate of 2.75 MMT per year should be maintained. In such case, the required volume of natural gas or each type of construction is approximately:

Floating platform .....13 MM Nm^3/day.

Floating process unit .....12 MM Nm^3/day.

Land-based plant .....12 MM Nm^3/day.

Increase in number of LNG carriers should be also studied to increase LNG transportation capacity.

Loading time to LNG carrier is assumed to be 12 hour for every type of plant. The storage capacity is 160,000 m^3 for 1st. Stage and 80,000 m^3 for 2nd. Stage in both Case b and Case c. In Case a, the storage capacity will be 160,000 M^3 for both Stages I and II so as that each platform can fully load LNG carrier. This arrangement enables, in case of overall maintenance service of one of the platforms, the remaining platform to fully load LNG carrier.

As each floating platform should be equipped with full facilities which can be commonly used in any of the other two cases, Case A plant is considered as over-equipped.

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UNIT D - SHIPPING

TRANSPORTATION COSTS

In this project, the ocean freight is crucial, given the fact that special ships are required, and the low cargo temperature (-161°C) needs extra special design and expensive materials.

Thus cost effectiveness is important for LNG ships considering the distance between Tocopilla area (Chile) and Japan of about 9,000 nautical miles, the programed transportation of 2,750,000 tn yearly of LNG, the ship's capacity of 135/160.000 cubic meters, a round trip period of 44 days, six ships will be required in the first stage.

Tocopilla harbor allows the entrance of 80.000 tn ships, or registered 66,000 tn displacement of "dead weight" ships.

The minimum depth of the harbor is 16.00 m (52 ft), the maximum draft permitted in winter is 14.00 m (46 ft) and 14.30 m (47 ft) in the summer.

Notwithstanding the ocean freight, it is possible to deliver the product to its destination at a considerably feasible price.

The fuel efficiency is one of the most important matters in transportation costs. That is why the carriers should be equipped with dual-fuel diesel engines.

The LNG boil-off is another one of the crucial points. That is why the insulation in storage tanks has to be as effective as possible. The boil-off will be used as fuel.

The insulation to reduce the gas boil-off rate will be as important as the type and capacity of the tanks are. The ships should have Dual-Fuel Diesel Engines. The budget for the six ships will be u$s 1.200 million in the first stage.

The Tocopilla harbor area permits the operation of ships of this type all year around.

Six other similar ships will be incorporated in a second stage, with a similar budget, when the LNG plant capacity increases to 5.5 million tons per year.

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III.- WORLDWIDE EVOLUTION OF LNG SUPPLY AND DEMAND PERSPECTIVES

GENERALITIES:

Fueling the increase of the LNG market implies things such as a desire for clean burning fuels out of concern for the environment, a slowdown in nuclear power additions, and surging energy demand stemming from economic growth.

LNG suppliers in Asia, north Africa and the middle east, are preparing to step up deliveries to existing customers and develop new markets.

Traditionally, LNG has been the only viable way of utilizing gas found in remote locations where a pipeline LINK to customers is not economically viable.

In international terms, the LNG market is still very small. Only 3% of total world gas production is liquefied for exports, which amounted to about 56.3 million tons. in 1990.

Figures compiled in summer 1989 by Institute of Gas Technology, (Chicago) show that world LNG trade has grown from two projects with deliveries of 55 billion cf/year (1.55 billion m^3) in 1964 to 17 projects totaling 2.6 Trillion cf/year (73.4 billion m^3).

The figures do not include the latest international LNG venture, Australia´s northwest shelf project.

Royal Dutch/Shell group, the world´s largest gas supplier outside the Soviet Union, forecast that by 2010 demand for LNG could rise to as much as 130 million metric tons/year.

The Pacific rim, with Japan far in the lead, is the biggest LNG marketing region.

Indonesia, the world´s largest LNG exporter, caved in to buyer pressure and ended a complex system of official prices that made its LNG shipments to Japan about 20% more expensive than other suppliers.

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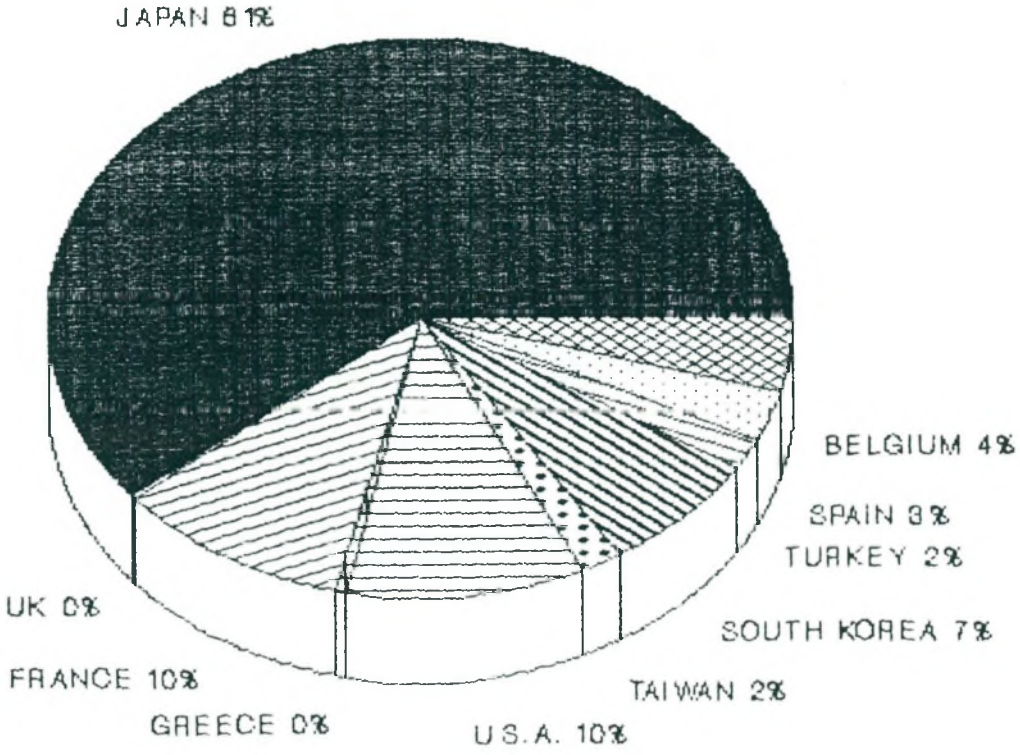
INCREASE IN LNG IMPORTS
1995



