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GAS PROJECTS FROM A FINANCIAL POINT OF VIEW

Luigi ARCUTI
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2/paper 3

EGPC - IEOC

INTERNATIONAL SEMINAR
ON NATURAL GAS AND ECONOMIC
DEVELOPMENT - Cairo - February 26 - 27, 1982

GAS PROJECTS FROM A FINANCIAL POINT OF VIEW

LUIGI ARCUTI

1) It is with particular pleasure that I welcome the opportunity to address the participants of this conference.

The Istituto Mobiliare Italiano is the largest Italian institution extending medium and long term finance and export credit to industry. IMI has been able, therefore, to develop a substantial expertise in the assessment of large long term industrial investment projects. Such expertise, I believe, can be regarded as the basic skill for successful project financing.

In the field of natural gas projects, I would like to mention the role played by IMI in the financing of a substantial portion of the transmediterranean pipeline connecting the Algerian natural gas fields of Hassi R' Mel to the Italian distribution network (a total of 2500 kilometres of pipeline, including sections of deep-water submarine multi-pipeline systems).

The funding of such a large gas project (for an investment bill which totals 3500 million dollars) must realistically be provided through package financing. Consortia of Italian banks led by IMI extended buyer's export-credits for a total of nearly 800 million dollars. Additional funds were provided through a bond issue, by export credits from France and Japan, by the European Investment Bank and by means of international syndicated bank loans. These loans, which totaled over 400 million dollars, were coordinated by the Crédit Lyonnais and by the Bank of America and lead managed by a number of internationally well known large banks (the Italian banks were the Banca Commerciale Italiana and the Istituto Bancario San Paolo di Torino).

2) My career in banking started in 1945, at the very beginning of the reconstruction period which followed World War Two.

Remembering those years of toil for my country, I wish to recall, very briefly, the impact of the discoveries of natural gas on the economic development of Italy during the post-war period (the first successful drilling, by AGIP, took place in 1946 in the Po Valley).

Because of their limited volume, the Italian gas reserves were never able to be exploited for export purposes. Their use did allow, however, a reduction in the foreign currency energy bill, and thus a larger portion of the "European Recovery Program" dollar funds was made available for productive investment.

The natural gas discoveries made by AGIP financed the growth of the ENI group, which has since played a leading role in the industrial development of Italy. The price and marketing policies pursued by ENI have also encouraged a balanced growth of industrial and household energy consumption.

The need for bringing natural gas to the market induced long term investments in a pipeline network. The favourable effect on industry of such an infrastructure takes place through the following, mutually interacting, mechanisms (assuming, of course, that natural gas is cheaper than oil).

(a). Investments which improve the cost-efficiency of energy consumption can be regarded as a substitution of energy costs with physical capital which, to a large extent, embodies accumulated labour. This establishes a direct link with employment, industrial output and productivity growth.

(b). In the case of an energy-importing country, such as Italy, a reduction in the foreign currency energy bill eases the well known balance of payments constraint on economic growth.

(c). The improvement in the cost-efficiency of energy consumption is an important factor affecting the international competitiveness of industry, thus promoting export growth and import substitution. The ability to be competitive internationally, is extremely important for an energy importing country like Italy. It should be recalled that the industries of many Western European countries (which are our competitors in the field of foreign trade) can avail themselves of a widely extended pipeline grid which was begun in the late fifties to exploit the natural gas discoveries in France, The Netherlands, Western Germany, Norway and the United Kingdom.

For a developing country, then, investment in a pipeline network decreases the ratio of Balance of Payments deficit to Gross Domestic Product and allows savings and/or earnings of foreign exchange. This is likely to improve the risk ranking of the country and its credit worthiness, and so raising funds on the international financial markets is made easier.

The beneficial effects of all efficiency-improving infrastructures are, of course, especially relevant for the establishment and the development of medium and small industrial firms. These firms are, in turn, widely recognized as a principal element in all stages of the industrial development process. In Italy, the importance of medium and small firms has clearly been proven, both during the rapid growth experienced in the fifties and sixties and during the less favourable late seventies.

The pipeline network, started in Italy during the postwar period, has grown to a sizable 15,000 kilometers and is now connected to the liquefied natural gas (LNG) regasification plant in the port of La Spezia and three big international pipelines for importing natural gas from the Netherlands, the Soviet Union and the Democratic and Popular Republic of Algeria.

In part because of existing infrastructures, the 1981 Italian National Energy Programme, by the Ministry of Industry, envisages a growing contribution of natural gas to energy consumption (from its present level of 16% to

17.5% in 1985 and to 19% by the end of the decade).

An extension of the pipeline network to Southern Italy and to Sicily has also been planned. The ensuing improvement in the cost-efficiency of energy consumption should play a very important role in fostering the economic development of these areas. I may add that, in my opinion, cost reducing infrastructures can be more effective in promoting economic growth than traditional investment incentives, extended through capital grants, subsidized credit and tax benefits.

3) In previous papers and discussions, various aspects of the growing contribution of gas to economic development have been carefully spelled out.

Long term gas supply is expected to show a remarkable growth potential due both to the extent of known reserves and to the possibility of collecting and utilising associated gas (which is now being flared for a value of several billion dollars a year, at current market prices). Advanced engineering companies, such as those of the ENI group, have by now accumulated a sophisticated know-how, which allows them to meet almost any technical challenge. The project must however be economically and financially viable and, therefore, able to raise the necessary funds.

Long term demand is also expected to grow because of the technical advantages offered by natural gas;

provided, of course, that an adequate price differential with oil is maintained. It might be added that the only radical alternative to hydrocarbons, namely micro nuclear fusion contained by means of inertial confinement, has a development time of at least 20 to 30 years, according to the most optimistic estimates.

Clear proofs of the importance of natural gas are the giant pipeline projects which will take Alaskan gas to continental United States and Soviet Union gas from Siberia to Europe. The pipeline financing agreement with the USSR has already been entered into by France and the Federal Republic of Germany; Italy could soon follow.

The interconnected natural gas pipeline network which covers Western Europe also allows the different countries to arrange gas swaps, thereby increasing the security of supply.

I have briefly recalled demand and supply scenario forecasts (at the risk of burdening you with some unnecessary repetition) in order to point out that gas-related investments are indeed expected to take place on a very large scale.

According to "low case" estimates by the authoritative Institut Français du Pétrole, the investment bill in the eighties will range between 87 and 139 billion dollars, at 1981 prices. These figures do not include working capital requirements and interest costs during construction. Interest costs are important because investment gestation periods are rather long for gas projects and, as a rule, no gas can be produced, and no cash flow can be generated, until the last piece of equipment is in place.

4) The huge volume of investments which is required to develop energy projects makes it necessary for most countries to tap the resources of the international financial markets, where long term funds can be raised under different forms such as bank loans, syndicated loans, bond issues, export credits, development aid credits, etc.

By some estimates, the energy industry is already covering a full third of the syndicated Euroloan market. William Butcher, the chairman of Chase Manhattan bank, has forecasted that, in the next decade, the oil and gas industry will have to come to the world's money and capital markets for over 100 billion dollars a year, including working needs for short-term finance. Nobody in the major energy banks thinks this forecast is too high.

International financial markets have experienced an unprecedented development because of the necessity for recycling the massive and growing flow of foreign exchange to capital surplus OPEC countries.

The balance of payments surplus of OPEC countries is generated by the export of a product, namely oil, which has proven to be hardly price-elastic, especially so in the short run. In such a scenario a higher level of surplus absorption will result in a higher equilibrium level of economic growth on a world wide scale. This result is well known in the economic theory of transfer payments which was first systematically developed in the late twenties by Keynes and Ohlin.

The recycling of oil-export surpluses has until now been carried out with remarkable effectiveness by the international financial markets. This has avoided the risk of a world-wide depression. There are, however, some obstacles which will have to be overcome.

(i). Recent experience has destroyed the myth that international banking offers higher yields than domestic banking, even if the advantages of wholesale banking are taken into account. As a consequence, a number of banks seem less eager to continue international expansion at its previous pace. A greater emphasis is being placed both on profitability and on risk analysis. This increasingly more cautious outlook should, however, be welcomed. Economic history has shown time and time again that banking is not like any other business activity. The confidence upon which banking rests is a dangerously volatile element and the prudence of bankers is in fact their surest protection. One of the new and more remunerative activities which banks are seeking is, however, represented by project financing which, as we shall see, is particularly suited for large scale energy-related investments.

(ii). The persistently high level of inflation makes it difficult to forecast both real, inflation-adjusted, interest rates and future exchange rates (forward exchange rates have proven to be a remarkably unreliable estimator of future spot rates). One of the most obvious consequences of inflation is the disproportionate shortening of the maturity pattern of the liability side of banks' balance sheets as against the asset side. The build up of short-term liquidity inside and outside the banking system (of which the explosive growth of "money-market mutual funds" in the United States is the clearest example) is a development which, I believe, could have far reaching implications quite apart from the problems it raises for monetary control. If depositors do not have the confidence to hazard their funds on a long-term basis, and those making investment decisions cannot know the cost of funds beyond a short-term horizon, usually three or six months, investment decisions are bound to be fewer and, to some extent, distorted. This will result in impaired economic growth.

(iii). The potential growth in the volume of the surplus of some oil exporting countries could easily lead to overbanking on a world wide scale (with a further shrinking of the profitability of the conventional international loan business). This trend could, however, be corrected by a decrease in the well-known risk-consciousness of most OPEC investors, resulting in a larger percentage of OPEC funds being channelled directly to equity investment and project financing.

International development banks such as the World Bank Group, the European Investment Bank, the Islamic Development Bank have played an important role in the supply of financial resources and technical expertise to implement energy projects.

The World Bank Group (which includes the World Bank itself, the International Development Association and the International Finance Corporation) is by far the largest source of public support for energy development.

I read recently in an official news release of an exploration and development programme in the Western Desert of Egypt, supported by one of the loans made by the World Bank. This had a positive outcome, allowing the Egyptian State Oil Company to exploit possible recoverable reserves of 400 billion cubic feet of gas and 15 million barrels of condensate.

In some subsectors of energy related projects, the World Bank is virtually the only agency providing both technical advice and financial assistance. While it is highly desirable that other agencies expand their efforts, the very large investment requirements which lie ahead in developing countries are the basis for welcoming a further expansion of the Bank's activity in this vital sector (The World Bank "Expanded Program for Energy Development").

We should, however, keep in mind that constraints on the supply of funds are likely to affect adversely the operations of many international development banks, with the exception of those backed by capital-surplus OPEC countries.

Large amounts of long-term loans are also provided by the export-credit agencies of industrialized countries. Main features of such loans are the subsidized rate of interest and the insurance, by state companies, against all political and commercial risks. These cost and risk reducing features make export-credit loans a fundamental component of a financial package. Export-credit loans do not differ significantly from one country to another, because of the existing agreement to apply the same rules ("consensus" terms) for rates of interest, period, amount of finance as a percentage of the value of the goods exported, and so on.

The fundamental role played by export credits is supported by a well established evidence. I would like to mention, in addition to the already discussed transmediterranean pipeline from the Algerian natural gas fields to Italy, the recent 875 million dollar project financing of the COGASCO 1800 km pipeline across the Argentinian pampas. A total of 715 million dollars was provided by export credits and the remaining 160 million was raised through a $ 85 million euroloan and a $ 75 million syndicated standby facility.

In concluding this brief survey of the possible sources of funds for gas projects, I would like to add that finance can also be provided through government-to-government aid credits as well as by a number of development funds, those of the United Nations, the European Economic Community and the Arab oil exporting countries, for example.

5) Having given a sketchy survey of some of the problems related to the supply of funds for the financing of large scale energy projects, I would now like to point out that such projects, and in particular the financing of gas and pipeline projects, are typical examples of what in recent years has become widely known as project financing.

Project financing is now becoming more and more fashionable and is coming to represent a sizable sector of the international capital market. It is interesting to recall that the first project financing structures were developed in the fifties, by the largest U.S. banks, mainly to finance energy and mining industries in the U.S. domestic market.

Without going into unnecessary technical details, we can define project financing as the financing of a self-contained economic unit (which will be regarded as a closed economic system), its cash flow being subject to an appraisal independent of any direct support from the project sponsors.

In other words, the cash flow which is expected to be generated by the project is regarded as the main, if not the sole, source of funds from which the loan (or the package of loans) will be repaid.

In the case of ordinary balance sheet financing to large firms, the funds needed for the repayment of a number of liabilities are provided by the cash flow generated by a portfolio of investments. Liabilities typically cover a wide range of maturities and are, therefore, likely to generate a decreasing profile of debt servicing requirements.

Of course, all sizable medium and long term bank lending is, to some extent, project financing, in the respect that the impact of the new investment on cash flow and balance sheet forecasts must be carefully analyzed. In balance sheet financing however, banks can rely on the track record of existing investments and, in most cases, on the significant risk reduction due to a diversified investment portfolio. Medium-sized oil or gas projects by large sponsors, can easily be financed on the basis of the cash flow generated by existing fields already in production.

The magnitude of the investments involved and the single purpose nature of large gas projects has often made it necessary to treat each project almost as a self-contained equity for the purpose of financing and implementation.

The banks involved will, therefore, have to undertake an analysis of the project itself, one far more thorough and so requiring greater specific skills and technical knowledge than are usually necessary for conventional credit analysis.

Project financing, in the strictest sense of the term, implies that the lenders take a number of project-associated risks (limited-recourse and non-recourse financing).

Limited-recourse project financing through bank loans and syndicated loans will, of course, be more expensive than balance sheet financing. The return on assets for the lenders usually ranges between 1% and 1.25% per year over that for ordinary lending. This is due to higher spreads, to stiff management fees and to the commitment fees over the extended drawdown periods which derive from the long investment gestation lags.

The average cost of the financing package can, however, be reduced by obtaining subsidized interest rate export-credits and aid loans by bilateral and by international development institutions.

The banks' involvement implies a careful assessment of risk which can be geological, completion and cost overrun, operating, marketing and price, political and socio-economic.

The attitudes of bankers towards project-associated risks are rather mixed. Some believe that they are asked to take equity-holders' risk without adequate return in the case of a favourable outcome (facing investors' risk and receiving lenders' profit). Others believe that the higher return on assets is a sufficient compensation for risk-taking.

These opposing views are perhaps due to the higher level of competence and technical skill in project evaluation which allows large and experienced institutions to carefully assess risks and to build-in adequate safety margins. It should also be noted that rapidly rising energy prices have substantially improved cash flows, thus rescuing a number of projects which otherwise could have shown a loss.

The question of whether sufficient equity financing will be available, is, of course, quite critical. Adequate equity capital is the necessary basis for every sound financial package, not only because of leverage reduction but because, more generally, it embodies the sponsors' own involvement.

6) ~~Before proceeding to a brief survey of the components of a financing package for natural gas projects - commercial bank loans and syndicated loans, bond issues, export credit, loans by international development institutions, etc. -~~ I would like to say a few words on

the important issue of the interrelation between economic viability assessment and financial planning.

Project appraisal from an economic point of view implies a dynamic optimization exercise. This must take into account the likely future trends of a number of exogenous variables (typically demand and prices) and a large number of control variables such as the scale of the investment, the choice of techniques taking into account the costs of feasible alternatives, the quantity to dedicate to export and to domestic consumption, etc.

Project analysis, from an economic point of view, is therefore designed to optimize, subject to capacity constraints, the net present value which can be derived by the exploitation of gas resources.

It is quite evident that a number of factors relevant to economic planning and viability assessment cannot be associated with a relevant market price. This is either due to the lack of such a price (as in the case of intergenerational equity considerations) or the lack of relevance in the market price (the typical example being industrial wages in a scenario of unemployment or underemployment).

While economic planning and viability assessment should logically come before financial planning, it must be emphasized that all those elements (shadow prices) which do not contribute to cash flow should be regarded as irrelevant for the purpose of fund raising.

The constraints imposed by fund raising therefore interact with other aspects of economic planning and should be taken into account for a global optimization.

THE EXPERIENCE OF THE ITALIAN GAS INDUSTRY AND THE FUTURE ROLE OF NATURAL GAS

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1/paper 3

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THE EXPERIENCE OF THE ITALIAN GAS INDUSTRY AND THE FUTURE ROLE OF NATURAL GAS

GIAMPAOLO BONFIGLIOLI

1. INTRODUCTION

I have pleasure in honouring the invitation to address this International Seminar about the experience of the Italian gas industry and the future role of natural gas in Italy.

I intend to set about this by first explaining the Italian experience obtained so far, from the start of the use of domestic natural gas, to the achievement of the import systems from Lybia, the Netherlands, the Soviet Union and the new pipeline from Algeria.

After having explained the present market structure in Italy, I should like to outline our National Energy Plan and the foreseeable future development of the role of natural gas.

2. THE EARLY UTILISATION OF DOMESTIC NATURAL GAS

SNAM, the company of the ENI Group which is mainly in charge of the supply, transport and sale of natural gas to the Italian market, started its gas activity in the beginning of the '40s, when the first gas fields were discovered in the Po Valley, the most industrialised area of Northern Italy.. New gas fields, both onshore and offshore, were discovered, mainly by AGIP, but also by other companies. SNAM then extended its activity and its network throughout the whole Italian peninsula (Fig. 1)

SNAM's first customers for the pipeline system were those of heavy industry, such as cement plants, electric power stations, iron and steel factories, followed by the new fertilizer plants based on natural gas.

The pipeline network was later extended to supply the lower consuming medium and light industries, towns and villages. The construction of the urban distribution system and the build up of consumption required several years and the unit investment per m^3 sold was high. Both the small industrial and household consumers are premium users of natural gas, particularly in congested built_up areas where there is high atmospheric pollution. (Fig. 2)

3. NATURAL GAS IMPORTS FROM LIBYA, THE NETHERLANDS AND USSR

In order to face the growing market demand SNAM began in the early 1960s to study the possibility of importing large quantities of gas either by pipeline or as LNG.

The first project to be implemented was that of importing 3 billion m^3 per year (about 300 million cu.ft. per day) of LNG from Libya for twenty years. (Fig. 3)

The contract was signed in 1965 and the first deliveries began in 1971. The gas, liquefied in the Marsa El Brega plant in Libya, is trasported by LNG tankers to La Spezia, where it is then unloaded, stored and regasified in a plant operated by SNAM.

The La Spezia plant was the first of such large capacity plants of its kind to be built in Europe.