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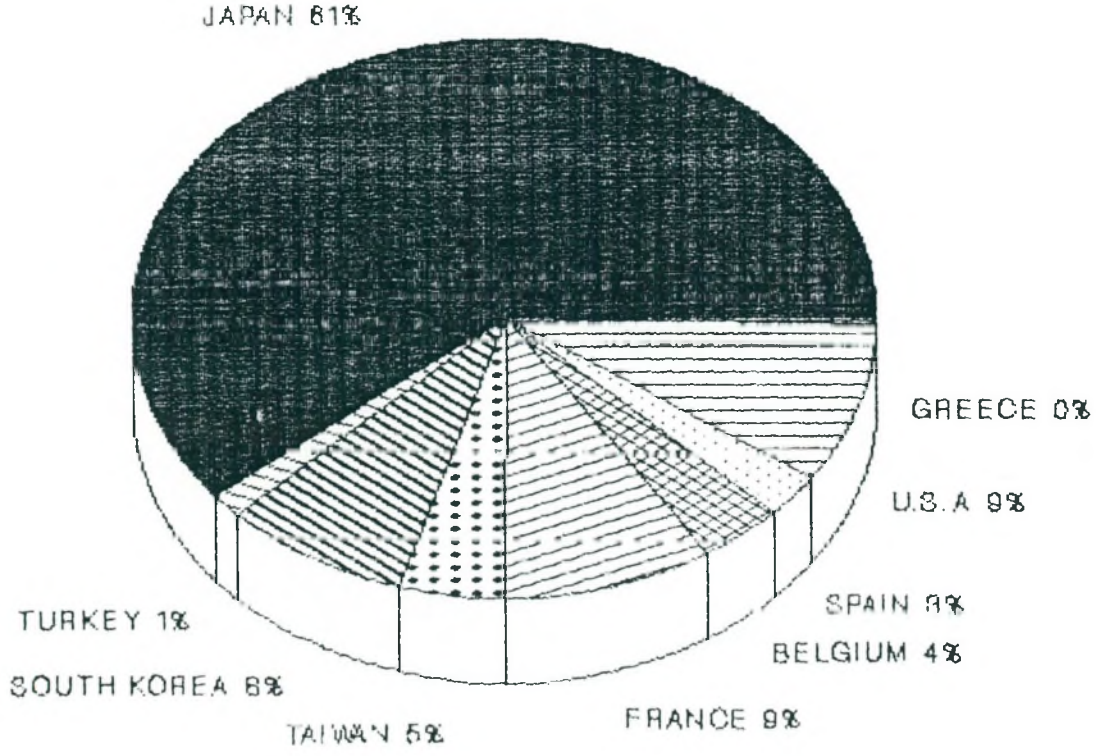
NORPACIFICO LNG PROJECT

INCREASE IN LNG IMPORTS
2000



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NORPACIFICO LNG-PROJECT

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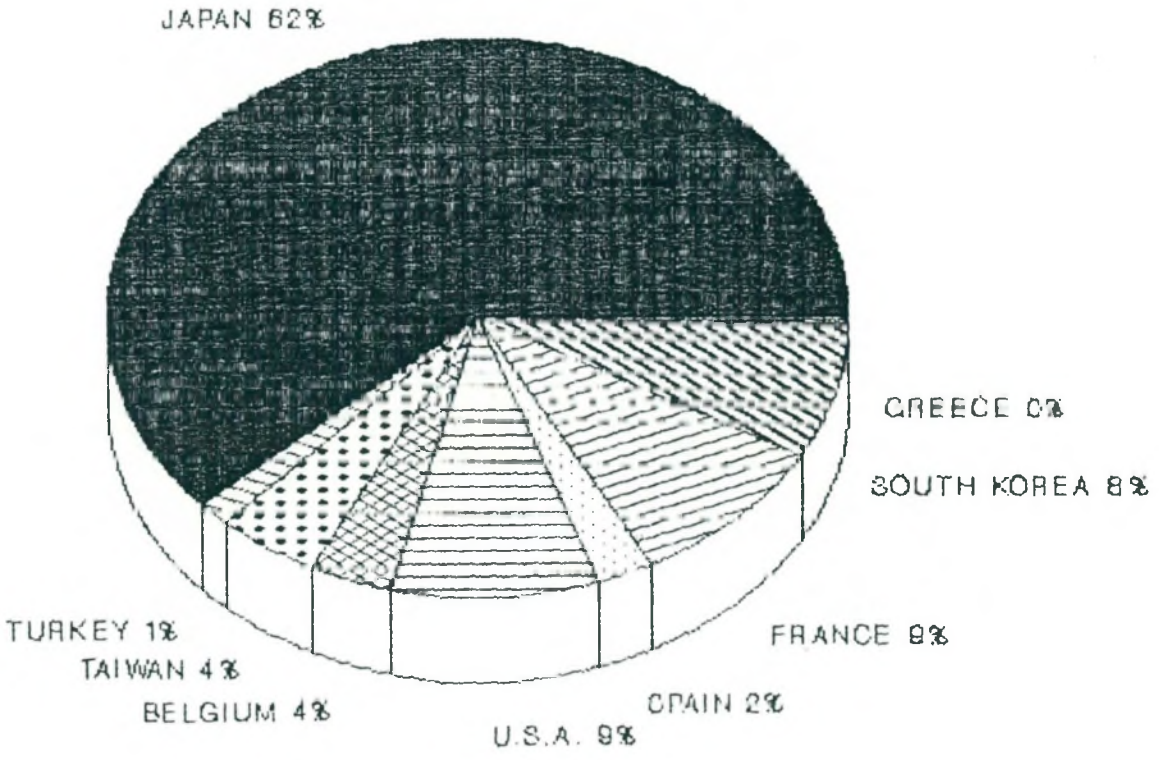
NORPACIFICO LNG PROJECT

INCREASE IN LNG IMPORTS
2005



GLOBAL LNG COMMERCE:

Projecting LNG trade for the remainder of the century is troublesome because it is subject to many variables of incalculable weights. This is clear when observing the turmoil created by the invasion of Irak and the associated disruptions in the international oil markets.

At best, those variables that appear to impact most powerfully on trade can only be listed and arranged in an ordinal rather than cardinal manner. When weighing opposing forces, the resolution will necessarily blend both positives and negatives and reflect changing conditions over time. Only when very significant long term forces emerge can there be relative confidence in the prediction.

The most significant positive aspects of LNG are still in place and becoming even more important, I.E., safety, environmental advantages and abundance of supply.

The negative aspects facing LNG, such as required large investments, inflexible pricing and politic insecurity, seem to be moderating over time as projects are down-sized, pricing is more spot market oriented and the geographic diversity of producers is widened.

There is no question that natural gas will occupy a more prominent place in the international fuel mix, the only question is, how much larger.

Within the foregoing industry backdrop, and given the limitation and uncertainty surrounding any long-term forecast for a complex industry, we foresee the following trade profile developing over the next 15 years:

REGION	CURRENT TRADE (MM TONS)			
	1990	1995	2000	2005
EUROPE	12.99	13.36	13.23	13.23
JAPAN & PACIFIC RIM	40.85	42.67	42.67	42.67
AMERICA	2.40	7.20	7.20	7.20
SUB TOTAL	56.24	63.23	63.10	63.10

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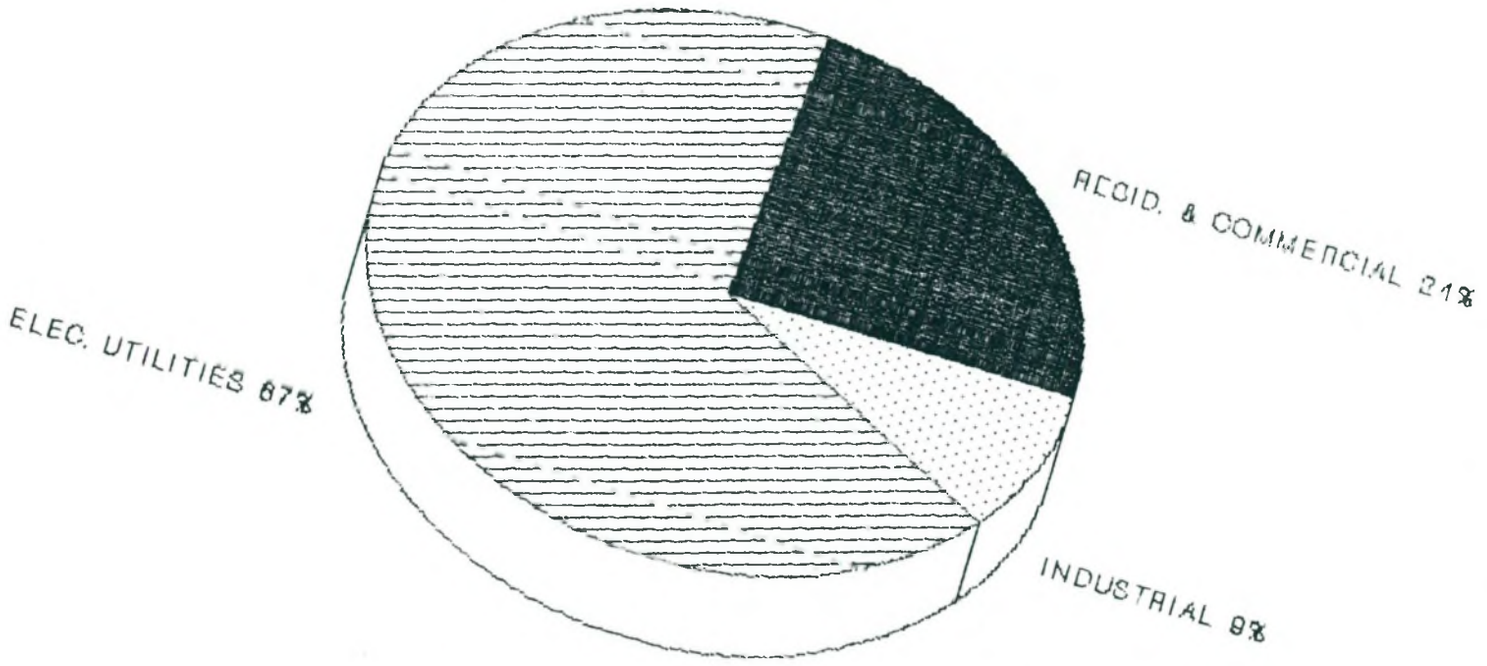
USE OF NATURAL GAS BY SECTOR



JAPAN

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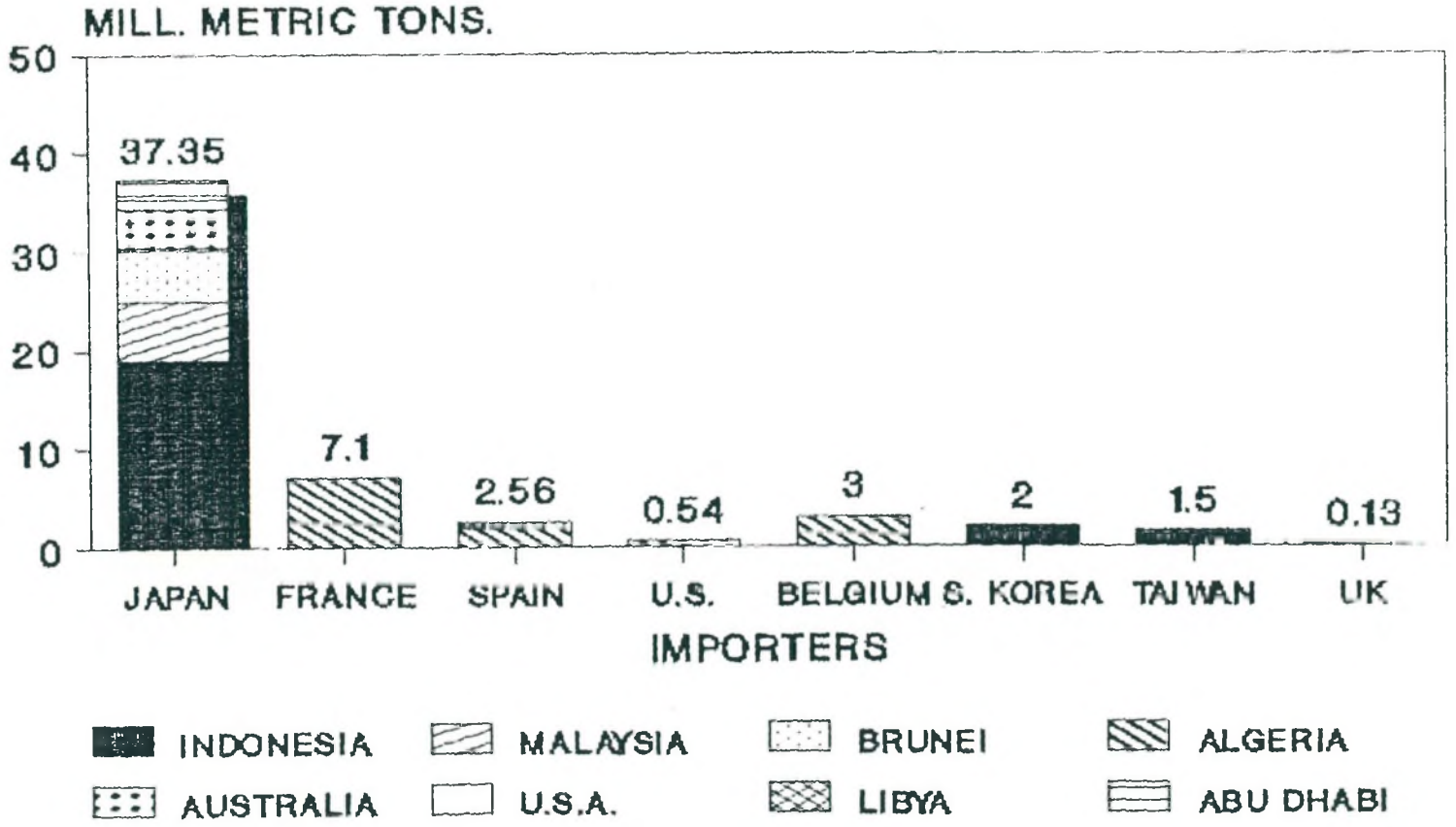
LNG IMPORTERS
YEAR 1990



NORPACIFICO LNG PROJECT

It would require great presumption to project that the actual volume of LNG shipped in the forecasted period will even come close to the following projections:

PROJECTION OF LNG TRADE (MM Tons)

YEAR	1995	2000	2005
MM TONS	84.10	125.47	129.47

Such a projection only accounts for all of the current projects.