At the end of the '60s, two important contracts were signed for the importation of gas from the Netherlands and the Soviet Union. The contract for Dutch gas covered the importation of 6 billion cm/year (about 600 million cu.ft. per day) and required the laying of a 826 km (about 510 miles) large diametre pipeline (38" - 34") in a joint venture with the local gas industry from the Netherlands' border, across Germany and Switzerland to Italy. Many difficulties were encountered during the construction period, such as the crossing of the Alps, where an elevation of 2.400 m (about 7.900ft.) above sea level was reached. Here, in order to avoid the main peaks, 13 tunnels of a total length of 38 km (about 24 miles) were built.

The construction was completed in early 1974, and deliveries began in May 1974. (Fig. 4) Imports from the Soviet Union began at about the same time with the volume of gas to be imported being 7 billion cm/year (about 700 million cu.ft. per day).

In this case the gas is sold by the Soviet supplier at the Czechoslovakian - Austrian border. Once again SNAM was responsible for the construction of the transportation system.

This project was a joint venture between SNAM and the Austrian gas industry, comprising a 774 km (about 480 miles) pipeline, with a diametre of 38" - 34", crossing Austria to the Italian border where it then connects with the Italian gas network system.

It is important to underline that, through these two pipelines, the Italian grid is well connected to all the gas networks of the major European countries.

4. THE ALGERIA - ITALY PIPELINE

The last and most recent contract entered into by SNAM provides for the importation from Algeria of 12.4 billion cubic metres of natural gas a year (about 1,240 million cu.ft./day) for a period of over 25 years. It is foreseen that this supply will start within the next few months with peak level being reached in 1985.

The pipeline starts from the Hassi R'Mel gas field in the Algerian Sahara and has a total length of about 2,500 km. (1,500 miles). It crosses Algeria, Tunisia, the Sicilian Channel, Sicily, the Messina Straits, up through Italy, to be connected near Bologna with the Northern grid.

Considerable technical problems had to be overcome concerning the crossing of the Messina Straits and the Sicilian Channel where depths of 600 metres (about 2,000 ft) were reached for the first time (Figs. 6 and 7).

In order to overcome these problems new engineering techniques were devised by SNAMPROGETTI and new equipment and new concepts of pipe-laying had to be designed; one example of this is the SAIPEM "Castoro Sei" pipelaying vessel. (Fig. 8).

The pipeline has a diametre of 48 inches across Algeria, Tunisia, Sicily and Italy up to Rome. From Rome to the link-up with the Northern grid (near Bologna), its diametre is 42 inches; in the Sicilian Channel as well as in the Messina Straits 3 lines of 20 inches each have been laid.

There are eight compressor stations along the route. Engineering and construction works along the whole of the route of the pipeline were carried out by companies of the ENI Group.

5. THE ITALIAN GAS MARKET

Natural gas plays an important role in the supply of energy to Italy. In 1980 total energy consumption in Italy was about 147 million tons oil equivalent and the total amount of gas sold about 27 billion cubic metres (about 2.700 million cu.ft. per day) of which 53% was imported. This figure represents 15.5% of total Italian energy consumption. (Fig. 9)

In 1980, of this, SNAM supplied gas to 2,960 industries and 1,670 towns: approximately 7.5 million households, representing about 50% of the Italian population, were supplied. Preliminary figures for 1981 show a general reduction of about 3% in the sales of natural gas and total energy consumption.

In 1980, the total natural gas availability was divided as follows: 41% to the industrial sector, 40% to public distribution, 9% to fertilizer and other petrochemical uses, 9% to power stations and 1% to the automobile sector. (Fig. 10)

In fact 250,000 cars in Italy are run on natural gas, compressed at 200 atmospheres, and distributed through 220 filling stations. Of the amount delivered through the public distribution network 73% was used for heating, 20% for household cooking and water and the remaining 8% for other commercial and small businesses.

In 1980 natural gas met about 29% of energy demand in the household sector (32% for heating), 24% for industrial use, 27% for the petrochemical sector, 7% for power plants and 1% for the automobile fuel sector.

6. THE PIPELINE NETWORK AND STORAGE SYSTEM

SNAM directly operates the Italian gas pipeline network which in 1980 exceeded 14,700 km (about 9,150 miles) in length, and now covers the whole of Italy. (Fig. 11)

This network consists of a system of pipelines connecting the national onshore and offshore production centres, the La Spezia re-gasification terminal and the international gas pipelines, to all industrial and domestic consumers throughout the country.

Seven underground storages provide for peak winter demand and fulfil the strategic function of providing gas in the case of temporary interruption of imports.

The entire network is kept continuously balanced, controlled and regulated through a centralised computer system.

The SNAM dispatching centre controls

the compressor and regulation stations, the main line valves, cut-off of pipeline sections and modulation of the gas flow rate throughout the country.

Sixty-eight operating centres are strategically placed throughout the country to provide assistance and maintenance for the system.

7. THE NATIONAL ENERGY PLAN AND FUTURE DEVELOPMENT

The natural gas market in Italy is still in an expansion phase. In 1985, when the deliveries of Algerian gas will have reached peak level, SNAM will be supplying 35 billion m^3 of gas per year (about 3,500 million s cf per day), covering about 18% of total Italian energy requirement. Gas will be supplied to 3,700 industries and to over 2,000 towns through the main network having a length of over 18,000 km (11,200 miles). Households supplied with gas will amount to about 10.5 million (about 2/3 of the Italian population). According to the National Energy Plan, assessed by the Minister of Industry and approved by Parliament in November 1981, the role of natural gas in covering the Italian energy demand is forecast to be increased over the next 10 years. By 1990 total gas consumption will reach 45 billion m^3 (4,500 million s cf/day), corresponding to about 20% of the total energy demand at that time.

Expansion of the premium sectors, both industrial and household, is expected. Due to the mild climatic conditions (with a minimum of heating consumption required) and the geographic dispersal of industry in the Southern Regions, the extension of the pipeline system is proving to be very costly. Because of this, the Plan foresees, with the EEC, financial aid for the urban distribution network.

In order to improve the total load factor and to face a possible temporary reduction in imports, the Plan recognises the importance of maintaining a constant supply in the volume on an interruptible basis for power plants.

Within the Plan, emphasis is also given to the increase in seasonal and strategic underground storage, necessitated by expansion within the premium sectors and imports. For strategic reasons, domestic production is expected to be decreased from 13 to 7-8 billion m^3/year. In accordance with the National Energy Plan, which stresses the need for diversification of the sources of supply of natural gas, SNAM's activity in the field of gas supply continues to intensify; so new agreements, mainly in association with the most important European gas companies, are being drawn up for the importation of natural gas from other sources, some of which are often geographically situated remote from Italy.

Amongst these, I can indicate the agreement with Nigeria. According to this, SNAM will import a volume of LNG equal to 1.4 billion m^3 of gas per year for 20 years (about 140 million s cf per day).

Because of the considerable and constant increase in energy prices, gas transportation costs, although high, have a lower impact on the final cost of gas. Therefore, natural gas producing countries which, due to their distance from the consumer markets were previously considered to be uneconomical, are now being regarded as potential suppliers.

The expected expansion of the role of natural gas in Italy, as in other European countries, is based on the hypothesis of its availability to the final consumer at a price competitive with that of other sources of energy. It is also necessary that natural gas will continue to be considered a secure source of supply.

Should prices, however, reach the levels some producer countries require, namely the same price as that of crude oil FOB, the role of natural gas would be reduced. This concerns not only Italy but also other importing countries. In the case of Japan, which has practically accepted the CIF parity, the role of natural gas is marginal and covers only 6% of primary energy needs.

The future of the international natural gas trade will depend upon the results of the debate on the sales price FOB producing countries.

8. CONCLUSIONS

In concluding my contribution to this Conference, I would stress that the forecasted increased in the availability of natural gas in Italy until the year 1985 is based on the new imports from Algeria and future imports after that period will allow the further development of natural gas.

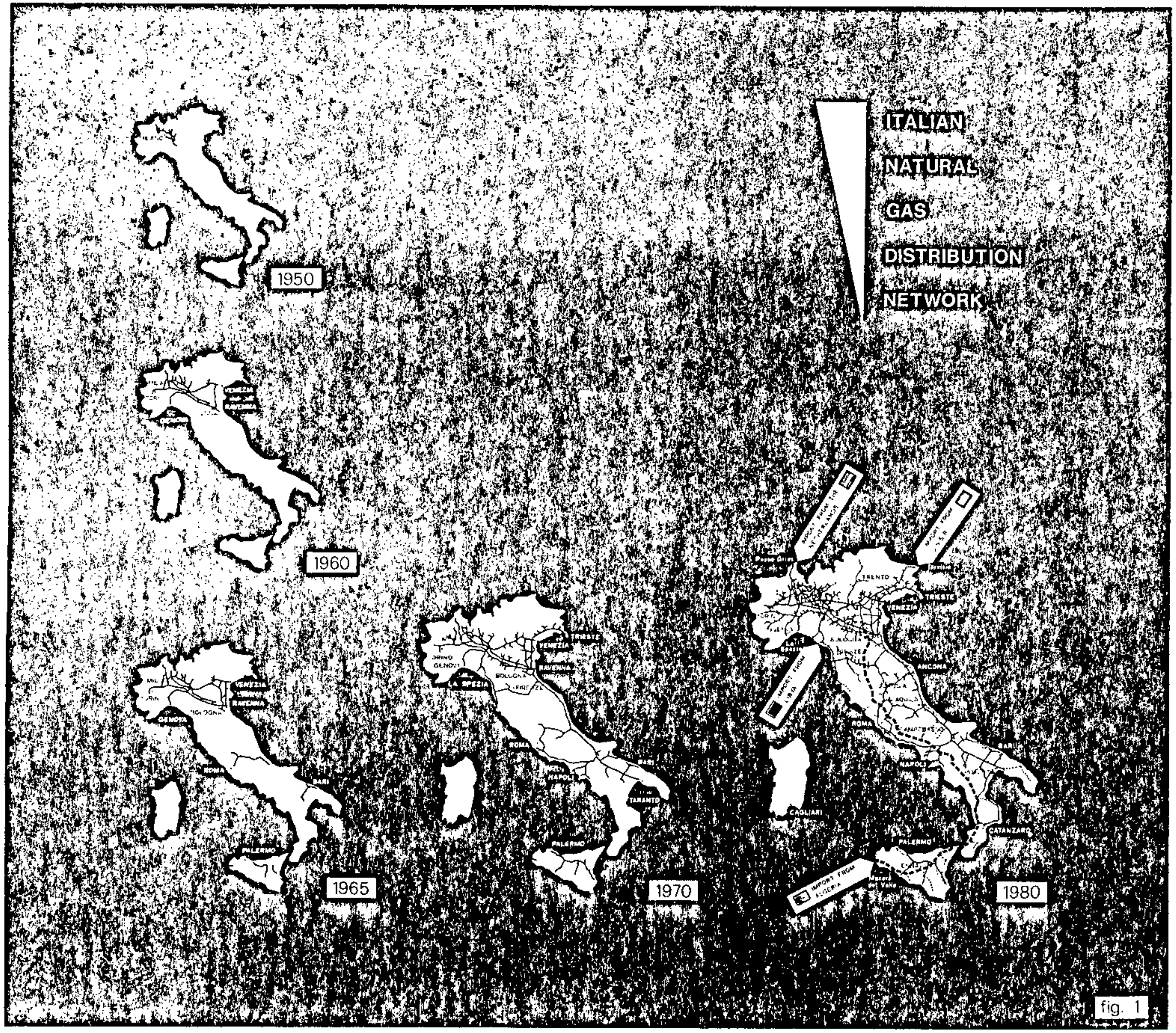
The Italian gas industry is ready to continue its efforts in the technical, economic and financial fields, in order to further develop all systems of importation, the expansion of the transmission and distribution system, the development of underground storages and all means of enabling the improvement of the use of natural gas.

It is also necessary, however, that on the one hand the final customer has an assured price competitive with that of other sources of energy, and on the other, the producing countries have the maximum possible FOB price for the natural gas they export in order to develop their economy.

I should like to end my speech with the optimistic wish that we may find a fair solution to such a problem, due both to the energy requirements of the importing countries and the revenue of the producing countries through the sale of their natural gas surplus.

In the context of what I have just said, I can envisage a future joint effort between the Egyptian and Italian gas industries, for the development of the gas activity in Egypt by availing themselves of the Italian experience gained and, by possibly starting exports to Italy and other European countries of any natural gas surplus.

In such a case Egypt's geographic position could suggest the possible siting of an LNG reception terminal in Italy (perhaps on the Northern Adriatic coast), to handle the volume of gas destined for the various European markets.


ITALIAN
NATURAL
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NETWORK
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CATANZARO
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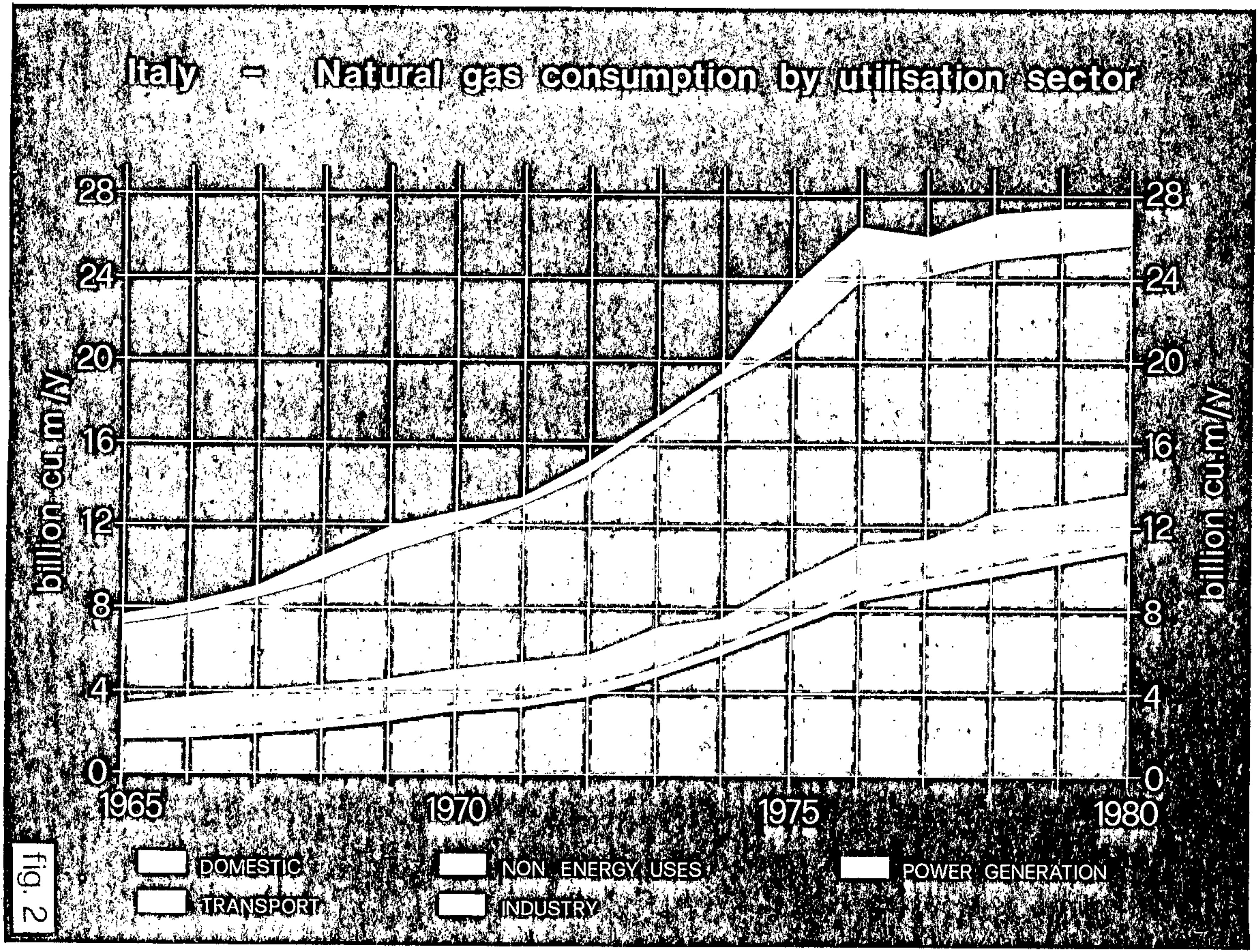
IMPORT FROM ALGERIA

fig. 1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POWER GENERATION
fig. 2