The distribution of LNG trade would thus be broadened to include the U.S. and Europe in a greater extent than at the present time. The major consumption market would remain in the far east with over 75% of the market destined to Japan, Taiwan and South Korea.

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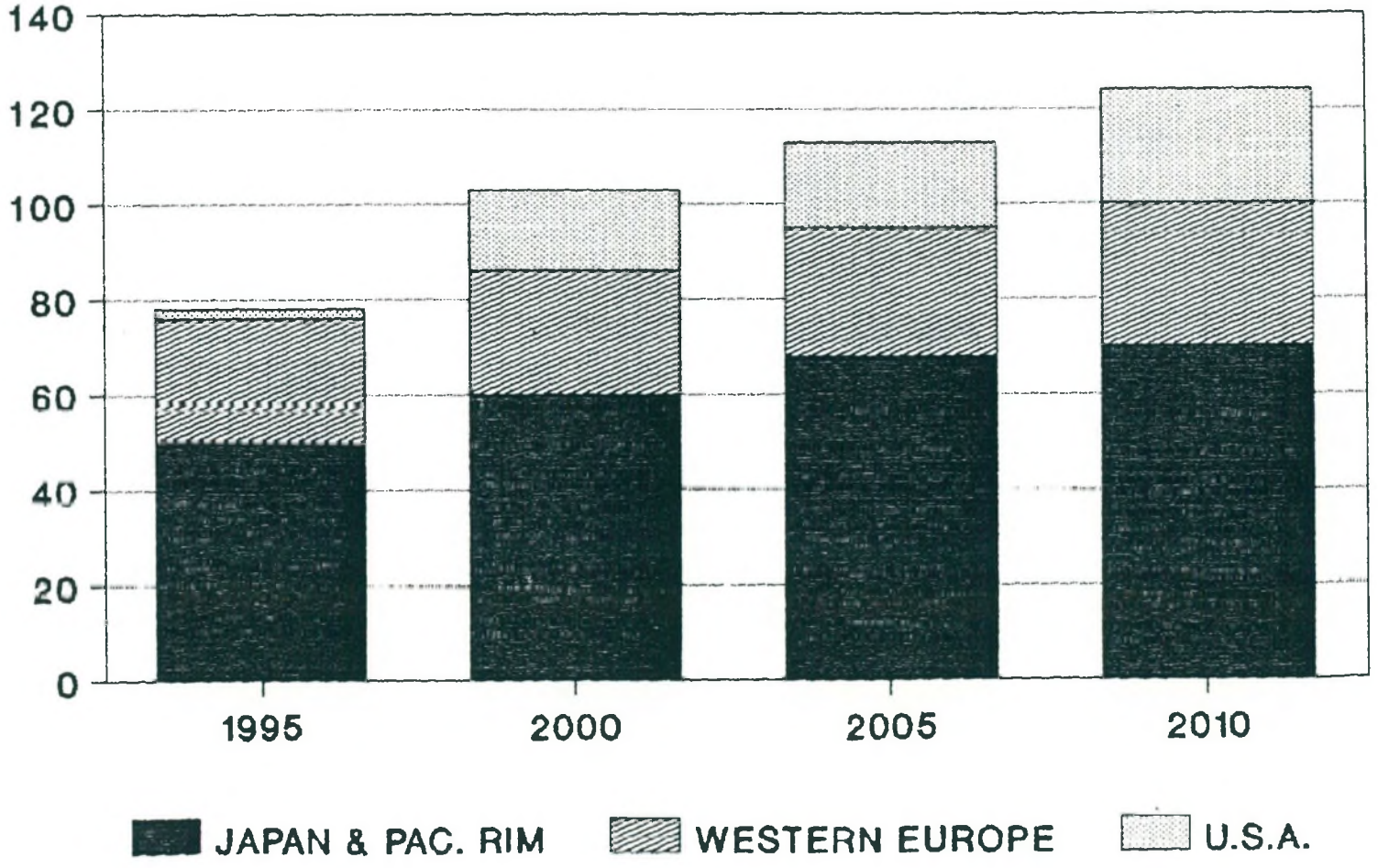
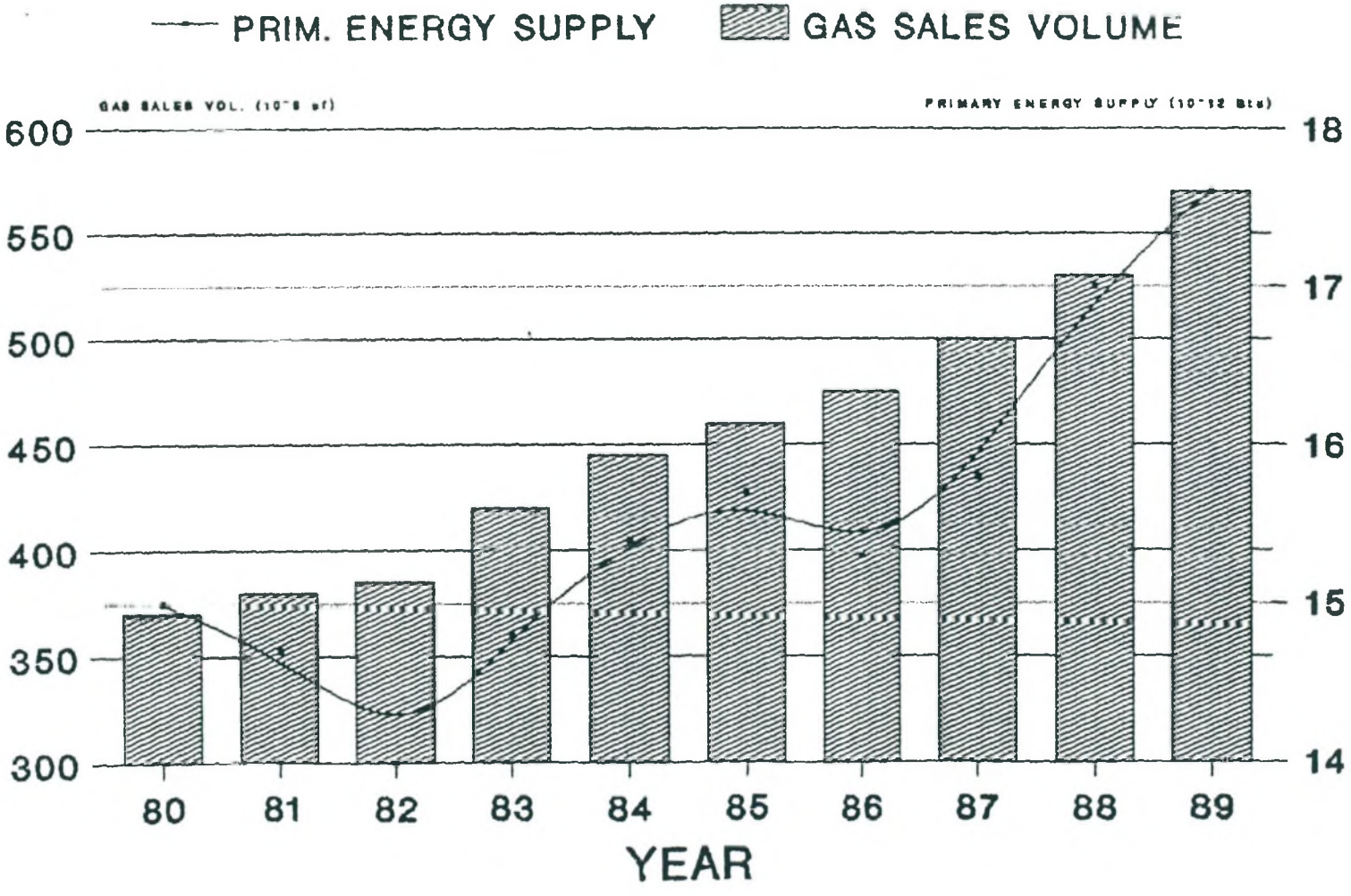
NORPACIFICO LNG PROJECT

LNG DEMAND GROW

SOURCE: ROYAL/DUTCH SHELL



GAS SALES VOLUME IN JAPAN



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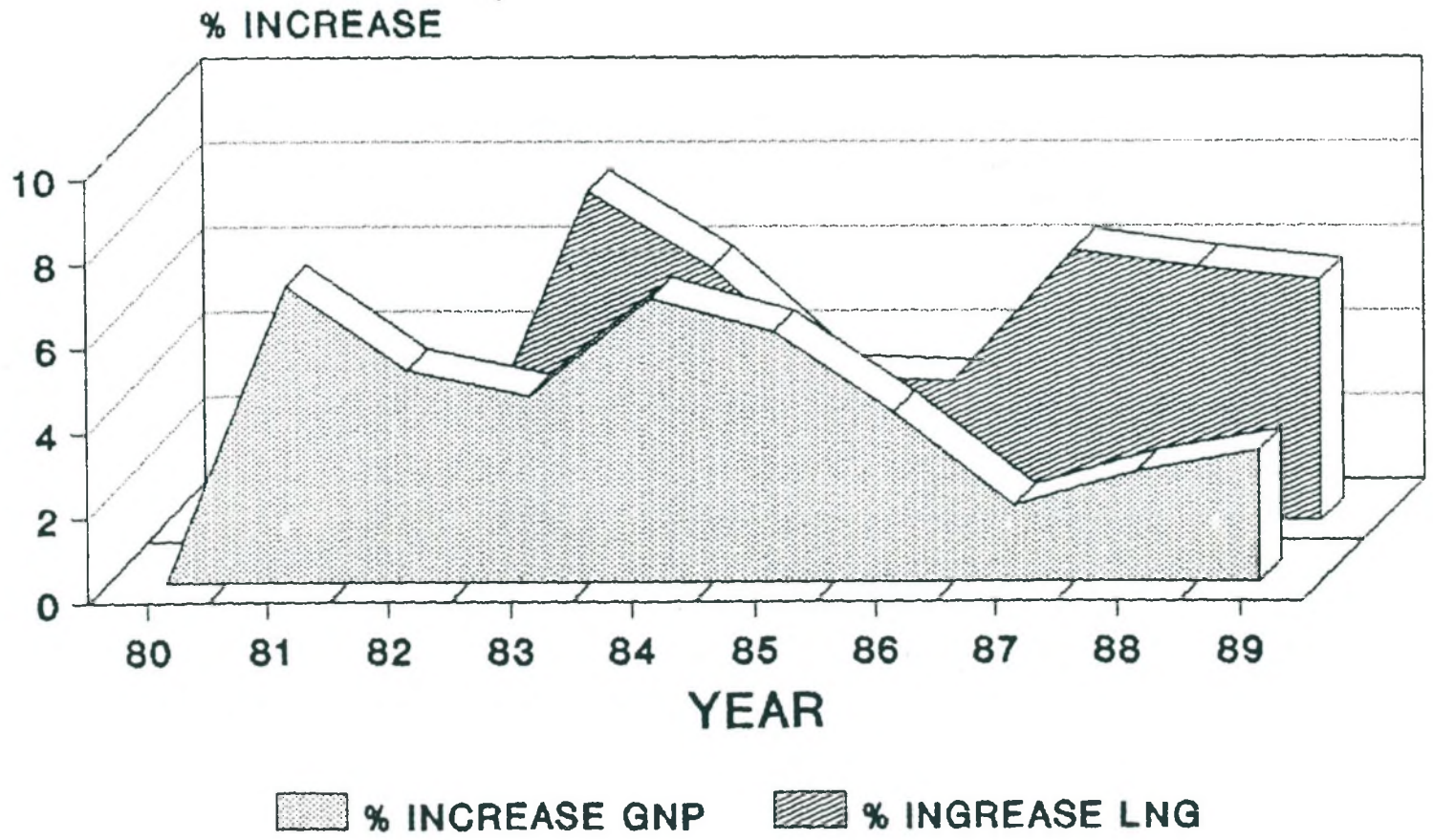
JAPAN
LNG SALES Vs. GNP



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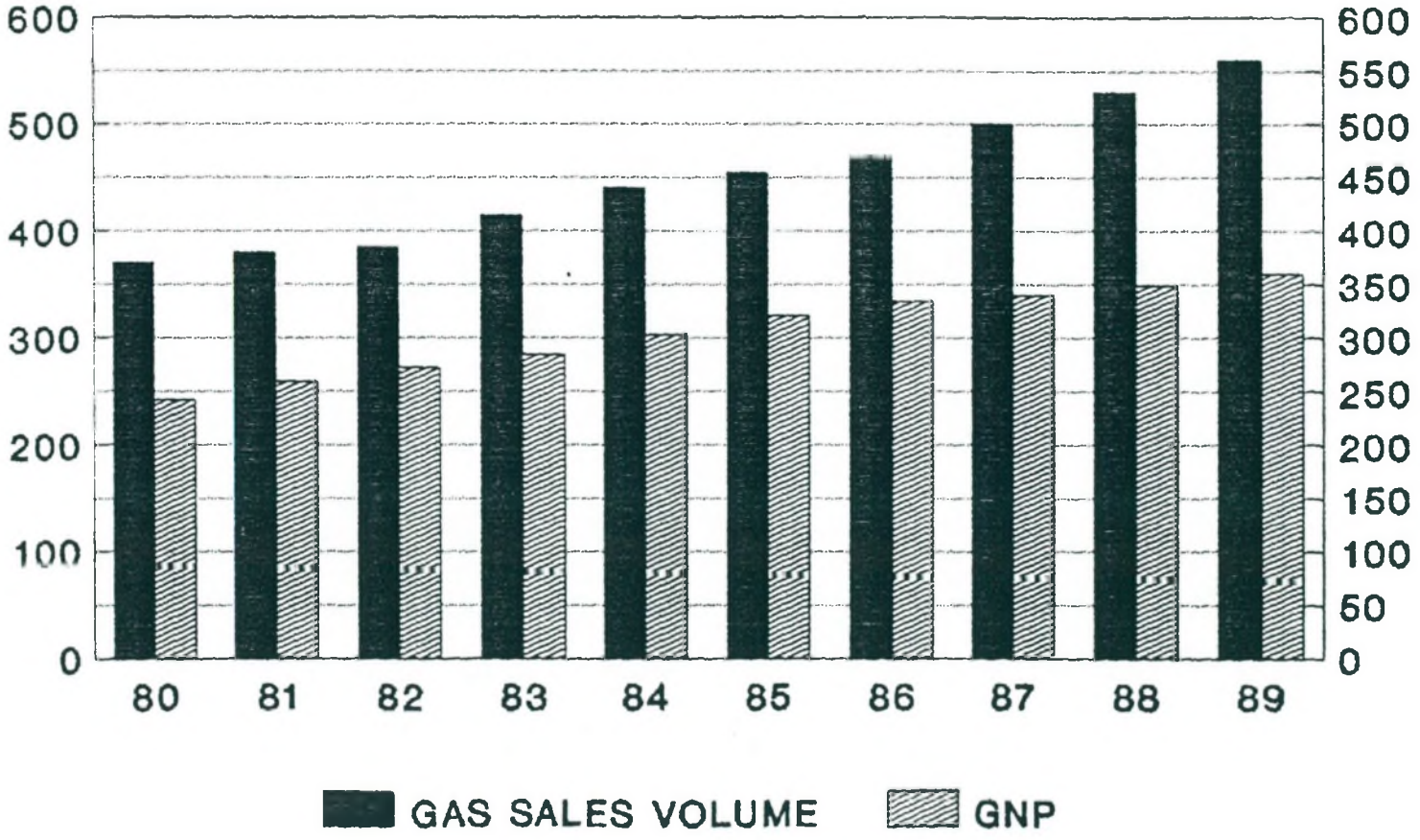
JAPAN
GAS SALES VOLUME