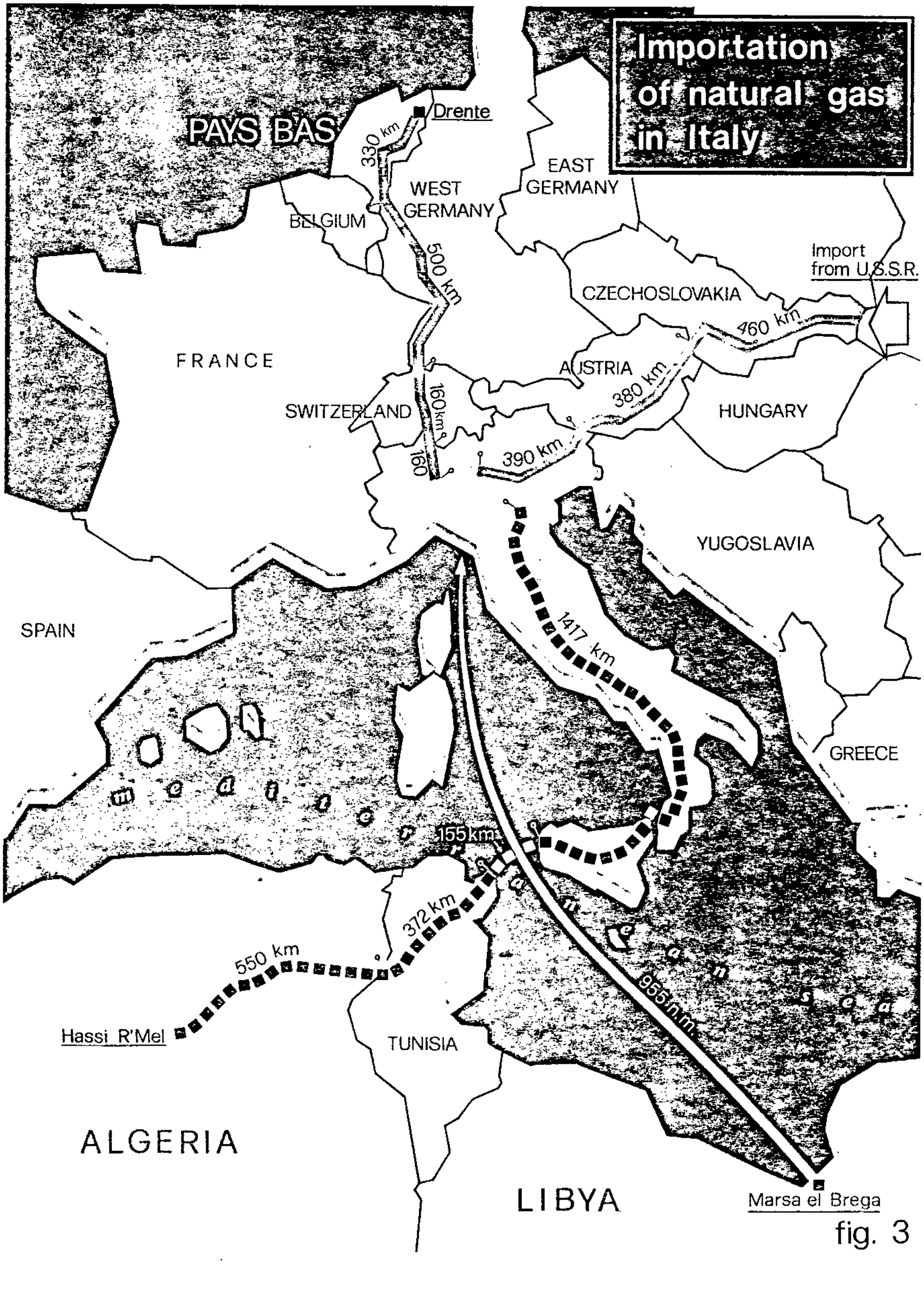

Importation of natural gas in Italy
PAYS BAS
Drente
330 km
500 km
160 km
160
WEST GERMANY
EAST GERMANY
BELGIUM
FRANCE
SWITZERLAND
CZECHOSLOVAKIA
AUSTRIA
HUNGARY
YUGOSLAVIA
GREECE
SPAIN
Import from U.S.S.R.
460 km
380 km
390 km
1417 km
155 km
372 km
550 km
955 n.m.
Hassi R'Mel
TUNISIA
ALGERIA
LIBYA
Marsa el Brega

fig. 3

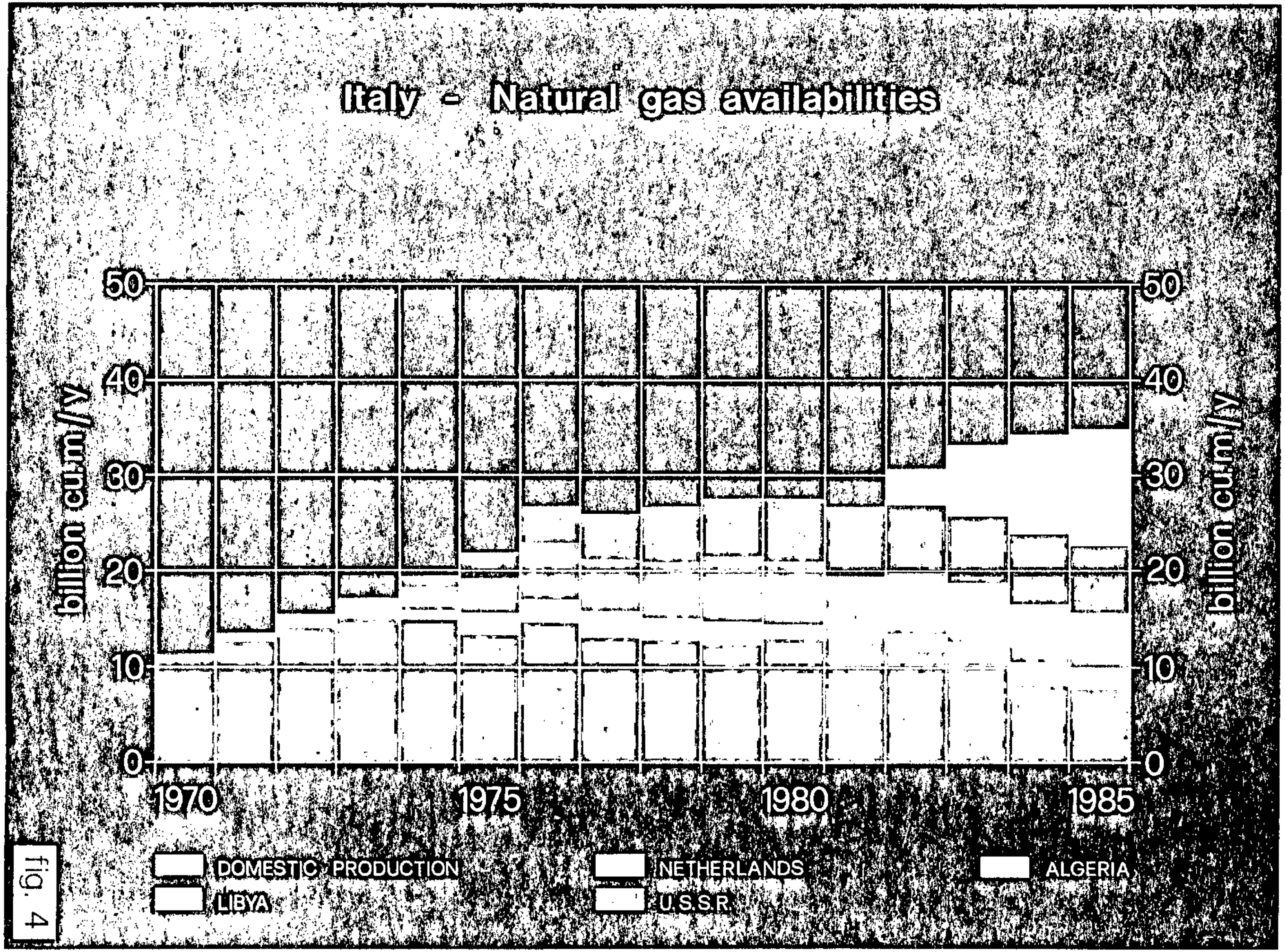
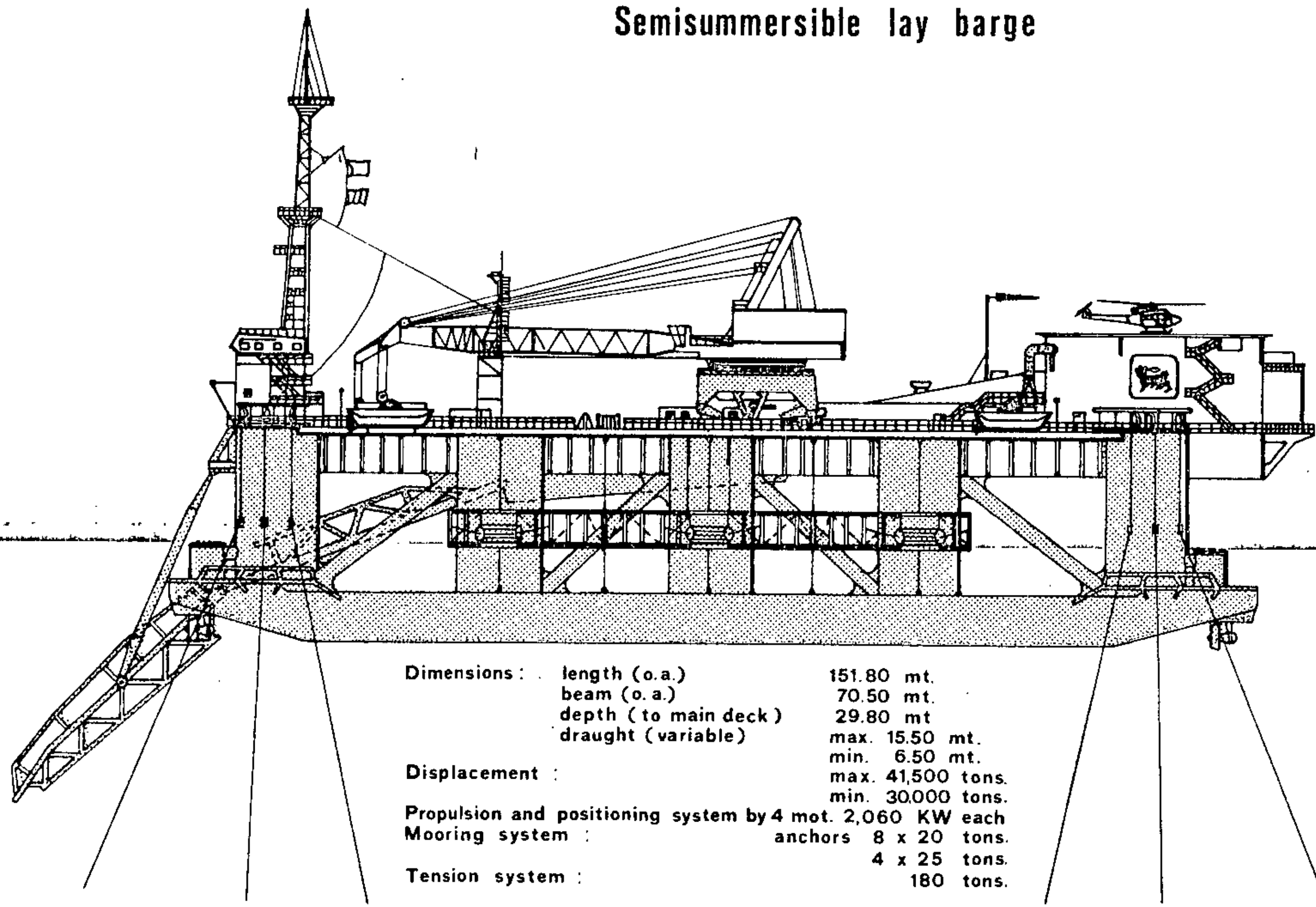

Italy - Natural gas availabilities
billion cu.m/y
50
40
30
20
10
0
1970
1975
1980
1985
DOMESTIC PRODUCTION
LIBYA
NETHERLANDS
U.S.S.R.
ALGERIA

fig. 4

CASTORO VI

Semisummersible lay barge



Dimensions :	length (o.a.)	151.80 mt.
	beam (o.a.)	70.50 mt.
	depth (to main deck)	29.80 mt
	draught (variable)	max. 15.50 mt.
		min. 6.50 mt.
Displacement :		max. 41,500 tons.
		min. 30.000 tons.
Propulsion and positioning system by		4 mot. 2,060 KW each
Mooring system :		anchors 8 x 20 tons.
		4 x 25 tons.
Tension system :		180 tons.

fig. 8

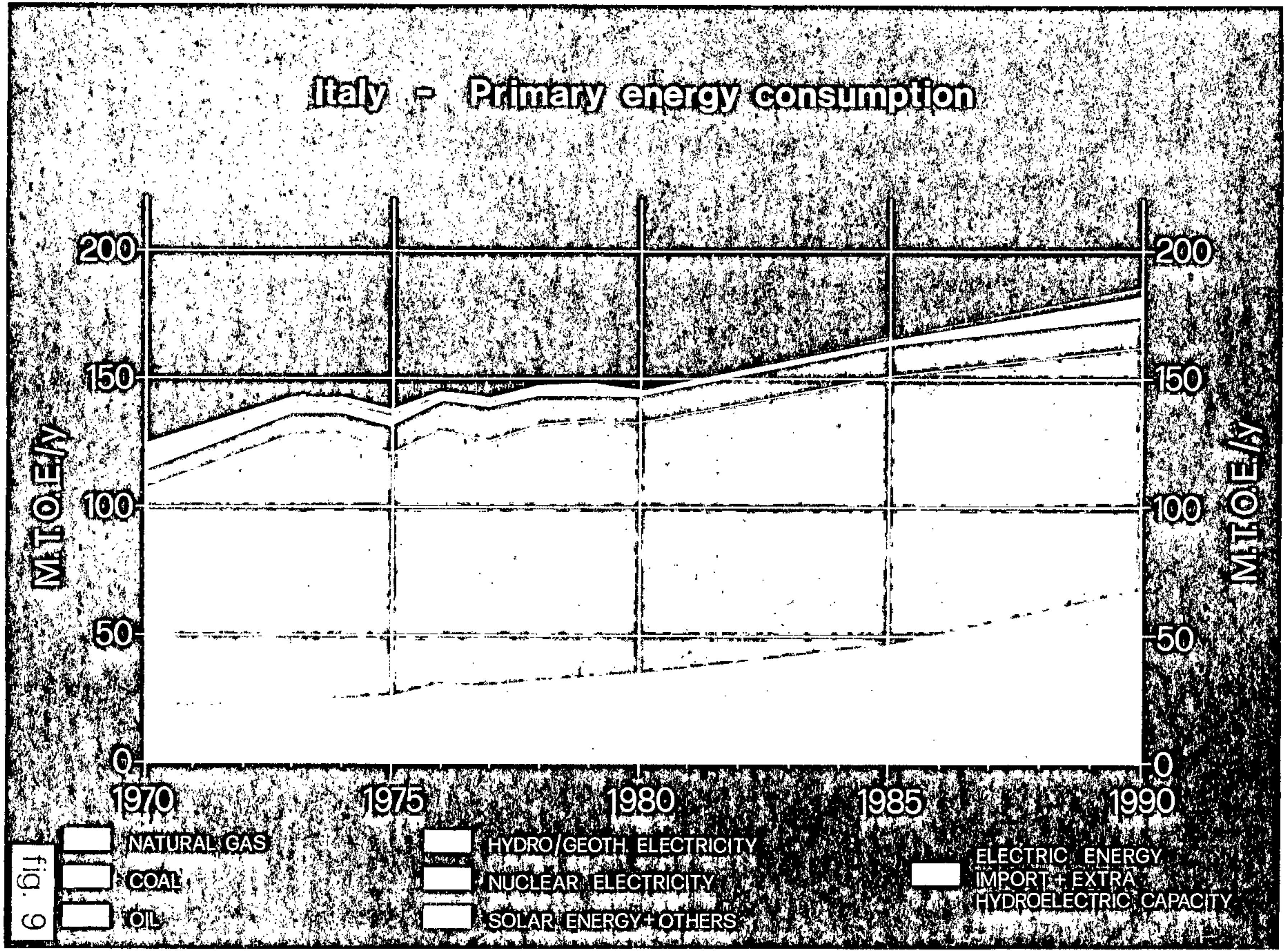
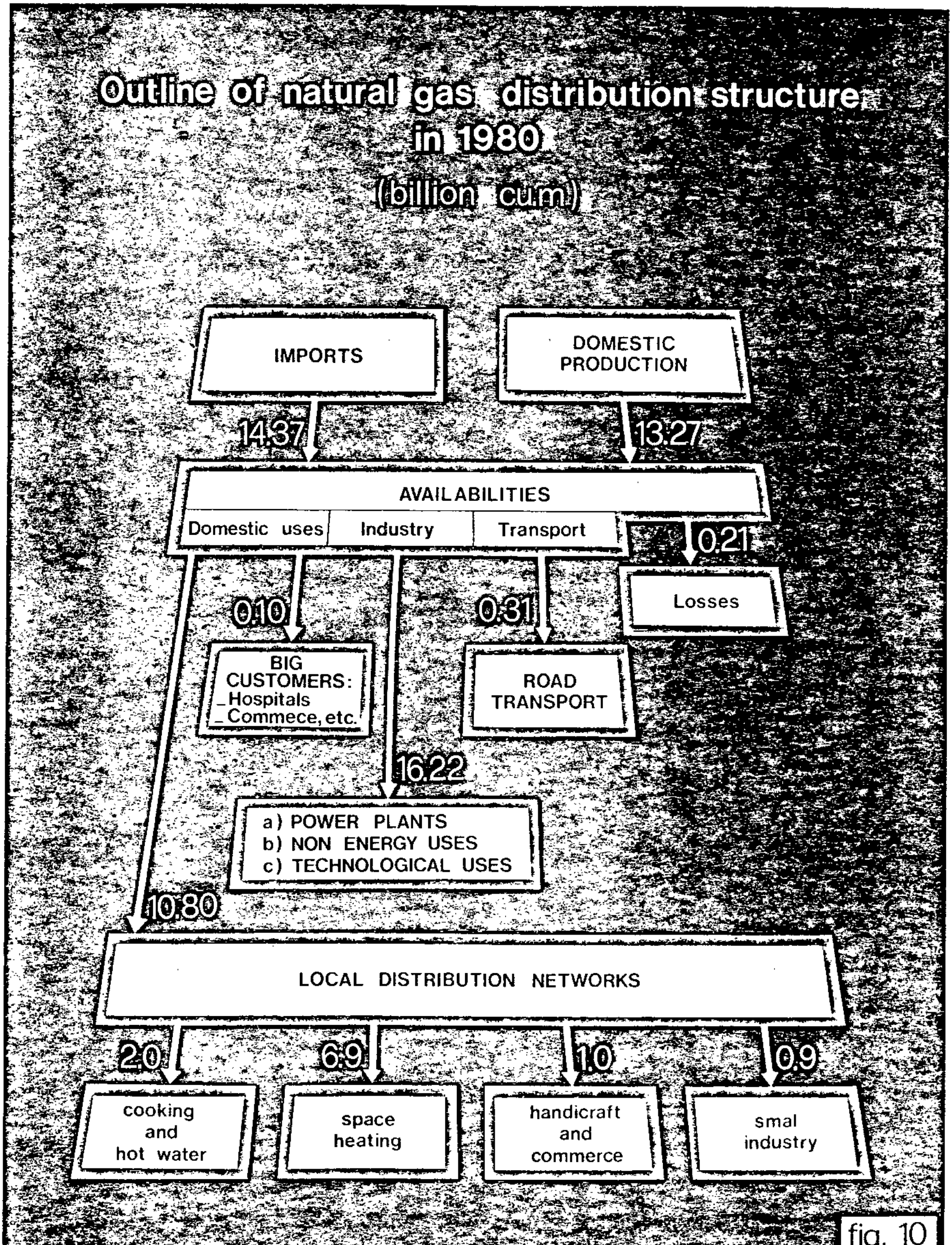
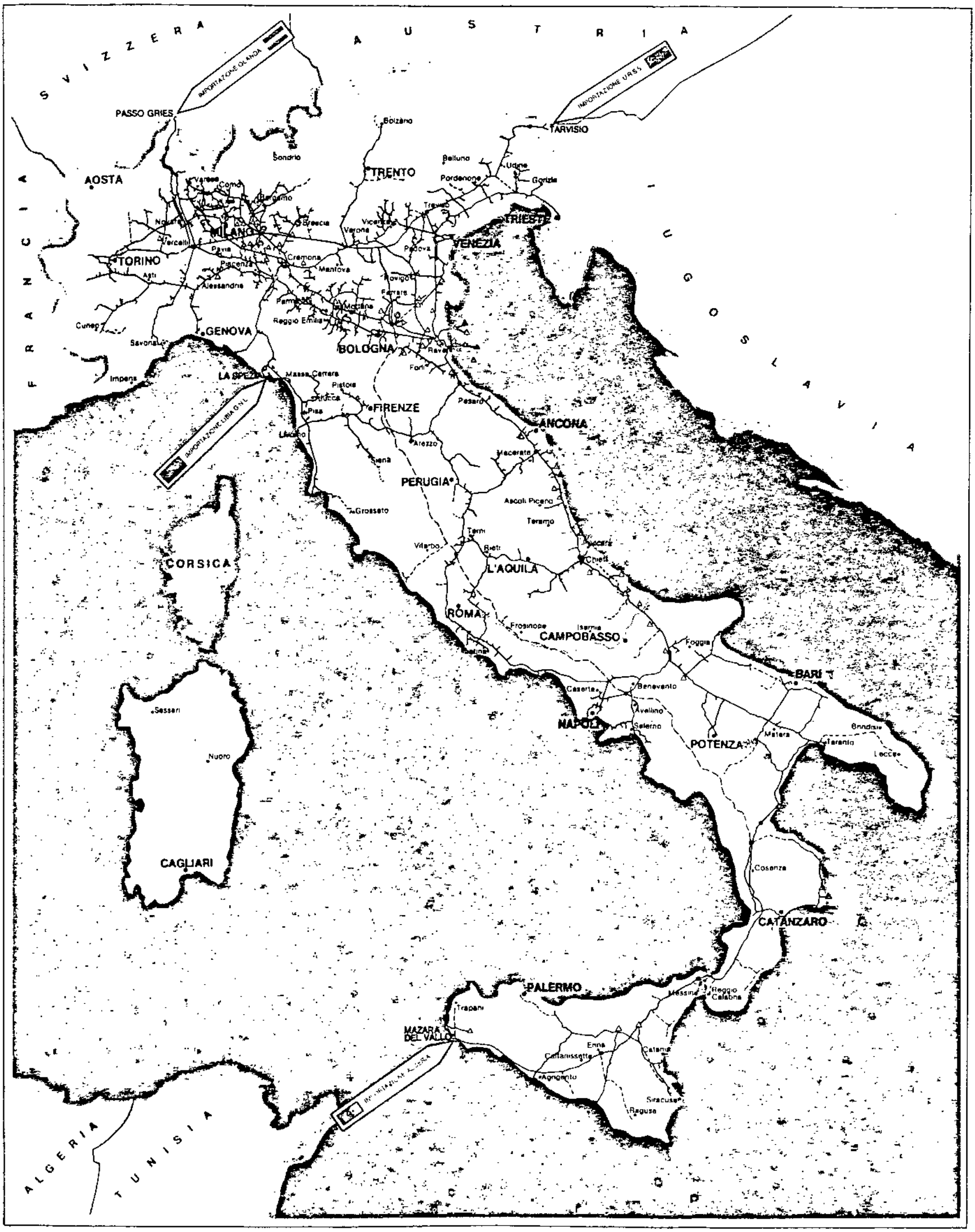

Italy - Primary energy consumption
M.T.O.E./y
200
150
100
50
0
1970
1975
1980
1985
1990
NATURAL GAS
COAL
OIL
HYDRO/GEOTH. ELECTRICITY
NUCLEAR ELECTRICITY
SOLAR ENERGY+OTHERS
ELECTRIC ENERGY
IMPORT + EXTRA
HYDROELECTRIC CAPACITY

fig. 9


Outline of natural gas distribution structure in 1980
(billion cu.m)
IMPORTS
DOMESTIC PRODUCTION
14.37
13.27
AVAILABILITIES
Domestic uses
Industry
Transport
0.21
Losses
0.10
BIG CUSTOMERS:
_Hospitals
_Commece, etc.
0.31
ROAD TRANSPORT
16.22
a) POWER PLANTS
b) NON ENERGY USES
c) TECHNOLOGICAL USES
10.80
LOCAL DISTRIBUTION NETWORKS
2.0
6.9
1.0
0.9
cooking and hot water
space heating
handicraft and commerce
smal industry
fig. 10

ENI'S NATURAL GAS DISTRIBUTION NETWORK

(AT DECEMBER 1980)



- ——— in operation
- - - - - under study
- .... owned by other companies
- △ natural gas fields
- ● underground stations
- ■ compressor stations in operation
- □ compressor stations under study

fig. 1

NATURAL GAS AND ECONOMIC DEVELOPMENT

Marcello COLITTI
Vice Chairman, AGIP

1/paper 1

EGPC - IEOC

INTERNATIONAL SEMINAR
ON NATURAL GAS AND ECONOMIC
DEVELOPMENT - Cairo - February 26 - 27, 1982

NATURAL GAS AND ECONOMIC DEVELOPMENT

MARCELLO COLITTI

Ladies and Gentlemen,

Let me first underline the importance of this meeting. The North and South shores of the Mediterranean Sea are linked to each other by a common history, and by lively flows of trade. In the last twenty years, the Mediterranean regions have increased their importance in the world's economy: to-day there are tendencies towards a more pronounced cooperation that let one hope for an even better future. This meeting is in fact an important step in this direction: to study together some of the great economic problems of the area is an effective way to transform historic ties into concrete economic cooperation.

Some European countries have a relatively recent experience of the difficult path of economic development, and of its relations with energy; an experience that can be useful to their friends who are now developing their natural resources in order to convert them into an income-producing modern economy. Of course, one should not forget the many differences between the social and physical environments of the two areas, and in the economic climate of to-day compared with the one prevailing during the post-war years of European industrial reconstruction and subsequent rapid development. The utilitarian use of history has quite obvious limitations and dangers. But our common ancestors, the Romans, used to call history "magistra vitae", a teacher for the living; let's see what it has to teach us on this particular point.

Let me start by briefly touching upon a subject which you certainly know already, and which will be developed further by other speakers: i.e. the nature of the energy source we are talking about, natural gas.

The qualities of natural gas

The nature of gas makes it a very good energy source. It is flexible: it can produce directly both thermal and mechanical energy, i.e. it can supply not only heat but also movement without passing through the costly stage of electricity. Natural gas is very clean, and does not leave nasty black fumes in the air. Its purity is an important economic asset: its flame can be put directly into contact with whatever you are heating or cooking, and can be pinpointed almost at will. Finally, you can use natural gas in large or small quantities, without serious economic differences; you do not need to build any kind of storage; and its utilization process can be made completely automatic.

These advantages are of great importance. Natural gas will give its users not only an economic advantage but also a strong incentive to technological progress, especially fostering the growth of those that can fully profit from its special properties by manufacturing products with high value added. The use of gas as an industrial fuel brings with it a simpler and cheaper technological process of utilization, a better product and quicker production than practically any other source of energy. In a word, natural gas seems the ideal fuel to use in order to obtain a strong acceleration of economic development.

But another peculiarity of natural gas has to be dealt with, which is by no means less important than its technical qualities. Natural gas produced in any country will be put on the existing energy market. If the gas reserves of the country cannot provide a supply big enough to substitute gas for all the other fuels previously consumed and satisfy all the future energy needs of the country (or if, quite correctly, it is decided not to substitute all of them), then gas will have to be sold in competition with other energy sources, i.e.: LPG, gas oil, fuel oil and coal. Its price will have to be somewhat in line with those of the other sources, because gas prices lower than those would create a position of privilege for consumers who, for geographical or other reasons, have access to gas and would therefore enjoy an unfair advantage over their competitors. If gas is sold at prices near to those of the other sources, it is very probable that its average price will be higher than the cost of producing it and bringing it to the market, calculated including exploration and substitution costs, the latter being the cost of finding later a quantity of gas to substitute for the gas consumed.

Therefore, selling natural gas on the market in competition with other energy sources will produce a rent (not to be mistaken for a profit) stemming from the difference between the total cost of the gas sold and the average price of the other energy sources sold on the market. This rent will accrue to the company that exploits the natural gas fields and sells the gas on the domestic market. In Europe, mineral deposits are the property of the State: so the rent pertains to the State, too. Therefore, the State is justified in using the fiscal instrument in order to appropriate the gas rent that accrues to private companies.

However, the fiscal weapon is a very clumsy one. The level of rent varies greatly field by field and even in the various phases of the field's life. It is very difficult, perhaps impossible, to devise a fiscal system able to mop up all the rent without discriminating unfairly among producers operating gas fields with different levels of rent.

If the State exploits the fields and sells the gas through a State-owned company, the rent obviously accrues to the State and there is no need to use the fiscal weapon. But the problem of what destination to give to it would remain.

The Italian experience

These problems formed the crucial point of the discussion that raged in Italy immediatly after the end of the Second World War. The outcome was the creation of ENI, explicitly designed to appropriate the rent resulting from the exploitation of the natural gas fields of the Po Valley and to invest it in development projects. In this way, the gas rent was used to finance directly (i.e. without going through the State Budget) the industrial development of the country, especially in the energy field.

The other choice might have been to give part of the rent to the consumers, i.e. to sell the natural gas at a price near its cost, without taking into account the prices of the competing energy sources. This solution was avoided for two main reasons. First, the Italians believed that energy and investment were the keys to the reconstruction and development of their economy, and they organised the exploitation of the gas fields already discovered in order to provide directly the risk capital necessary both to look for new reserves and to promote industrial development. Second, following the other choice, the gas prices would have been too low and would have created a demand for gas that would have been impossible to satisfy completely. Gas would have been allocated not by the market, but by administrative decisions. This would have created a privileged position for some consumers, presumably at first the ones nearer the gas fields, which, by the way, were found in the richest area of the country, Northern Italy.

According to the policy that was in fact chosen, the price of gas was calculated using a formula that explicitly linked it to the prices of its main competitors, coal and fuel oil. The resulting price still gave the consumers the incentive that was necessary to persuade them to switch to natural gas, because it gave them, free, all the technical advantages of gas over the other sources, as well as a discount for quantity and regularity of supply. As the energy market developed and diversified, parity prices of natural gas came to be fixed by comparison with other energy sources too, such as gas oil or LPG, and different users came to pay different prices, whibh took into account the source actually competing with gas. Finally, to avoid giving unfair advantages to any group of customers, the price of gas was calculated in the same way for all the area served, i.e. with no reference to the distance from the production fields. So energy consumers, and especially industries, found it convenient to switch to gas, in order to reap the benefits of the new energy source, while the pricing system avoided the danger of creating an artifical, subsidized energy market.

This strategy was put into action with great speed. Italy had always been poor in energy, and especially in fuels; so, everybody understood that natural gas could represent a unique opportunity of development, and that, in order to bring a real benefit, it had to be put on the market as quickly as possible and in rapidly increasing quantities.

The efforts of the ENI Group, which was being developed in those years, were primarily devoted to the task of discovering gas fields, putting them into production, and building gas lines to the market as fast as possible. There was no reason to wait for a certain level of reserves before launching an all-out attack on the domestic market. In 1952, total discovered natural gas reserves in Italy were estimated at 60-70 billion cu. m.; in previous years, they had been assessed at 29 billion cu. m. Probably, there has never been a time since 1950 when Italy's gas reserves have exceeded 200 billion cu. m. Of course, exploration has never ceased, and the gas consumed has been replaced by new gas. In earlier years, the difficulty was not the availability of gas, but rather the ability to bring it to the market, which in fact meant connecting individual customers to the rapidly growing pipeline grid.

The gas market did not develop according to a plan, but rather on the basis of a thorough, and, for these years, original market study. In 1951, it was found that in Northern Italy, one could count at least 12,000 potential gas buyers, two percent of whom would have been able to consume about half the total. The gas was sold to anybody willing to buy it: obviously, in the early years the bulk of it went to big users, especially industrial ones, to the cities that already had gas grids previously supplied by gasifying coal or fuel oil and to smaller cities where new grids could be built fairly quickly. The effect of this policy was extremely positive: in fact, many economists believe that the "Italian miracle" of the '50s and '60s, which put Italy among the world's first ten industrialized countries, was partly due to the availability of rapidly increasing quantities of the new energy source.

The application of the new energy sources to industry favoured a strong process of technological change, not only in large industries, like steel or engineering, but also in smaller industries like food or ceramic tiles, which led to an enhanced capacity to compete with European industry.

The difference between then and now

At the start of this short comment on the Italian experience, I said that nobody can ignore the big differences existing between the two countries - Italy and Egypt - and the two periods in time. I should now like to say something about some other important differences which refer explicitly to our problem.

The first is that the rent we have been talking about, the accumulation of which was instrumental in creating the ENI Group, is probably higher now than it was then. Other things being equal, the prices of energy sources sold on the market to-day have increased at a faster rate since the early '50s than the production cost of natural gas. This means that the amount of rent produced by selling a cubic metre of gas on the internal market is in relative terms higher to-day than it was then. Technical conditions of production are very difficult to compare, and so are the transport costs from the fields to the domestic markets. But the simple argument that market prices of energy increased more than the cost of producing gas is enough, I believe, to constitute what can be called a "prima facie" case for taking the rent argument seriously. If rent is higher, the contribution that its accumulation can make to Egypt's economic development is also higher. Capital investment is the basis of production income, and the main engine in any kind of development, no matter how organized.

The second difference refers to the gas industry itself, and especially to the size of reserves in relation to consumption. I have already said that the Italian gas reserves were not very large, especially compared with the energy demand of the Italian economy. Egypt is more fortunate: its estimated proven gas reserves at the end of 1981, 260 billion cu. m., are much higher in absolute and relative terms, and give the country important options.

The third main difference between Egypt's present position and Italy's experience refers directly to the stage of development of the gas industry world-wide. In the late '40s and early '50s, gas was an almost total newcomer in Europe. Although already consumed in large quantities in the United States and in the USSR, its consumption had remained limited to the areas of production. No international trade existed and the technical and economic knowledge of gas in the areas outside the USA and the USSR was very limited indeed. In a word, natural gas was totally "an underdeveloped source of energy": to give you an example, in those early years, natural gas could only be sold to Italian urban consumers as a manufactured gas. Its calorific content had to be brought down to 3,000/4,000 calories per cu. m., less than half its actual value, because no transport or utilization structure existed that could take on the gas at its full value.

The situation is quite different now, although one can see that natural gas is still an underdeveloped source of energy, which means that it still has a great potential for further development. In order to set the present situation of your country in the general world picture, I will have to quote some figures. Although limited to the minimum, they are inevitable and I hope my audience will bear with me.

The status of natural gas in the world to-day

Total reserves of natural gas in the world were evaluated at the start of 1981 at about 78,000 billion cu. m., about 65 billion tons of oil equivalent. Their geographical distribution is not very different from that of oil, apart from the fact that two countries, the USSR and Iran, have more than half the world total.

In 1980, about 1,780 billion cu. m. of natural gas were produced. If we exclude the amount not marketed because it was reinjected into the fields or flared or lost in any other way, we reach the figure of 1,493 billion cu. m., no more than 17% of the total primary energy consumption in the world. It is obvious that the contribution of gas to world energy consumption is still very little compared with its overall potential. In fact, the ratio between production and existing reserves is much more favourable for natural gas than oil: i.e. the current rate of production would deplete the present reserves of natural gas in 43 years, compared with 30 years in the case of oil. That means that the present resources of natural gas are not produced at a rate comparable to that of oil. This ratio is even more favourable for Egypt, where it is 14 years for oil and 89 years for gas.

But the importance of this ratio has been largely overrated. It is, of course, impossible to produce a constant amount of gas or oil for a number of years until the field suddenly dries out. Even if the producer chose to attempt it, this behaviour would be technically impossible. The depletion of any oil or gas field, or of a number of them, must rather be described by a curve with a peak in the mid years and a slow decline to zero thereafter. Moreover, this ratio does not take into account something much more important in order to define the possible policy options: the amount of reserves of oil and gas that are still to be found. Although subjected to a very high degree of uncertainty, the evaluation of the reserves that the oil industry may be able to discover in the not too distant future is perfectly possible. For a producer country, actual or potential, this evaluation is in fact a must. Any rational decision about the rate of depletion of present reserves and the utilization of the production to be obtained has to be taken by any country on the basis of a reasonable hypothesis of the total hydrocarbons potential of its territory.

Future natural gas reserves in the world

AGIP has studied the subject very thoroughly and the results are, I believe, of the utmost interest. [1)] The study was based first of all on a hypothesis on the size of onshore and offshore sedimentary basins, i.e. of the areas in which modern science tells us that hydrocarbons may be found. For each of those areas, a calculation was made, based on the idea that the new reserves to be found in the future are directly related to those already discovered, which are, in fact, proof that naphthogenesis took place in the area. On the contrary, new possible reserves of any area are inversely related to what we may call its "oil history", i.e. the amount of exploration already carried out in it, measured both by the number and by the depth of the New Field Wildcats drilled. This is because the higher the exploration activity carried out in the past in any area, the higher the probability that whatever reserves there may be in it have already been discovered. In short, the first step was to evaluate the extension and the thickness of sedimentary areas; the second was to estimate their "maturity"

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1) A full account of the study is in: Marcello Colitti, "Size and Distribution of Known and Undiscovered Petroleum Resources in the World with an Estimate of Future Exploration," OPEC Review, Autumn 1981.

from the point of view of exploration already carried out and the results achieved.

The results of this evaluation give the volume of the reserves that may be there, not the probability that they will be found. Actually, an estimate of the New Field Wildcats to be drilled from now to the year 2000 was made; but nobody can tell whether these wells will be drilled or not. There are political, financial, technical and operational conditions to be satisfied to bring about such a devèlopment. But the study defines a challenge that the producing countries and the oil industry should not refuse to take up; and there are signs that at least the former are awakening to this possibility. It should also be borne in mind that this method does not measure the whole wealth of oil and gas that may exist in the world; only the part that can be found with the technology applied now and the one that will be applied in the years from now to 2000.

The results of this study are that from now to the year 2000 it is possible to discover new reserves of natural gas in the whole world equal to 134,000 billion cu. m., and equal to 114 billion tons of oil equivalent.

At the final year, total producible reserves of natural gas would be 207,000 billion cu. m., equal to 177 billion tons of oil equivalent; those of crude oil would be 227 billion tons.

The consequences one can derive from these figures are manifold. First, it is obvious that the scope for finding new reserves of natural gas is very high. So, one should not be afraid to deplete too quickly a resource that appears largely underdeveloped. At least in the case of gas, but probably also in the case of oil, the conservationist attitude has to be weighed with other approaches, that appear to have at least a basis as sound as it has.