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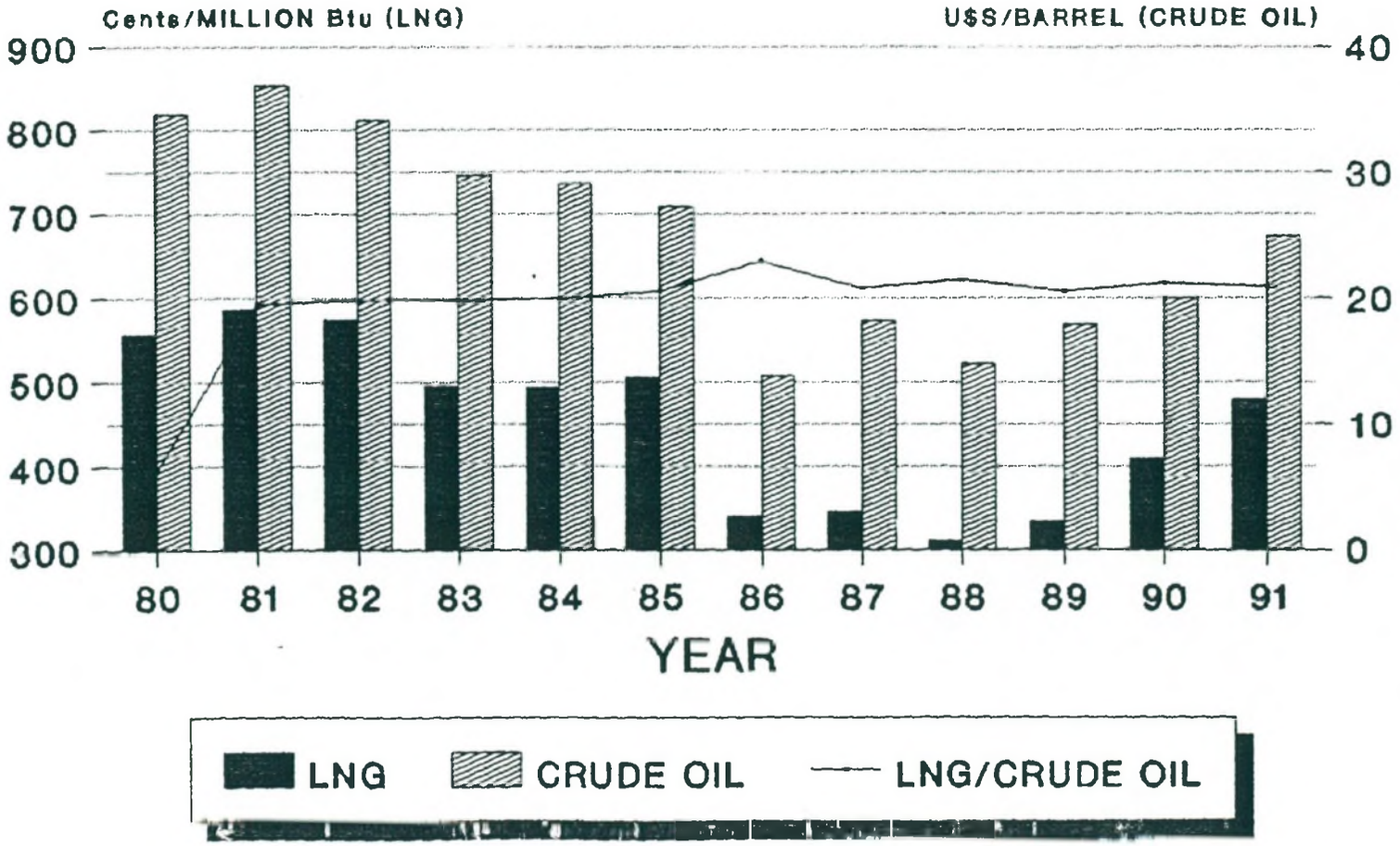
JAPAN
PRICES OF LNG & CRUDE OIL