Second, it will not be easy to organize such a revival of exploration, as it is necessary to discover this large volume of potential reserves. There are difficulties of many kinds and especially from the political and financial point of view. A whole new approach to the triangular relationship among producing countries, consuming ones and the oil industry has to be found and tried out in practice.

Third, the present price of oil and gas reflect, in their own way, some sort of equilibrium between the existing demand and the oil and gas reserves already discovered. They do not take into any account the future reserves; in fact, the impact of present prices on demand for oil and gas is so strong that it seems to reduce future markets to very little, so little as to menace the absurd outcome that some of the reserves we believe to exist will remain underground, undiscovered, undeveloped, and, what is more serious, not translated into wealth. It is certainly a point that requires very careful examination, and which everybody operating in any capacity in the hydrocarbons sector should consider thoroughly, in a long-term evaluation of his own interest, and of that of the world's economy.

We will come back to this subject at the end of my lecture.

<u>A possible development of natural gas in Egypt</u>

Let's now ask ourselves openly a question that you have probably been asking yourselves for some time already. What part will Egypt have in this development of natural gas resources in the world? Before I answer this question to the best of my ability, let me add a very serious word of caution. The figures I have been quoting were not estimated in the field, but are the result of a study carried out exclusively by desk work. For this reason, the results, although correct at least methodologically, for the world total and perhaps also for the larger areas, are much more uncertain, and, I would add, almost methodologically incorrect, for a single country. In order to obtain data by country, the regional approach has to be supplemented with a careful field evaluation of the actual geological and industrial situation. We did not do that; so our data have really little more than an indicative value.

After this warning, I must finally say that the application to Egypt of the methodology that I have briefly described brings very good results indeed: recoverable natural gas reserves to be found from now to the year 2000 may be estimated at 590 billion cu. m., to which 200 billion cu. m. more should be added as possible re-valuations of the reserves already proven. Adding to this the gas reserves proven up to date, estimated at about 260 billion cu.m.

Egypt's total recoverable gas reserves could amount by the end of the century to a total of about 1,050 billion cu. m. (See Graphs 1 and 2). As I said before, this is only a guess at what could be found with the technology that is, and will be, in use now and during the next twenty years: it is not a forecast of what will actually be found. That will depend, apart from the not too remote possibility of mistakes in our calculations, on the actual exploration activity developed in the country, which in its turn impinges upon those conditions we were talking about a few minutes ago.

These figures may look very high, perhaps too high. But very similar figures were arrived at in a completely independent way by the studies of natural gas in the developing countries prepared by a subsidiary of the Institut Français du Petrole and by the Société Nationale Elf Aquitaine [1]. So we may take them at least as a basis for an exercise that has serious methodological relevance for anybody faced with the question we are trying to answer.

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1) See BEICIP - The Utilization of Gas in Developing Countries, September, 1981
Estimated proven reserves of national gas: 203 ÷ 264 billion cu. m.

See SEDES - Assessment of Egyptian Gas Policy Options, December 1979

Estimated proven reserves of natural gas	231	billion cu. m.
Possible reserves	980	" " "
Total proven and possible reserves	1,211	" " "

See PETROCONSULTANT S.A., 1981
Estimated proven natural gas reserves: about 200 billion cu. m.

What should be done with this very considerable wealth? Of course, these are decisions that only Egypt may take, using its sovereign power over its own mineral resources. But the subject is, I hope, open to discussion, and friends may at least try to present options to be subjected to the criticism that must come from a better knowledge of the real situation of the country and of its economy.

The first option must necessarily be related to the development of the Egyptian economy. So considerable is the expected wealth in natural gas that the obvious choice for Egypt is to rely heavily on it for the satisfaction of its energy demand, which is steadily increasing its share of the total energy supplied to the internal market. Let's substantiate this hypothesis with a few figures, bearing in mind that they do not come from a careful examination but only from the possibly over-simplified hypothesis that the increasing supply of natural gas would have its own very strong development effect. Egypt's total energy consumption may develop at an average rate of 5.9% per year between 1980 and 1990, slowing down to 2.8% in the last decade of the century. This would be compatible, for example, with an increase of Egyptian GNP in the two decades of 6.5% and 4.6% per annum, and an energy GNP ratio decreasing from 0.91 in the first decade to 0.61 in the second. Natural gas might increase its share of total energy supply from about 10% in 1980 to slightly below 50% in 1990 and to about 75%

in the year 2000. This share, although very high, would still be similar to that enjoyed by crude oil, for example, in Italy in 1975. This would bring the volume of natural gas marketed in Egypt to 17.5 billion cu. m. in 1990 and 34.3 in the year 2000. (See Graph 3). This trend would result in a cumulated production of natural gas for the Egyptian internal market between 1980 and 2000, equal to 372 billion cu. m. At the end of the century, Egypt would therefore have consumed a little more of the reserves proven at 1980, but would be left with a lot of those discovered between 1980 and 2000.

In order to calculate the contribution these new reserves would make to consumption in the last decade of the century, it is necessary to elaborate a hypothesis on the distribution in time of possible discoveries expected from 1980 to 2000. Let's choose one of the worst possible time distributions and put the discovery of the highest quantities well into the last decade. Suppose that little more than 30% of the total expected is found between 1980 and 1990, and the rest is found in the latter period. Even according to this pessimistic hypothesis, the natural gas reserves producible from Egyptian fields would steadily increase well into the last decade of the century.

One could deduce that restricting the natural gas to the internal market only would entail a slow utilization of this resource, which would not be justified, given the necessity to transform as quickly as possible natural wealth into economic development in a modern productive structure. There is, in fact, a clear-cut case either for an even quicker rise in consumption, which would probably be impossible or downright wasteful, or for middle-sized exports of natural gas to the European market. Given the long time necessary to prepare and implement an export project, gas exports could not start before the next decade, with an initial quantity of three billion cu. m. in 1990. Then, exports of gas from Egypt might reach nine billion cu. m. by the year 1991 and would stabilize at this figure. (See Graph 4). According to this hypothesis, the natural gas reserves of Egypt would still amount to 585 billion cu. m. by the year 2000; the production reserves ratio would be about 14 years, which is by no means a short time. It is, for example, much higher than the same ratio for the gas industry in the USA in 1979 (9.7 years). (See Graphs 5 and 6).

A complete numerical calculation of this set of hypotheses and assumptions is shown in Table 1, which presents year by year from now to the year 2000 a possible long-term development of natural gas in Egypt, and can therefore be used to check the internal consistency of the methodology applied.

Having put together all these figures, not one, but many words of caution must now be said.

First of all, the figures for reserves to be found, although calculated to the best of our ability using the methodology I have briefly explained, are highly uncertain. Let me repeat that they do not come from an on-the-field evaluation of Egypt's potential, but from the application to the country of a world-wide, desk-top methodology.

Besides, very few things are less certain than the volume of reserves underground, no matter how calculated.

Moreover, the level of gas consumption assumed in our hypothesis may be difficult to reach. The Italian experience tells us that the real bottleneck is the capacity to put the gas on the market, i.e. to develop the fields and to put them into production, to lay the pipeline grid, to find a price policy able both to give enough incentive to develop the gas market with the necessary speed and to produce the resources to be accumulated as capital investment. Finally, it may be difficult to launch an export project, given the state of the energy market in Europe, the huge financial means required and the difficulty of finding in the present circumstances a long-term agreement with European consumers. You are probably familiar with the recent abandonment of at least one export project, which had already absorbed a considerable volume of resources and effort in studies and projects, and whose economics had taken a turn for the worse due to the high rate of interest, as well as low energy demand and competition from cheaper energy sources in consuming countries. We have said that gas is an "underdeveloped" source of energy: we may add that its development path is now at a crucial point. Gas can price itself out of the market, especially if its peculiar economics are ignored. The physical nature of gas makes its long-distance transport more costly and more capital-intensive than that of oil; and this must be recognized both in the price asked for it and in the way the relation between buyer and seller is established and maintained. Higher gas prices at the well-head have reduced the importance both of its transport costs and of the "regional" character of gas, which finds its market near its production. But they have not cancelled either and in the present climate of high elasticity of demand to price, ignoring these factors can only lead to the self-exclusion of gas from the international market.

The difficulties to be mastered in order to put into practice a sizeable programme for natural gas development in Egypt do not reduce the value of the exercise we have carried out so far. What I really wanted to do was to present you with a general methodology that can be employed to draft such a programme, in the reasonable confidence that no important element has been forgotten. This methodology should be tested with different figures for production and exports, and with different expectations as far as reserves are concerned, in order fully to understand the effect on resource utilization of the various possible solutions, and to find the one that looks like the optimum.

Final Considerations

The use of the methodology in this lecture, however sketchy, produced, at least in my opinion, a number of very important results, which I would like to summarize as a final consideration.

First, a great contribution to Egyptian economic development is to be expected from natural gas, as fuel, raw material and as a provider of rent that can be transformed into capital accumulation.

Second, the new, as yet undiscovered, natural gas reserves are a key element, and therefore a sustained effort in exploration and production should be made in this country.

Third, a thorough utilization of Egyptian gas reserves will require some exports, from which additional investible resources may be obtained.

Fourth, even at a very high rate of domestic utilization, the sum of exports and consumption will still leave a large amount of gas to be utilized after the year 2000.

There is a fifth, more general conclusion that slowly took shape in my mind while I was working on this paper. Egypt is now on the brink of a period of very rapid development, which may considerably improve the basic structure of its economy. It is up to all of us to try to encourage it and to participate in it, and nobody feels this as strongly as ENI and, I may add, as I do myself.

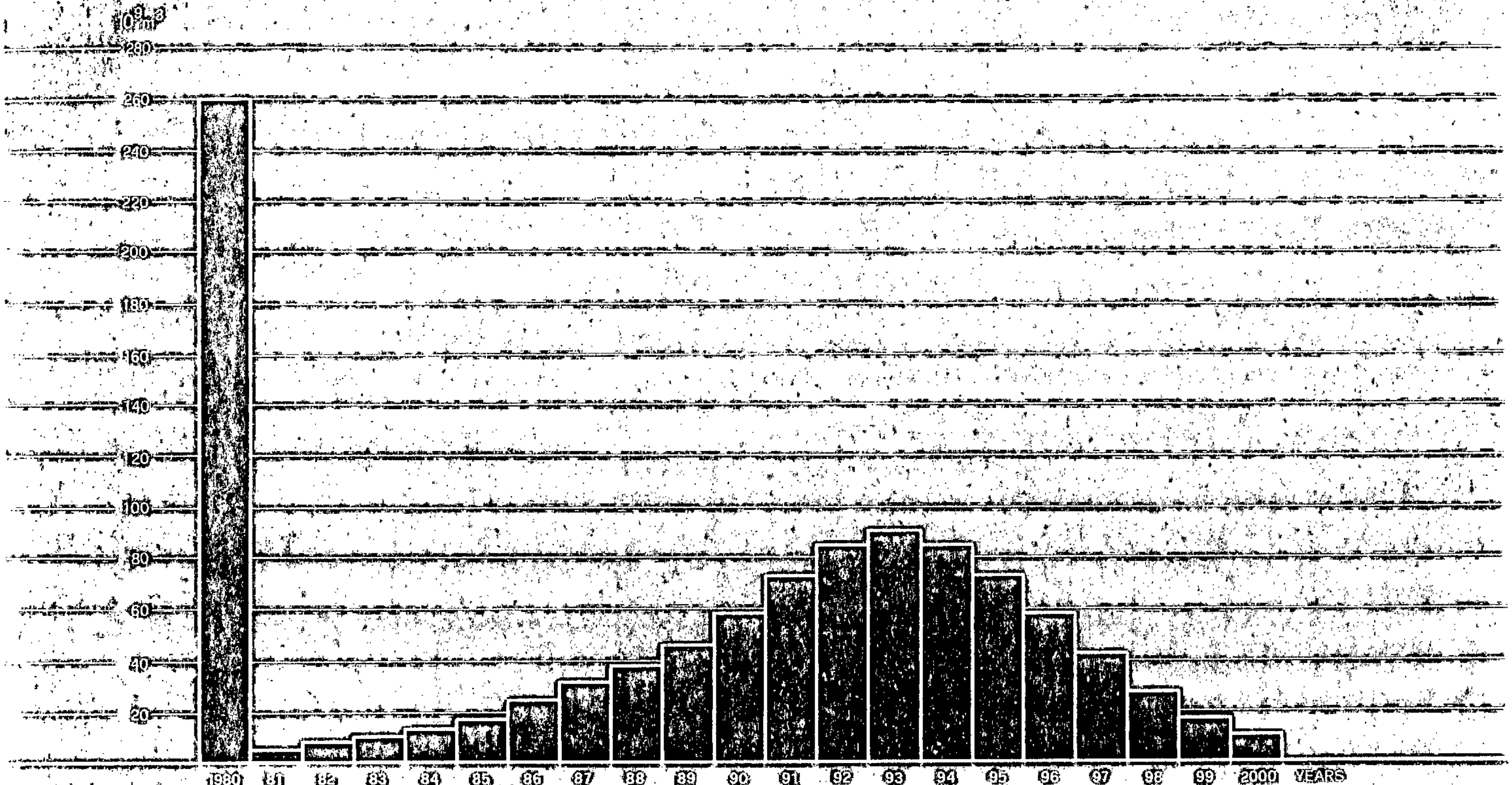
TABLE 1

A POSSIBLE LONG-TERM DEVELOPMENT OF NATURAL GAS IN EGYPT

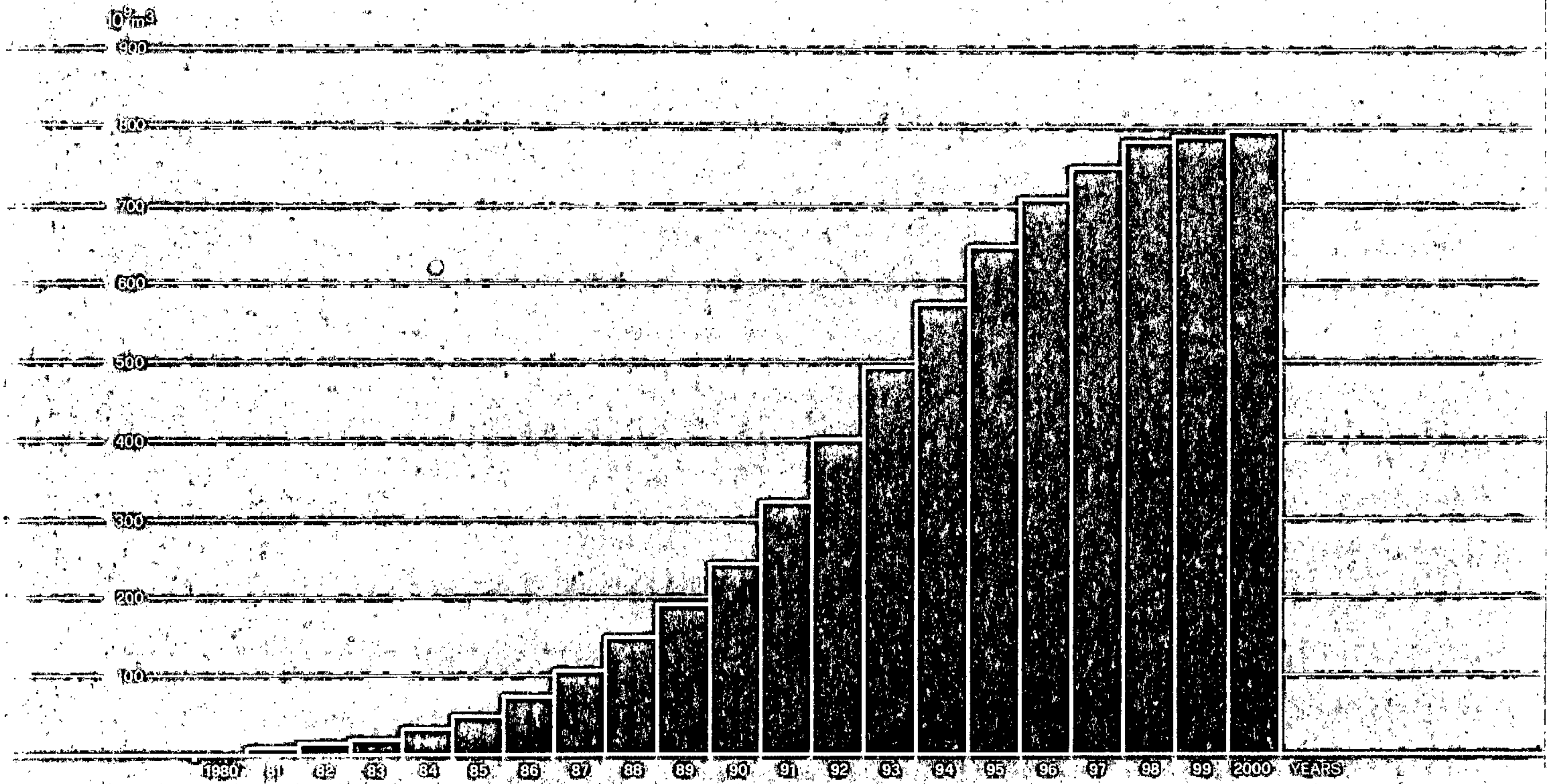
(billion cubic metres)

YEARS	ESTIMATED PROVEN RESERVES (a)	NEW RESERVES AND REVALUATIONS (b)	DOMESTIC CON-SUMPTION (c)	EXPORTS (d)	TOTAL MARKETED PRODUCTION (e=c+d)	RESIDUAL RESERVES (f)	RESERVES PRODUCTION RATIO (g=f:e)
1980	260					260	
1981		5	2.6		2.6	262.4	101
1982		7	3.1		3.1	266.3	85
1983		9	3.7		3.7	271.6	73
1984		12	4.7		4.7	278.9	59
1985		16	5.8		5.8	289.1	50
1986		23	8.2		8.2	303.9	37
1987		31	10.5		10.5	324.4	31
1988		38	12.9		12.9	349.5	27
1989		46	15.2		15.2	380.3	25
1990		58	17.5	3	20.5	417.8	20
1991		72	20.0	9	29.0	460.8	18
1992		84	22.5	9	31.5	513.3	17
1993		89	24.8	9	33.8	568.5	17
1994		83	27.0	9	36.0	615.5	17
1995		72	29.0	9	38.0	649.5	17
1996		57	31.5	9	40.5	666.0	17
1997		42	32.5	9	41.5	666.5	17
1998		26	33.1	9	42.1	650.4	16
1999		14	33.8	9	42.8	621.6	15
2000		7	34.3	9	43.3	585.3	14
TOTAL	260	790.0	371.7	93	464.7	585.3	14

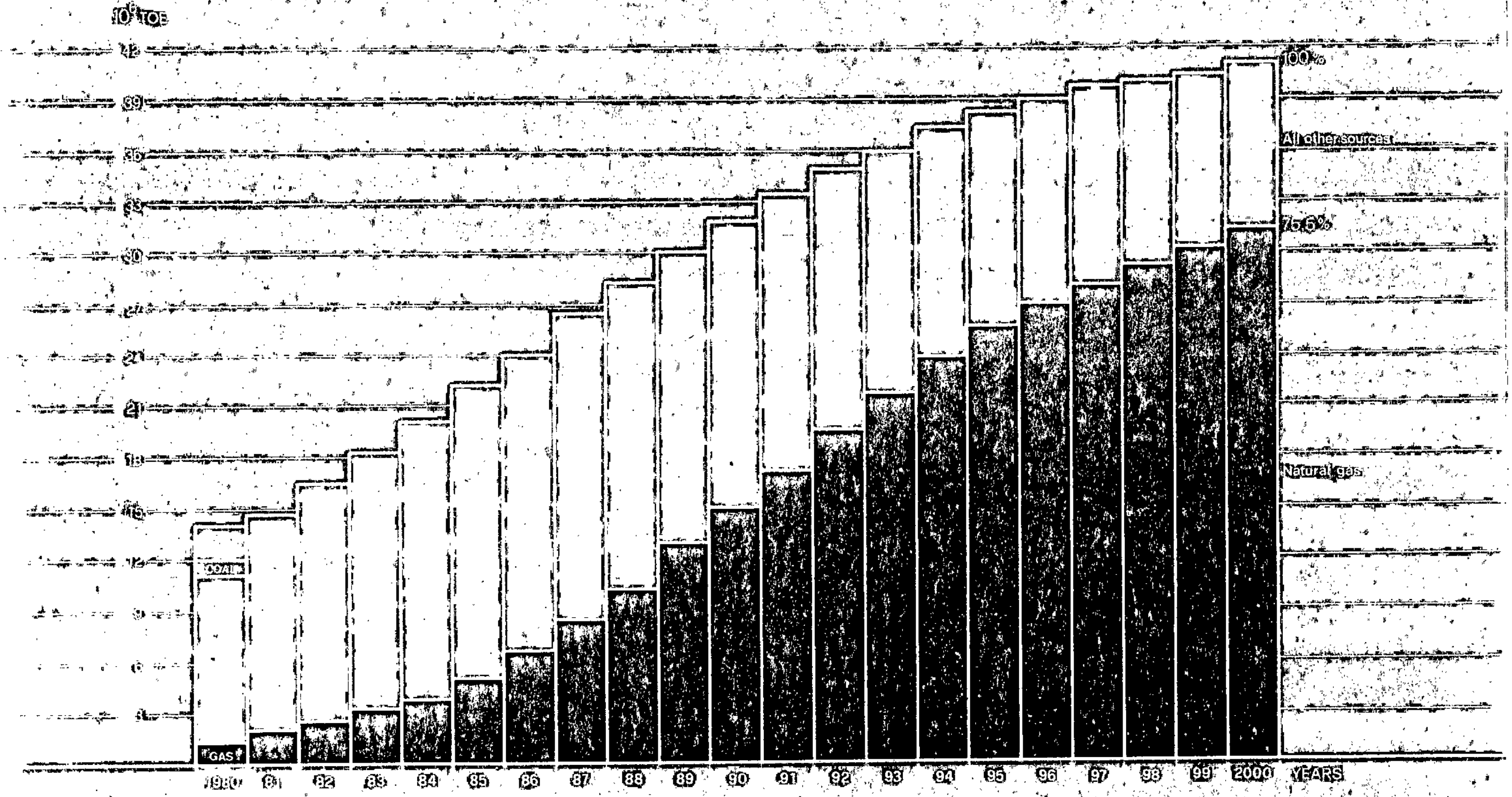
GRAPH 1 - EGYPT - NATURAL GAS -
Estimated proven reserves up to 1980 and forecast, by year of discovery, of new reserves from 1981 to 2000



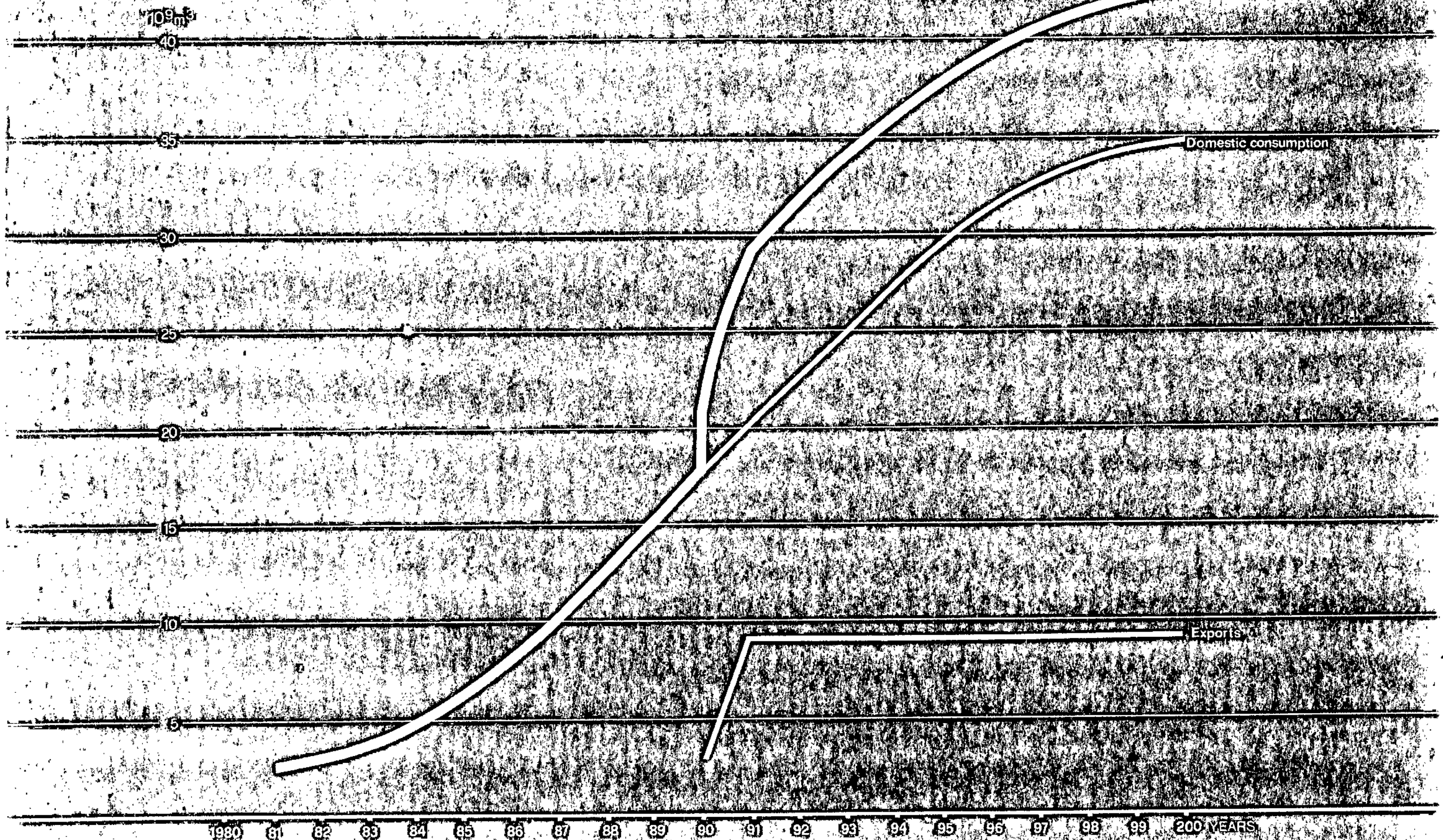
GRAPH 2 – EGYPT – NATURAL GAS –
Forecast of reserves to be found and revalutations from 1981 to 2000 (cumulative figures)



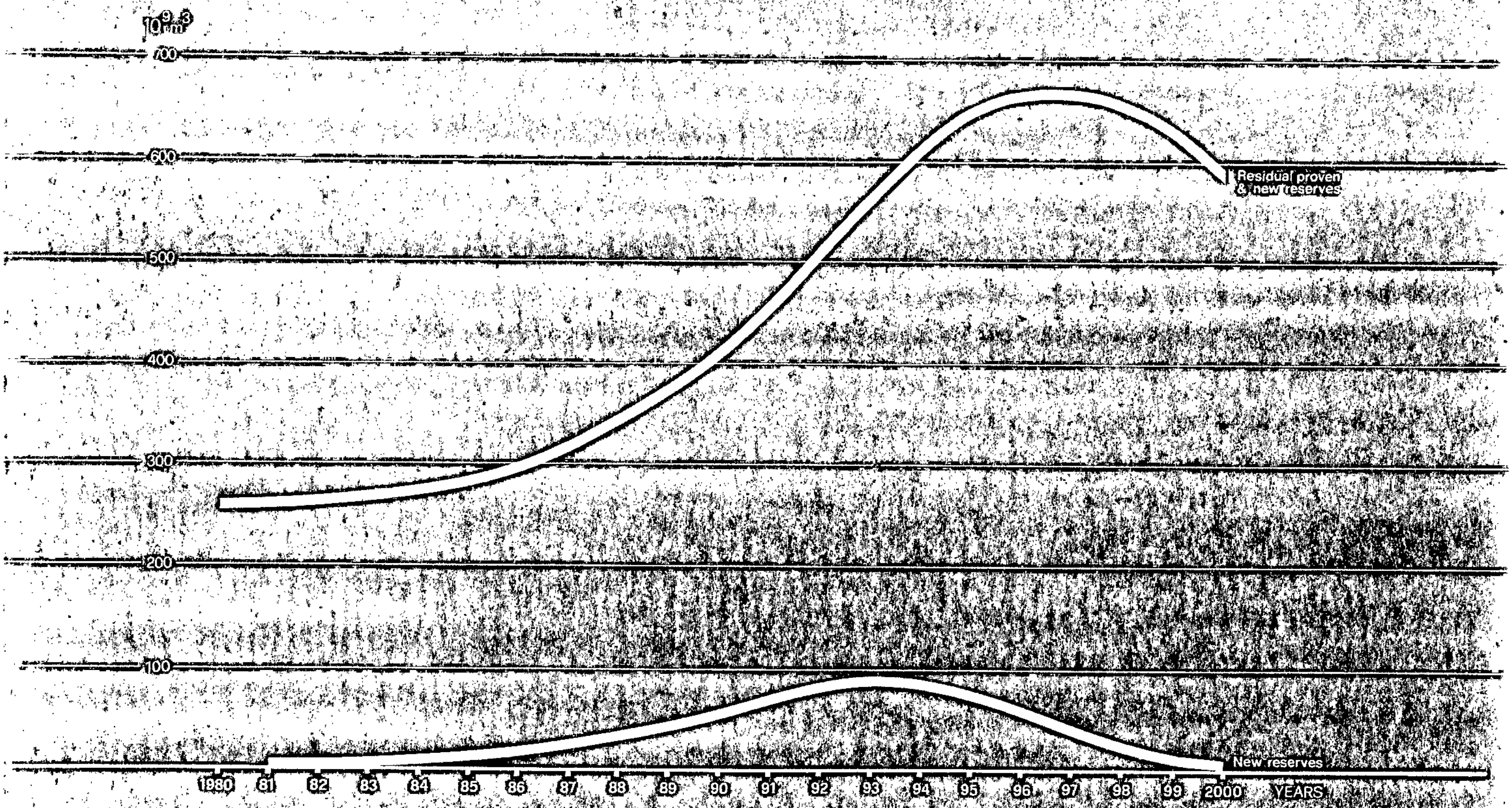
GRAPH 3 _ EGYPT - NATURAL GAS -
Domestic energy consumption in 1980 and forecast to 2000



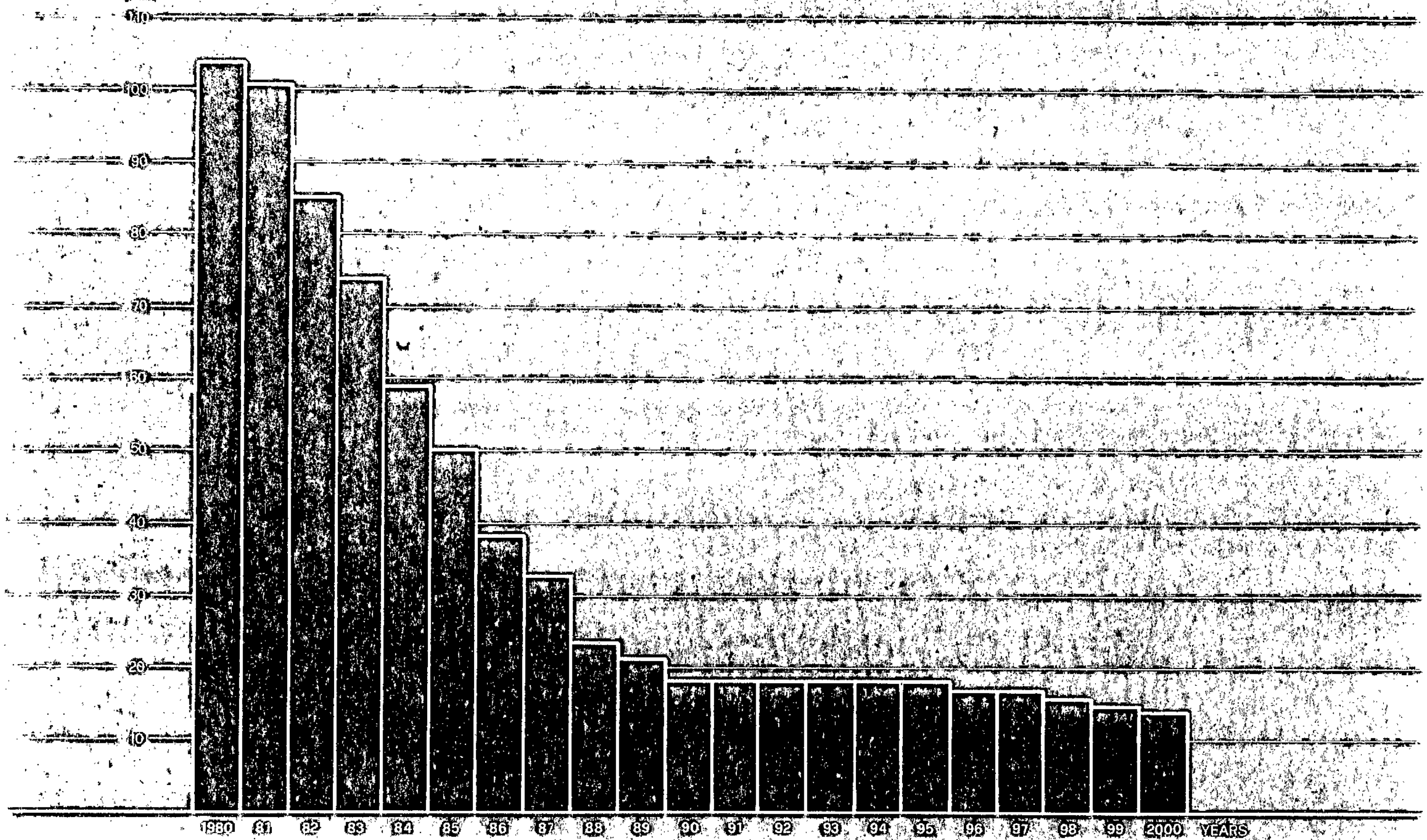
GRAPH 4 - EGYPT - NATURAL GAS
Yearly marketed production from 1981 to 2000



GRAPH 5 – EGYPT – NATURAL GAS – Development from 1981 to 2000



GRAPH 6 – EGYPT - NATURAL GAS
Yearly residual reserves/production ratio



EXPLORATION AND GAS DISCOVERIES IN EGYPT

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1/paper 4

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EXPLORATION AND GAS DISCOVERIES IN EGYPT

MOSTAFA KAMAL EL AYOUTY

Exploration for hydrocarbons accumulation is a process which witnessed a lot of technological inputs that paralleled the increasing need for the discovery of more new reserves. These new reserves are becoming more and more difficult to find since the discoveries which did not need the use of sophisticated techniques were made during the early days in the history of exploration. The increasing demand for hydrocarbons had to lead to the introduction of new technologies in surveying devices, interpretation techniques and drilling and production capabilities. This need was very evident, for example, when man had to direct exploration activities to the offshore areas after exhausting many of the possibilities on land.

Exploration for gas pools is an inseparable part of the exploration for oil accumulation. The process is based on the same ideas pertaining to the theories on the origin of hydrocarbons and involves the same exploration techniques.

Although exploration activities in Egypt date back to 1868, the first commercial gas discovery took place only in early 1967, with the discovery of the Abu Madi Gas Field in the north central Nile Delta Basin by the International Egyptian Oil Company, a subsidiary of AGIP. At that time the discovery was made while the Company was conducting oil exploration work.

In other words, discovering gas pools is an outcome of the overall exploration activity which, as mentioned above, started in 1868, some nine years after the famous oil discovery in 1859 in Pennsylvania by Colonel Edwin Drake. In reviewing exploration activity in Egypt, it can be demonstrated that it is confined to three phases, according to the exploration techniques used.

The First Phase (1868 - 1921)

During this phase exploration was, in the beginning, directed towards drilling in areas where surface seeps were reported, particulary in and around the Gemsa and Gebel Zeit areas. Later, this was supplemented by surface geological surveys to locate surface structures. This development was a logical outcome of recognition by the Industry in Egypt and elsewhere that oil accumulations are associated with certain geological settings. This discovery triggered off wide surface geological surveys in both the Eastern Desert and Sinai, and some 45 "exploratory" wells were drilled to a total of 18,590 metres. During this phase, however, most of the wells were still drilled where surface oil indications were known.

The outcome of those activities was the discovery of three oilfields which were put into production, namely, Gemsa and Hurghada in the Estern Desert and Abu Durba in West Sinai, in 1909, 1913 and 1919 respectively. Of these three fields , only Hurghada was discovered by purely surface geological survey. Gemsa and Hurghada were discovered by the Anglo Egyptian Oilfield which was a Royal Dutch Shell and BP affiliated company, whereas Abu Durba was discovered by the Geological Survey of the Egyptian Government.

The Second Phase (1922 - 1945)

Exploration in this phase was characterized by the introduction of geophysical techniques, namely, the magnetic and gravity methods. These geophysical methods, together with structural hole drilling, were utilized in order to recognize sub-surface stratigraphical and structural settings. In addition, extensive surface geological surveys continued in northern and central Sinai and along its Gulf of Suez coastal area and in the Eastern and Western Deserts.