NORPACIFICO LNG PROJECT

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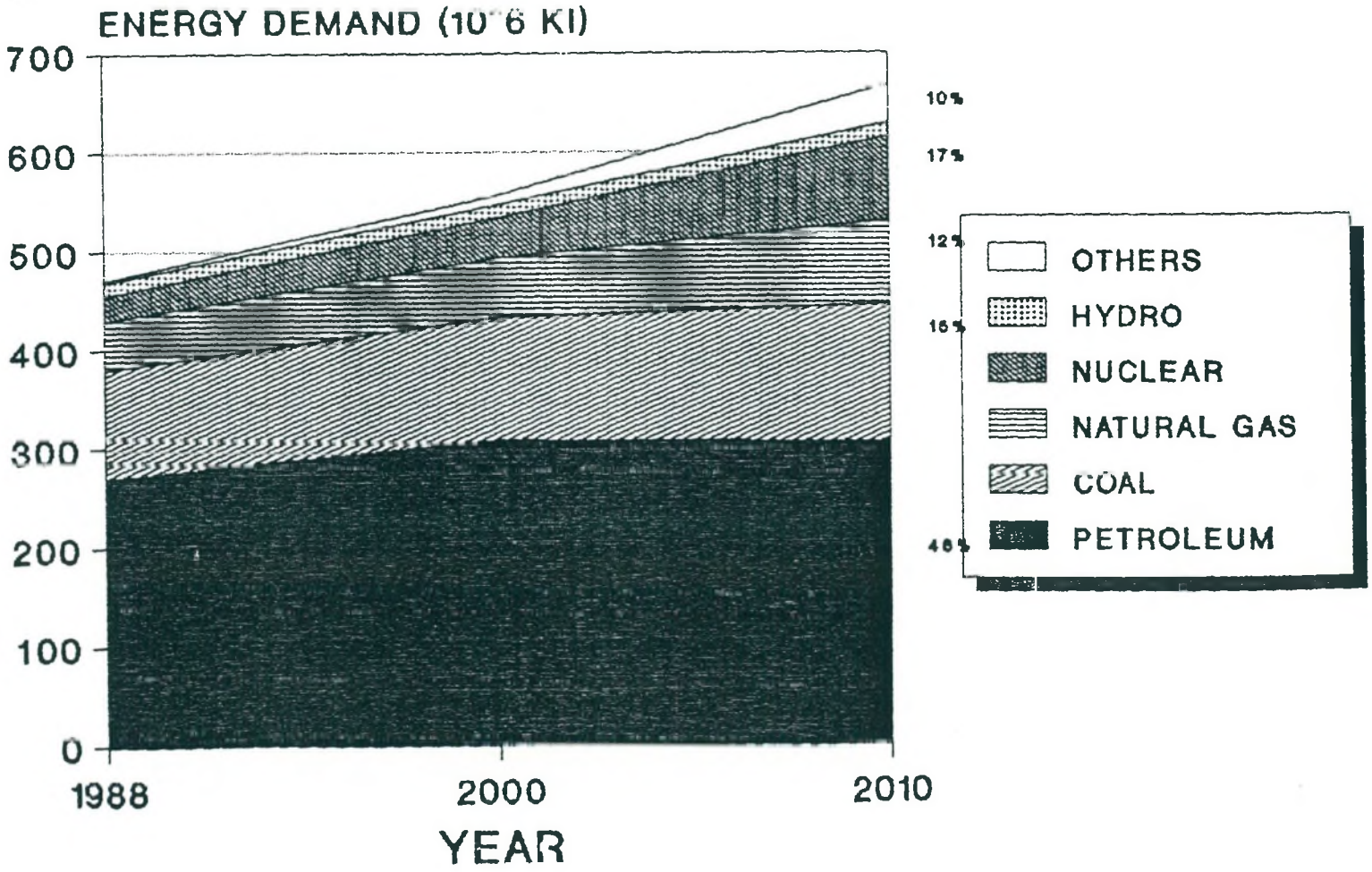
LONG TERM ENERGY OUTLOOK FOR JAPAN



NORPACIFICO ING. PROJECT

IV.- PRELIMINARY BUDGET

The amount of the investments required for the project attainment has been appraised upon maximum-flow assumptions.

It is possible to think in substantial reductions on the estimated prices, along the different stages, specially referring to equipment utilization, raw materials, and local labor force.

Without considering the necessary investment for the purchase of Argentine northwestern gas reserves, the following magnitudes have been foreseen:

INVESTMENTS REQUIRED

		MILLIONS
GAS PIPELINE (1ST. STAGE)	U$S	700/750
COMPRESSION STATIONS (2ND. STAGE)	U$S	70/80
LNG PLANT (1ST. STAGE)	U$S	750/800
LNG PLANT (2ND. STAGE)	U$S	700/750
SHIPPING (1ST. STAGE)	U$S	1.200/1.300
SHIPPING (2ND. STAGE)	U$S	1.200/1.300
TOTAL	U$S	4.620/4.980

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V.- ECONOMICS, SENSIBILITY ANALYSIS AND LNG PRICES

The following table indicates the investment return according to a range which oscillates between the floor and the roof of historic prices registered in the last years.

For the referred appraisal there have been considered CIF Japan harbor price quotations for million of BTU in U.S. dollars.

For the return equity esteem an equity of 30% of the investment.

In every case, the rate of return has been appraised after taxation and considering the project being accomplished in its two stages.

Though the present supply is determining CIF prices which oscillate between u$s 4.50 and u$s 5.00, an increase of them of about 10/12% is foreseeable as for within the next five years.

LNG PRICE
(CIF - JAPAN)

PRICE (USDOLLAR/MMBTU)	I.R.R. (%)	R.O.E. (%)
4.00	11.08	13.55
4.50	13.31	17.33
5.00	15.02	20.45
5.50	17.18	24.48

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			FIELD		PIPELINE		LNG PLANT		SHIPPING		GLOBAL PROJECT	
			IRR	ROE	IRR	ROE	IRR	ROE	IRR	ROE	IRR	ROE
	$OPERATING	-10	18.01	24.24	25.87	43.30	14.67	20.78	16.34	23.18	17.57	25.24
	$COSTS		17.95	24.12	25.71	42.98	14.00	19.43	15.85	22.24	17.18	24.48
	$	10	17.88	24.00	25.55	42.65	13.32	18.10	15.36	21.30	16.78	23.72
LNG SALE	$											
PRICE	$	-10	18.18	24.63	28.01	47.14	15.71	21.74	17.56	24.49	18.71	26.56
us/MMBTU	$INVESTMENT		17.95	24.12	25.71	42.98	14.00	19.43	15.85	22.24	17.18	24.48
5.50	$	10	17.72	23.63	23.75	39.50	12.54	17.51	14.39	20.32	15.83	22.66
	$											
	$FINANCIAL	-10	17.95	24.58	25.71	43.79	14.00	20.02	15.85	22.80	17.18	25.05
	$RATES		17.95	24.12	25.71	42.98	14.00	19.43	15.85	22.24	17.18	24.48
	$	10	17.95	23.68	25.71	42.18	14.00	18.87	15.85	21.70	17.18	23.93
	$OPERATING	-10	18.01	24.24	18.56	27.35	14.67	20.78	14.48	19.66	15.45	21.23
	$COSTS		17.95	24.12	18.36	26.98	14.00	19.43	13.97	18.72	15.02	20.45
	$	10	17.88	24.00	18.17	26.61	13.32	18.10	13.45	17.77	14.60	19.67
LNG SALE	$											
PRICE	$	-10	18.18	24.63	20.18	29.65	15.71	21.74	15.56	20.66	16.46	22.27
us/MMBTU	$INVESTMENT		17.95	24.12	18.36	26.98	14.00	19.43	13.97	18.72	15.02	20.45
5.00	$	10	17.72	23.63	16.81	24.74	12.54	17.51	12.61	17.05	13.76	18.85
	$											
	$FINANCIAL	-10	17.95	24.58	18.36	27.61	14.00	20.02	13.97	19.22	15.02	20.98
	$RATES		17.95	24.12	18.36	26.98	14.00	19.43	13.97	18.72	15.02	20.45
	$	10	17.95	23.68	18.36	26.38	14.00	18.87	13.97	18.23	15.02	19.98
	$OPERATING	-10	15.65	20.07	15.80	21.93	13.77	18.98	13.02	17.01	13.75	18.1[illegible]
	$COSTS		15.58	19.95	15.59	21.54	13.09	17.66	12.49	16.06	13.31	17.3[illegible]
	$	10	15.51	19.83	15.38	21.15	12.40	16.35	11.94	15.11	12.85	16.5[illegible]
LNG SALE	$											
PRICE	$	-10	15.80	20.40	17.24	23.70	14.74	19.77	13.10	17.79	14.66	18.92
us/MMBTU	$INVESTMENT		15.58	19.95	15.59	21.54	13.09	17.66	12.49	16.06	13.31	17.33
4.50	$	10	15.35	19.51	14.18	19.70	11.68	15.89	11.17	14.58	12.12	15.92
	$											
	$FINANCIAL	-10	15.58	20.33	15.59	22.08	13.09	18.21	12.49	16.52	13.31	17.73
	$RATES		15.58	19.95	15.59	21.54	13.09	17.66	12.49	16.06	13.31	17.33
	$	10	15.58	19.57	15.59	21.02	13.09	17.13	12.49	15.62	13.31	16.88
	$OPERATING	-10	15.03	19.03	11.17	13.70	10.96	13.74	11.49	14.34	11.56	14.35
	$COSTS		14.96	18.91	10.91	13.28	10.22	12.45	10.92	13.39	11.08	13.55
	$	10	14.89	18.79	10.64	12.85	9.46	11.18	10.34	12.43	10.59	12.75
LNG SALE	$											
PRICE	$	-10	15.18	19.34	12.29	14.75	11.69	14.05	12.33	14.91	12.33	14.91
us/MMBTU	$INVESTMENT		14.96	18.91	10.91	13.28	10.22	12.45	10.92	13.39	11.08	13.55
4.00	$	10	14.74	18.49	9.72	12.00	8.96	11.09	9.70	12.06	9.97	12.35
	$											
	$FINANCIAL	-10	14.96	19.28	10.91	13.68	10.22	12.89	10.92	13.80	11.08	13.95
	$RATES		14.96	18.91	10.91	13.28	10.22	12.45	10.92	13.39	11.08	13.55
	$	10	14.96	18.55	10.91	12.89	10.22	12.03	10.92	12.99	11.08	13.17
	$											