During this Phase, 42 exploration wells were drilled to a total of 52,000 metres and four oilfields were discovered, with the gravity method as the main exploration tool. These were Ras Gharib, along the west coast of the Gulf of Suez in 1938 and Sudr, Asl and Matarma, in the period 1946 - 1948, thus extending into the following Phase.

The Third Phase (1946 until now)

This is the Phase in which the seismic method was "the" tool in exploration work. It should be mentioned that the use of this tool actually started on a very small scale in the Western Desert in 1938 by the South Mediterranean Oil Company but the use of the method was not continued at that time.

The first wide scale seismic survey was conducted by Standard Oil of Egypt in 1946 in the area between Abu Zenima and Abu Durba. The same company drilled the first exploratory well on a seismic prospect in Feiran, along the west coast of the Gulf of Suez in Sinai in 1949, which was an oil discovery.

Since then, extensive seismic surveys were conducted, first on land, and then offshore in the Gulf of Suez Basin, the Western Desert, the Nile Delta Basin with their offshore extensions and relatively lately, in areas in Sinai outside the Gulf of Suez Basin. On the evidence of these seismic surveys, about 480 exploration wells were drilled, both on land and offshore, with about one billion metres drilled. This led to about 50 oil and gas discoveries during this Phase. Of these, 20 discoveries are in production, whereas the rest are either under development or evaluation.

So far, some seven billion barrels of recoverable oil and gas reserves have been found. The bulk of the gas reserves are present in the three gas fields, whereas about 1.5 TCF is associated gas. At present, some 21 million barrels of oil equivalent of gas and condensates were produced in 1981 from the three gas fields namely, Abu Madi in the Nile Delta, Abu Qir, offshore the Nile Delta and Abu Charadig in the Western Desert.

The data so far collected from all exploration activities in the different parts of the country, indicate that some parts seem to be Gas Prone areas, namely, the Nile Delta Basin (on land and offshore), Northern Sinai, as well as some horizons in and around the Abu Gharadig Basin in the Western Desert. This statement, however, by no means rules out the presence of oil in these areas. For example, in the offshore Nile Delta Basin to the north east of Port Said, IEOC and TOTAL discovered oil - not gas - in the oligocene in their Tinah well. In the famous Gulf of Suez oil province, AMOCO and GUPCO found gas in separate pools in the Amal structure, which was drilled in the late sixties. Moreover, AMOCO and GUPCO found separate oil pools somewhere above the gas pool in their Abu Gharadig field in the Western Desert. It is believed that there is still a big gas potential in the so far known gas prone areas in Egypt, as well as in other areas.

From the current reserves and production figures available up until now and referred to above, one can conclude that the known gas reserves represent some 40% of the known oil reserves. However, the production of gas represents 9% only of oil production. This shows that gas production can be, and should be boosted in order to save on the local consumption of oil products. For this target, the use of more gas in industry, power stations and household purposes, should be pushed forward, which will allow for more exports of oil and oil products and will reduce LPG imports.

For this reason, more effort is at present being exterted to secure more gas for local use. The approach to this task is to avoid the flaring of associated gas and to encourage exploration for new gas reserves.

Towards the end of 1982, the greater part of the flared gas in the Gulf of Suez Basin will be saved by gathering it onshore in the Shukeir area. It will then be taken by pipeline to Suez and other areas. Expansion of the plant is envisaged in the future to cope with the increase in the amount of associated gas. The plant will handle LPG separation and gas condensates before it is supplied to industry, power stations and for household purposes.

On the other hand, a lot of thought has lately been devoted to encouraging companies to explore for gas. A few years ago it was recognized that the companies which found by their exploration efforts that their areas were gas prone, were not very enthusiastic about continuing aggressive exploration activities. This was due to the fact that their oil agreements stipulated that any gas discovered by any of the operators which is not sufficient to justify liquefaction and export in the form of liquefied gas, should revert to the Government at no cost. To continue with this arrangement would have had an adverse effect on any endeavor to discover more gas reserves. Accordingly, it was felt vital to find ways and means for encouraging companies to continue with their exploration programs in case they find gas in the areas granted to them. This matter was discussed at length with the group of companies in the Nile Delta area, namely, IEOC. MARATHON, CONOCO and BP. A memorandum of understanding was signed by them and EGPC and, in the light of that memorandum, draft amendments to the original agreements were approved and will be issued as laws in the near future.

In substance, the amendments provided:

1) that the gas export project is allowed after securing a certain amount of gas as a National Gas Reserve,

2) that pooling of the gas reserves of different operators is allowed in order to supply the gas export project,

3) that the operator is entitled to appropriate compensation for any gas contributed by them to the National Gas Reserves,

and

4) that by separate agreement an operator can take part in developing gas production for local consumption.

In this respect it is worth mentioning that once these amendments were intitialed, the companies continued with their exploration activities, without waiting until these amendments were issued in the form of laws. This is a spirit which is very much appreciated. It is worth mentioning also that since then, EGPC and other companies have negotiated amendments of other agreements in order to incorporate the new gas provisions referred to. Moreover, new agreements on the same lines were concluded in new areas which lie in gas prone areas.

It can be stated that the response to the new provisions is very gratifying. It is believed that in the near future the activities will be boosted and new gas reserves are expected to be discovered.

RECENT EXPERIENCE AND OUTLOOK OF THE INTERNATIONAL NATURAL GAS INDUSTRY

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1/paper 2

EGPC - IEOC
INTERNATIONAL SEMINAR
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RECENT EXPERIENCE AND OUTLOOK OF THE

INTERNATIONAL NATURAL GAS INDUSTRY

JACK E. HARTSHORN

During the 1970s world consumption of natural gas grew faster than that of energy in general and of any other fossil fuel; indeed, from 1973 to the end of the decade about half as fast again as oil. In 1980-81, moving into the eighties, that might still be claimed. But all it has meant just recently is that gas consumption has stayed level or risen hardly at all, while most other energy consumption has actually fallen. This is not the firmest growth record upon which to base prospects for gas in the 1980s. The average annual increase in the seventies was about 4 percent: the gas industry is still hoping for about 3 percent annually in the eighties, with perhaps 7 percent annually in international gas trade. But a few export projects for liquefied natural gas have been abandoned; and others remain stalled through haggling over price. The two largest pipeline projects envisaged for this decade, one for eport and one for indigenous supply, are encountering significant political opposition. Certainly, a year or two of political hesitation might readily be caught up by the second half of the decade. But confidence in expansion of gas markets, like most others, is nowhere nowadays quite what it was three to four years ago.

In one sense, this may seem paradoxical. Prospects for all other forms of energy have been conditioned, obviously since 1973 but in reality for much longer, by world oil prices and price expectations. By the end of 1980, oil prices were about 80 percent higher in real terms than in 1978. That should have improved the commercial prospects for competitive fuels like natural gas. Admittedly the oil price expectations that fluctuated towards panic in 1979 have reversed towards complacency in 1980-81. The world finds itself on a high plateau of oil prices, but with less fear that these need go on rising, through contrived or real shortage, than at any time since 1973.

For some forms of alternative energy, technically but not yet commercially established, prospects that soared in 1979-80 are now coming down to earth with a thud. Oil prices had shot up the scale of comparative costs at which quite a variety of forms of alternative energy looked economic to develop. Moreover, intense uncertainty about over - dependence on the Arabian Gulf gave importing governments an extra political incentive to diversify into safer energy anywhere outside that vulnerable place. But now oil prices are falling. Indeed, OPEC's strongest price-setter now argues that in real terms they may go on declining until 1986, and for some years after that the real price may be no more than maintained. So some plans for alternative energy such as synthetic liquid or gaseous fuels from shale and coal might now be shelved. Those involve long time-lags before actual production. So they depend more on price expectations than on a high level of prices now. Moreover, such energy development generally means capital-intensive construction and engineering close to technological frontiers. Few entrepreneurs expect the comparative costs of such new alternative energies to remain level in real terms. Indeed, renewed hesitation and delays in investment are continuing even for established forms of energy that are already cheaper than oil, such as nuclear power and coal.

As to the importing governments' political incentive to diversify, there are signs that this is losing influence in,for example, the United States and France (though not in Germany and Japan). This might arise from a judgment that the Middle East, since 1980 has become a safer place. If so, it would be surprising. But perhaps it simply reflects a colder-blooded acceptance of unavoidable political risk.

Oil Prices and Gas Prospects

Has this switch into panic and then back to complacency about oil price expectations made much difference to the international prospects for natural gas in the 1980s? In certain ways the jerk upwards in price levels already has. And over time, if oil prices cease to rise, that may have a contrary effect. For it would imply oil products in ample supply and even relatively cheap. And oil products are gas's main competitors . But so far, most of the effects on gas of this seesaw in oil price expectations appear to be limited, selective and indirect.

One effect was immediate and specific. Early in 1979 the revolutionary Iranian government cancelled its IGAT-2 "export swap" deal with Russia, Eastern and Western Europe, which was almost ready to begin pipeline exports of some 9 billion cubic metres annually, and also the IGAT-1 deliveries of gas that it was already exporting to Russia. Ironically enough, the "oil shortages" feared as a result of that revolution, which shot oil prices up, never really materialised. OPEC oil exports in 1979 went up, not down. It was Middle East gas exports, for what they were worth, that were cut. That Iranian cut-off triggered, as a replacement, the only major new project that has been planned in the international gas trade since 1979. This is a pipeline to be constructed from Russia - to deliver much more gas to Western Europe than was planned under the Iranian swap deal: the volumes may eventually reach 40 bcm annually.

With that exception, most of the expansion in the international gas trade that is planned to offer deliveries by the middle to late 1980s was already under fairly firm contract before 1979.

Essentially, this increase in export-import trade was intended to top up supplies in three of the world's four developed regional markets for gas. (Natural gas is an established large-scale industry producing some 1500 bcm annually, nearly 20 percent of the world's primary energy. But its markets are extraordinarily concentrated.) Gas exports were due to rise to offset a levelling off and later decline in two of these four main markets, the USA and Western Europe, and to meet modest further growth rates in demand there. A third market, Japan, with no significant local reserves of gas or any other energy, has for years been encouraging imports of LNG as a sulphur-free boiler fuel to reduce dependence on oil, particularly from OPEC. All these imports to major markets were already commercially viable even at the prices and with the price expectations of the late 1970s. (The world's other great developed market for gas, the USSR, is much more than self-sufficient. Already the world's second largest national producer and consumer, it became in 1980 the largest exporter too.)

At the margin, obviously, more natural gas becomes economic to develop farther afield, or in more difficult circumstances technically, when prevailing energy prices rise. (This is not quite the same as high-cost alternative energies that emerge into commercial viability only when oil prices go high enough. It is location and transport costs that usually make gas development marginal, not production costs. Often, indeed, gas may be a complementary by-product, associated with oil at no extra production cost up to the well-head. That does not necessarily make it any easier to move economically to market.) Incidentally, without doubt, the steep 1979-80 increase in oil prices did make the expansion of gas trade already planned suddenly, or potentially , more profitable. This applied to local development as well as exports.It enhanced the opportunities that the promised US deregulation of gas prices was offering to explorers in the lower

48 states. It improved the economics of the pipeline project planned to bring Alaskan gas to US markets. By 1980, too, crude prices reached the levels that Arab gas experts had often declared would be necessary to offer an adequate return on exporting LNG from the Gulf to OECD markets. That strengthened interest in such gas exporting from, for example, Qatar and Bahrain. Higher oil revenues also, on the other hand, were making it easier for OPEC governments such as Nigeria to contemplate once again the heavy capital investment upstream that LNG development involves.

The 1979-80 upsurge in oil prices, then, hardly brought any new major gas projects into being. But it made all the trade involved much more profitable; and brightened the prospects for some marginal prospects, existing and dormant. Has the subsequent collapse in oil price expectations since last year checked or tended to reverse this?

Revisions in Gas Planning?

The pause in gas expansion began in 1980, not 1981. Probably it arose from two consequences of the oil price increases, not from the later prophecies that prices will fall. One of these consequences emerged into general recognition in 1980 for the first time. But it had been in the making since the first oil price shock in 1973-74. It was the very real saving in energy use that many oil-importing nations have been accomplishing in the last few years - along with the gathering world recession to which oil price increases have also contributed. The second consequence was specific to international trade in gas: disputes over price. Most gas contracts, whether in operation or pending start up, already had price escalation partly tied to changes in crude or oil product prices. But the price surge of 1979, and the apparent concentration of sellers' market power that revealed, encouraged gas exporters such as Algeria to mount a campaign for much higher basic gas export prices than had hitherto been paid, seeking parity on a Btu basis with crude oil. The resulting price negotiations have dragged on with US and European customers (though they have been settled sooner with Japan). It was only during the course of these negotiations that the 1981's sea-change in expectations - about economic growth and energy demand in general, and gas supplies near home, as well as oil prices - has come in to influence some gas importers' bargaining fortitude.

In the USA, the Reagan government is now pinning great hopes upon (perhaps even faster) de-regulation of gas prices to bring forth extra gas supplies in the lower 48 states. US drilling for gas certainly has increased greatly. But experts differ considerably about how much of a lasting increase in conventional gas production there can be counted upon. Pipeline movement of gas from Alaska, on the other hand, has always depended considerably upon relatively high oil price expectations to render the project competitive in US markets in the late 1980s. This project has become a subject of governmental and congressional controversy. The government has also indicated some preference for Western Hemisphere suppliers of gas imports over exporters from African and Pacific member countries of OPEC. Reserves of gas in Canada and Mexico are being up-rated, and would appear ample to allow traditional exports to the USA. But whether those exports occur will depend less on US government policy than on those countries' own government policies. As to LNG imports, implementation of the few contracts already concluded on paper has been stalled for some years, mainly over price demands from Algeria but for other reasons too. Eventually these may be fulfilled in one way or another, plus perhaps some small imports from Trinidad and Nigeria. But the USA seems unlikely to engage in importing LNG during the 1980s on anything like the scale it once planned. This will not be so much because of its own changed price expectations about oil, however, as because of gas exporters' changed price expectations about gas.

In Europe, higher prices may perhaps have encouraged Danish offshore gas development, plus some more North Sea exploration. On the other hand, lower price expectations may delay development of a few fields already discovered, and higher British and Norwegian taxation is contributing too. (All North Sea exploration is still essentially for oil. Norway has so far found no specific formula to encourage exploration for gas. The British government has now decided to abolish its state-owned gas industry's sole right to buy all gas found in the UK sector of the North Sea. That "monopsony" right, excercised at low prices, seemed in practice an effective formula for <u>discouraging</u> exploration for gas there, whatever oil or gas prices elsewhere might be.) Recent gas finds off Norway do appear to be giant fields; but their timetable of development will depend upon government policy regarding the depletion of total Norwegian petroleum reserves. The British government last summer also decided not to back a pipeline gathering system to exploit associated gas from oilfields in the northern North Sea. (That decision might have reflected lower price expectations about energy. But in fact it probably reflected simply local monetary policy.)

Europe is already the world's largest importing region for gas, and is predicted to become twice as large an importer as the USA and Japan combined. It is now left hardly better or worse off in its hopes of "domestic" gas production than it felt in the late 1970s when planning this decade's imports. But note that its import plans have changed considerably as regards sources. Any switch to Russian from Iranian gas - and perhaps to some extent, in volumes, from Algerian - appears to Europe as a political diversification, away from the Middle East and from OPEC. Dependence on Russia may involve political risks too, as the US government continues to try to persuade European governments. For Germany, the leading importer involved, Russian gas may eventually amount to 34 percent of its gas and 7 percent of its total gas supplies. The European reply is that the risks are different. Any diversification of risk away from OPEC supplies - of imports of oil as well as gas - is worthwhile. So are the huge steel pipe and engineering orders, amounting to something of a rescue lifeline for European heavy industries, that the Russian pipeline imports are bringing in reverse and in advance. (Politically, nevertheless, American and perhaps European opposition to military rule in Poland, and such economic sanctions as materialise, may at least postpone this whole joint gas development scheme.) As to LNG imports, certain contracts made between Germany and the Netherlands and Algeria have been abandoned, but by the exporter, not the importers. Algeria decided the cost of a third gas liquefaction plant would involve too much local investment. It has stated a preference for moving its exports by pipeline, offering these former LNG customers deliveries either via a doubling of the already completed submarine pipeline to Italy, or via an alternative pipeline to Spain. European utilities have contracts, too, for LNG from Nigeria, if that scheme eventually does go ahead.

But all suppliers of these imports except Russia - and though one classes it within "domestic" European production above, to the rest of Europe, Norway ranks as a gas exporter too - have ambitions for much higher prices, relative to oil, than the Europeans planning gas imports in the seventies ever expected to have to pay. The European utilities concerned are now looking at much lower projections of economic and general energy growth than they were, in say, 1978. Within that diminished demand for all energy, they argue, the 19-20 percent share gas is hoped to maintain will anyway be smaller in absolute terms. Also, much of the gas share will be of discretionary, substitutable demand, depending on price. They contracted for Russian gas at much less than Algerian or Norwegian asking prices. If they had to forego Russian supplies, they do not argue that they can readily find equally cheap gas elsewhere. But they argue that at the margin, some of their potential extra demand for gas can switch to other forms of energy - even perhaps to fuel oil - which almost everyone expects to be in surplus throughout the 1980s.

The sea-change in oil market expectations has not altered Japan's preference for imports of LNG and coal rather than Middle East oil. Japan's chances to maintain economic growth still look higher than for the rest of OECD. Nor has it moderated a continuing attempt since 1979 to find LNG suppliers outside the Middle East and OPEC. Japanese buyers have been signing up Canadian supplies, before considering those of Qatar and of Australia (upon which Japan feels it might become too dependent also for coal imports). Nevertheless, Japan already accounts for some 70 percent of the world LNG trade, and its plans to increase this are very large, so it may well draw upon further Middle East supplies. Most of this LNG competes with fuel oil, often in power generation. But Japanese sulphur restrictions enable it to pay higher prices for clean boiler fuels than other importers. So far it seems to have reached easier new accommodations over price with its existing LNG suppliers - Brunei, Indonesia and Alaska, plus limited Gulf supplies from a small Abu Dhabi export operation - than European or US importers have.