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NORPACIFICO LNG-PROJECT

COMISION NACIONAL DE ENERGIA
TEATINOS 120 - SANTIAGO - CHILE

Utilización del Gas Natural de Argentina-Bolivia en el Norpacifico LNG Proyect

El proyecto "Norpacífico LNG Proyect" elaborado por la empresa Argentina Upstream Services S.A. consiste en utilizar las reservas de gas natural probadas y probables en el noroeste Argentino y, también, en una segunda instancia, las reservas de gas de Bolivia. Para esto se construiría un gasoducto de 1002 km, desde la zona de Ramos, norte de Argentina, hasta Tocopilla de Chile. En esta ciudad chilena se instalaría una planta de gas natural licuado (GNL) para exportación, principalmenete a Japón, con capacidad de 2,75 millones de toneladas anuales de GNL, en una primera fase y 5,5 millones de toneladas en una segunda fase. El trayecto del gasoducto permitiría abastecer de gas natural a los grandes centros mineros de Calama y Chuquicamata, y, su capacidad de transporte sería de 14,75 millones de m3 al día, pudiendo aumentarse a 26 millones de m3 al día con la instalación de dos estaciones compresoras (el Norte de Chile podría consumir 5 millones de m3 al día).

Representantes de UPSTREAM efectuaron ante la Comisión una presentación de este proyecto el 11 de junio. Se nos informó que en diciembre de 1991 se firmó un joint venture entre Upstream Services y JAIDO de Japón, con el propósito de impulsar globalmente este proyecto. El estado de avance de éste es el siguiente :

- Reservas de gas. Se han realizados esfuerzos "avanzados" por asegurarse las reservas de gas necesarias para el éxito del proyecto. El joint venture señalado ha calificado para la licitación de la cuenca noroeste de Argentina, a realizarse en septiembre de este año, y, actualmente, están preparando la oferta correspondiente. UPSTREAM estima que los inversionistas japoneses aportarían hasta un 20% del capital en esta etapa del Proyecto. Las reservas de gas probadas en el noroeste argentino son 149,75 billones de m3 y las reservas estimadas son del orden de los 300 billones de m3. Bolivia tiene reservas probadas en el sureste por 116,4 billones de m3

Se invitó a SIPETROL a participar en el grupo que licitará los yacimientos argentinos.

- Gasoducto Argentina-Tocopilla. Sólo se dispone de una evaluación aproximada de su costo (700/750 millones de dólares en la primera etapa y 70/80 millones de dólares cuando se agregan los compresores necesarios para la segunda etapa). Aún no se ha definido el grupo que lo

abordaría y UPSTREAM estima que los capitales japoneses serían mínimos en esta etapa.

- Planta de licuefacción. La evaluación de costo de la planta es preliminar y aproximada (750/800 millones de dólares la primera etapa y 700/750 millones de dólares la segunda etapa). La estimación del aporte de capital japones para esta unidad es del orden del 50%.

- Transporte marítimo. Como en las unidades anteriores la *evaluación de* costo es aproximada (200 millones de dólares por barco). Para esta unidad se calcula que los japones absorberían el 100% de la inversión requerida en barcos gaseros, asegurando el control de las exportaciones de gas natural licuado.

El gasoducto, la planta de licuefacción y los barcos representan una inversión estimada de US MM$ 4.620 a 4.980 .

La opinión de los asistentes a la presentación es que el Proyecto está en etapa de idea avanzada y que mientras no se tenga un preacuerdo de contrato de compra-venta de GNL con Japón, su viabilidad es baja. Que, para ello, es indispensable una posición francamente favorable de JAIDO; la cual, a su vez, podría obtenerse si esta institución consiguiera evidencias de que se trata de un proyecto que cuenta con el respaldo de los Gobiernos de Chile y Argentina. Lo concreto, ahora, es la licitación de las reservas de la cuenca noreste de Argentina, anunciada para el 15 de Septiembre. En consideración de los antecedentes presentados al Consejo de la Comisión, los señores ministros acordarón analizar la compatibilización de este proyecto con las intenciones de integración gasífera con Bolivia; reunir mayores antecedentes de la idoneidad y compromiso de UPSTREAM de Argentina y JAIDO de Japón; y, considerar que este proyecto se materializaría a fines de la década.

Los representantes de UPSTREAM solicitaron explicitamente el concurso de las Autoridades chilenas, en conjunto con las argentinas, para apoyar este proyecto ante el Gobierno Japonés, particularmente ante la JAIDO; informando que este tema había sido conversado previamente con los representantes del Gobierno Argentino, Srs. Cavallo y Prol, quiénes les habrían confirmado su interés. Posteriormente han informado que producto de sus gestiones ante las autoridades argentinas, ésta propondría a la Autoridad Chilena un protocolo adicional al acuerdo de complementación económica suscrito entre ambos países el 2 de agosto de 1991.

GUIA DE INSTRUMENTOS DE APOYO A LA PYME

Para Industrias y Empresas de Servicios de Apoyo a la Producción

Julio de 1992
Elaborado por SERCOTEC

Auspician: Ministerio de Economía
CORFO
Banco del Estado

Patrocina: Secretaría Ejecutiva del Programa de Apoyo a la PYME