Three years of see-saw in oil price expectations have thus significantly trimmed the American import intentions of the late 1970s, and raised questions about one substantial development in domestic gas supply from Alaska. For Europe, the main result (of Middle East political change, not oil pricing) has been to shift the pattern of prospective import sources towards Russia. Also, its bargainers are expressing doubts about the total volume of imports it had planned for this decade, given exporters' pricing ambitions. Iran, temporarily or not, has dropped out of the potential Middle East exporters of gas. Qatar's interest in LNG has been revived by higher oil prices and revenues (also by further indications that its North Dome is one of the largest gasfields anywhere). Japan has not curtailed its planned requirements of LNG; but it is making a further attempt to diversify sources.

Using Gas At Home

Western analyses of world natural gas development tend to focus upon international trade in it. That has been indeed the fastest developing element in the industry, and has included a spectacular growth for the relatively new technology of seaborne LNG trade. Nevertheless, inter-regional trade in gas, in 1980, represented under 4 percent of total world gas consumption. Even by 1990, it may not reach 10 percent of the total. That includes most of the gas trade discussed above. If one counts in all gas movement across national frontiers (including, notably, Canadian supplies to the USA and Russian supplies to the rest of Eastern Europe) the comparative figures were about 13 percent in 1980 and might somewhat exceed 20 percent by 1990. Total trasfers across frontiers might account for close on half the growth of world natural gas consumption during this decade, and inter-regional trade for perhaps a third of it. But most natural gas will continue to be consumed within the regions where it is produced, and probably three-quarters of it within the countries where it is produced. Apart from the special case of Japan*, no sizeable market for natural gas has ever

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*Whose LNG consumption was deliberately decided on to diversify imports into an economy lacking any indigenous fuel, and is used to a large extent in power generation, a bulk use taking no advantage of any of the inherent "form value" of natural gas except freedom from sulphur.

been developed except on the basis of large-scale indigenous reserves. Today, the USA remains the largest gas producer. Even by the end of the century, it may still be producing some 85 percent of its needs; and with Canada, North America will remain more than self-sufficient. Europe now produces over 85 percent of its own needs; and though it may become dependent on exports for 60 percent of its gas by the year 2000, that will depend partly upon the stretched-out depletion policies of its then major producers, the Netherlands and Norway. The Communist sphere, likely to become the largest region of gas production and consumption during this decade, has developed gas entirely upon the base of the domestic Russian industry.

This will also be true of most developing countries, both inside OPEC and outside. Many of these will find it worthwhile to engage in gas exports, and a few may decide to commit all their reserves (for example Cameroon, following the example of Brunei). Some may find it geographically convenient to import gas in one area and export it in another (for example, Argentina). But for the most part one can expect countries where significant amounts of accessible natural gas are discovered to use some of it internally, whether they also export gas or not. OPEC countries have of course huge supplies immediately available for the gathering, in the approximately 110 bcm/yr of associated gas being flared in their countries. During the decade, significant development of petro-chemicals there will occur using associated gas newly collected; extra LPGs and methanol from it may move directly as fuels into local consumption and probably the world gas trade as well. That associated gas will be put into local industries in OPEC countries as a cheap feedstock. It will probably gain them a significant foothold in world trade in petro-chemicals.

For gas associated with existing oil production in particular, but for all gas operations in countries that export oil, the economics of market development, at home and for export, are complex. Locally, the characteristic problem of initial development is that premium markets for this noble fuel involve costly distribution networks and have low load factors. The gas supply comes on in large increments, for example in pipelines that once completed, need utilisation at high load factors to amortise their capital investment. Hardly any significant market for natural gas has ever been developed without bulk, high load factor sales, for example to power stations, to absorb the initial large surge of supplies.* Later, experts and sometimes governments may argue that gas should be diverted from such ignoble uses to premium industrial uses, or residential and commercial coustomers who can pay more for the desirable "form value" of natural gas. But without a base load of such sales, the local market could never initially have been developed at all.

In principle, again, utilising gas at home and freeing extra oil for export may improve profits and petroleum revenues. So far, no LNG operation in the world makes profits per Btu of energy exported (let alone of gas energy produced, before processing losses) comparable to those on the same country's exports of oil. Even if the Algerian ideal of pricing gas exports at calorific parity with crude oil f.o.b. were to be achieved (this might mean discarding all additional bulk fuel uses for gas in importing countries, but some gas exporters are quite prepared to see that happen)the large difference in costs upstream of the jetty would

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*The United Kingdom and the German Federal Republic, which had the longest established distribution networks originally developed for gas manufactured from coal, are the closest to exceptions to this rule. But Germany still has significant electricity generation from gas; and the British Gas Corporation is still saddled with some long-term and low-priced contracts it had to make when North Sea gas first came ashore.

"net back" less profit and national revenue per unit of energy exported than oil exports do. Oil costs about twice as much per unit of energy through a pipeline; and about seven times as much exported as LNG as oil by tanker. Those disparities seem immutable. However, they do not complete any immutable economic case for local use of gas against exporting it. The case depends on circumstances. Whether the gas is associated and hence whether you have to produce it because you want to produce the oil? If not, how big the non-associated gas discovery may be in relation to how much gas your country can reasonably hope to use within a period? Both are associated, like all national development decisions, with the cost of waiting, which varies from country to country. Time is not neutral - as between countries with more and less population and resources, more and less income per head to start with, more and less education and instincts of workmanship, different social structures and paths for advancement.

Finding Extra Gas

This paper did not begin with the traditional gambit of enumerating reserves of gas. Some of the measures are set out, for convenience, in Tables 1,2,3; but gas reserve figures, in particular, have little meaning. It suffices to say that so far as we know these are not far short of reserves of oil, and imply far higher reserves-to-production ratios. Most of this gas has been found incidentally while exploring for oil. Outside the USA little "directional" exploration for gas as such has ever taken place; and even inside it, until very recently, not an enormous amount. We are entitled to assume that gas reserves are significantly larger than has ever been measured. Those would be reserves of conventional gas, associated or non-associated with oil.

In the United States, much interest has recently been expressed in "unconventional gas" from "tight sands", i.e. gas that is harder to get out. Not to be outdone, Soviet gas experts are now talking with enthusiasm about "gas hydrates", or methane in actual solids. One of them feels that reserves of this hard stuff may be "several times larger than the overall resources of coal, oil and conventional natural gas on the Earth". A consensus of technical experts' opinions, let us say, implies that there is no lack of gas reserves of one kind and another. Perhaps, also, they are very widely distributed around all our countries. Provided, that is to say, that we can find them.

Whatever gas reserve figures may be cited, however, need treating with great caution as regards international trade in gas, and some caution as regards its development for local use. My own consultancy has pioneered a method of field-by-field analysis of published gas reserves that examines their assessability and association with oil; political deferment for one reason or another; commitments to domestic markets; remoteness from gathering systems; and existing commitments to export. Applying those criteria, we arrive at an "Exportable Surplus." That surplus amounts to only about 32 percent of published gas reserves - after setting aside something of the order of 40 percent of world reserves committed to domestic gas markets. (The 40 percent included the reserves of the great developed markets such as the United States and Western Europe, plus 30 years' domestic consumption for Eastern Europe taken out of Soviet reserves.) It has to be noted that about two-thirds of the volumes of world gas reserves that we classified as available for export were in Russia and Iran. The present government of Iran says it does not plan to export gas; and the present government of the United States would like to stop Russia exporting any gas beyond the Communist sphere. If both potential flows of exports should have to be written off permanently, the competive ambitions of other exporters of gas might soar. But expectations regarding total gas trade in future would probably need to be written down severely.

For trade or for domestic uses, the huge potential reserves of natural gas need to be discovered and proven. Explorers, that is to say, need to be caused to look for gas. Within the USSR, presumably, orders can be given - though the capital and of late the technology need to be generated locally or borrowed partly from outside. Within the USA, also , most of the exploration effort is local: a wide range of economic and fiscal incentives ean be offered in local legislation (or, simply, discouragements can be removed) to make exploration for gas commercially worth while. Outside those two super-powers, (i.e. in Europe as well as OPEC and other developing countries), most explorers tend to be foreign. Incentives to explore for gas need to be developed within the exploration and development agreements made by host governments with mostly foreign companies whose primary incentives are for finding oil - not gas - for export.

No petroleum exploration and development agreements in existence anywhere were designed primarily for gas. That was true of the former oil concessions. It has remained true in the various metamorphoses that have followed them. These - of which production-sharing is a distinguished and nowadays very popular variant - have tended to establish government ownership of the resource firmly, and greatly to increase the share that the government gets out of resource development. But the petroleum resource in mind was virtually always oil. Almost all the clauses that define performance and rewards for both sides in petroleum agreements define these in terms of oil. There is usually a gas clause, of two possible kinds. One kind is an agreement to agree later if gas is found: in effect, convenient because meaningless. The other simply rules that any gas found shall belong to the government. That may fortify or enhance national rights. Whether it will mean anything or nothing will depend still, on how much gas is found where, and whether there seems anything sensible to do with it. But more important, such a clause gives explorers no more incentive than the other kind does actually to look for gas - to drill, for example, where the geological indications imply a greater likelihood of the occurrence of gas than of oil. What can the explorer count on if he does so?

This problem is coming to the fore increasingly of late, mainly but not exclusively in non-OPEC developing countries. The price of imported oil for some, and the need to get the best out of their petroleum opportunities for others such as Egypt, make gas very well worth looking for in the national interest. In the foreign explorer's private interest, they may not. In my own view, as a consultant practised in the design and the modification of petroleum agreements, gas is one extremely important example of a new range of problems arising between international companies expert in petroleum exploration and their host governments. This range covers the circumstances in which a host country wants foreign explorers to find petroleum for it; but if they do find it, may choose in the national interest to develop the petroleum differently from the way in which they, commercially, would have chosen to develop it. (Once again, we return to the cost of waiting. Time is certainly not neutral between governments looking to long-run national interests and companies whose development plans must reasonably be influenced by commercial pay out periods and discount rates.) As regards gas, this difference in rates of time preference is often complicated further by the "set-aside" stipulations that host governments usually make. They want to defer any exports of gas until enough reserves have been accumulated from discoveries to cover the amount of local gas sales that they believe may reasonably be developed in some chosen period. (The Canadian "set-aside", often taken as a pattern, is 30 years' consumption at current rates. For a country only just starting to develop gas markets locally, choosing a sensible period, and hence the amount of reserves to defer, is not easy.) In the meantime, until that much gas may be found, it may be left in the ground for years. If so, and if the discoverer gets nothing in the meanwhile, why should an explorer look for gas at all?

Rewards for Discovery

I gather from friends in ENI that the government and a number of companies exploring in and offshore the Nile Delta are now working with a new gas clause in production-sharing agreements which is specifically designed to address this problem. Mr. Rustici will be describing and explaining this in detail later in our seminar. What interests me about the principle of it is that if an explorer discovers significant reserves of gas, which he is not able to exploit in any way because it has largely to be dedicated to the reserves deferred for local use, then there is provision for reward simply for having discovered it,as some multiple of his expenditures laid out on the exploration. (This is a principle that I raised for discussion some years ago*, but which I think has hardly been introduced into recent petroleum exploration agreements anywhere else.) It is a principle that may have particular application to exploration for gas. More generally, host governments might be interested in the fact that it fits another neglected feature of all petroleum exploration. In exploration the risks are extraordinarily high, but the expenditure need not be enormous.

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* In "OPEC and the Development of Fourth World Oil", an inaugural lecture at the School of Oriental Studies, University of London, February 1977.

Once the petroleum is found, the risks are much lower but the expenditures are of far higher orders of magnitude. For finding a nation's oil or gas, the discoverer deserves a very high rate of return on his very risky gamble. For developing petroleum, he and the host government need an equity return, covering normal commercial risk, on a far higher capital investment. (Both, of course, may be able to obtain institutional finance for this second stage from commercial or international banks.) That development may in any case be deferred, as with gas, or nowadays carried out with a time profile of depletion representing the non-commercial national interests of the country. If so, formulae are needed that can reward the explorer for his risk, as distinct from the proceeds of development, if further exploration is to be encouraged at all.

Egypt and the companies introducing this unusual feature in petroleum formulae (which has other unusual features such as joint commitments involving parties to several different agreements) deserve good luck with it. The principle of "the finder's prize" has a long and honourable history in mining legislation for solid minerals. Discovery under the mining legislation of the "Code Napoleon", for example, did not confer an automatic right to develop the find. The finder could be rewarded in money. It may not be generally appreciated that one of the world's greatest gasfields, at Groningen in the Netherlands, was discovered under just such a Code Napoleon Dutch mining law. Most petroleum agreements, and many petroleum companies and governments, have so far assumed that exploration and discovery should confer an automatic right to develop. They have ignored the possibilities that nowadays development may have to be deferred, or carried out according to national depletion preferences, not commercial considerations. Egypt which several years ago, borrowing the production-sharing system from Indonesia, adapted and improved it, seems to me to be introducing or re-introducing a valuable principle here that can strengthen one of the weaker links in the whole chain of petroleum development - offering a real incentive in newly prospective acreage to explore specifically for gas.

Many current projections of world energy demand and supply are now suggesting that from now on more of the growth in total demand may occur in the developing world than in the OECD countries, reflecting a faster average rate of general economic growth. (In terms of energy use or income per head, such faster growth will be less impressive; and for the poorer countries, both may remain woefully inadequate.) This will almost certainly be true of natural gas, in that it occurs so widely, and because such high proportions of the volumes associated with oil production are currently flared. Some of the OPEC countries now seem clearly committed to treating natural gas as a "resource-locating fuel", as coal was in the 19th century. Oil, moving so readily and cheaply vast distances across the world to develop other people's industries and markets, has generally not developed industrialised markets where it was discovered. Such OPEC countries are able themselves to finance the enormous local investment this development of associated gas involves. Other OPEC countries (though nowadays not all of them) may be able themselves to finance the comparably heavy upstream investment involved in exporting natural gas. For non-associated gas, even for such wealthy developing countries, the balance of advantage between these two industrial strategies for gas utilisation will vary from case to case. For countries without oil revenue surpluses to absorb. but with significant quantities of asociated gas to utilise and prospects of considerable further non-associated gas, the industrial strategy may need to be a mixed one. Both local and export development will require large inputs of foreign capital, either through governmental aid or from the private sector. But the rate of return on both ways of developing a country's gas should also be higher than ever before. In a decade when the cost of energy - whatever happens to short-run price expectations about oil - is likely to remain high, development of whatever gas a country has and can discover may well rank high among national economic priorities.

Table I. NATURAL GAS: World Reserves, Production and Reserves/Production Ratios, 1980

	Reserves	Production	R/P Ratio (Years)
	(billion cubic metres)		
North America	8162	637	13
of which USA	5670	569	10
USSR & E.Europe	31017	487	64
of which USSR	30500	435	70
West Europe	4375	191	23
Far East	4994	82	61
South America	4830	65	75
Middle East	18410	42	443
of which Iran	11000	8	
Africa	5923	18	324
World	77711	1522.3	51
of which OPEC	25585	91	282

Reserves: Proven at end-1980

Production: Annual 1980.

Source: Petroleum Economist

Table II: NATURAL GAS: World Consumption 1970, 1980 and Projection for 1990

(million barrels/day oil equivalent)	1970	1980	1990
Industrial Market Economies*	12.8	15.0	16.2
USSR & E.Europe	3.8	7.0	12.3
Capital Surplus Oil Exporters	0.2	0.7	1.1
Developing Countries:			
Oil Exporters	0.7	1.4	3.5
Oil Importers	0.3	0.7	1.6
Total	1.0	2.1	5.1
Total World	17.7	24.3	34.2
Gas as % World Energy	17.9%	17.9%	18.5%
Total World Oil	43.3	59.7	72.5
Total World Energy	99.1	135.5	185.1

Definitions: "Industrial Market Economies" include OECD except for Greece, Portugal, Spain and Turkey, included in "Developing Countries".

"Capital Surplus Oil Exporters" are Iraq, Kuwait, Libya, Saudi Arabia, Quatar, UAE.

"Developing Countries" include China: four OECD member countries: seven OPEC member countries.

Table III: Growth in Natural Gas Consumption 1970 - 1990

Average Annual Percentage Growth Rates	1970-1980	1980-1990
Industrial Market Economies	1.6%	0.77%
USSR & E.Europe	6.3%	5.8%
Capital Surplus Oil Exporters	7.2%	11.6%
Developing Countries:		
Oil Exporting	7.2%	5.8%
Oil Importing	8.8%	8.6%
Total World:		
Natural Gas	3.1%	3.6%
Oil	2.8%	2.0%
Total Energy	3.0%	3.2%

Categories of countries designed as in Table I.

Source: World Bank

U.S. NATURAL GAS POLICY AND OUTLOOK FOR GAS IMPORTS

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EGPC - IEOC

INTERNATIONAL SEMINAR
ON NATURAL GAS AND ECONOMIC
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U.S. NATURAL GAS POLICY AND OUTLOOK FOR GAS IMPORTS

JOHN H. LICHTBLAU

The U.S. gas market is almost completely self-sufficient. Yet, it is still of considerable potential interest to the international gas trade. For it is a market of such magnitude that even a small increase in the gap between domestic supply and demand could provide a substantial outlet for foreign gas. On the other hand, if this gap does not develop or is met by supplementary gas supplies other than imports, this too should interest the international gas trade, since it would forestall illusory expectations about a market that may never develop.

I would like to discuss the outlook for U.S. gas import requirements against the background of the new natural gas economics and politics that have emerged since passage of the Natural Gas Policy Act (NGPA) in November 1978.

Let me start with a few facts. In 1981 the U.S. consumed about 20 trillion cubic feet (Tcf)* of natural gas and produced 19.6 Tcf. This made it by far the largest consumer and producer of this fuel, accounting for about 38% of total world gas demand and supply.

When it comes to reserves, however, the U.S. gas position is much less strong. The 198 Tcf of proved reserves at the end of 1981 accounted for only 7% of world reserves. Furthermore, if we exclude northern Alaskan reserves whose commercial development is quite uncertain for the foreseeable future, U.S. proved gas reserves have declined every year since 1968 and now equal less than 9 years of

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* a cubic foot of gas equals about 1,000 Btu's.

the current annual production level. Ten years ago the U.S. reserve/production ratio was still 11.5 years, with a production level significantly larger than last year's. It is this growing discrepancy between the production level and the underlying resource which has given rise to the assumption that the U.S. will have to draw on substantial supplementary gas sources, including imports, if gas is to maintain its 26-27% share in U.S. energy consumption.

In part, this assumption is of course correct. But the decline in U.S. gas reserves over the last 13 years is by no means entirely due to a naturally depleting resource base. To a large extent it reflects decades of legislation and regulations which created disincentives for exploratory drilling.

Gas pricing policy is now undergoing basic changes. Under the NGPA the average U.S. gas price is rising much faster than the inflation rate and all new gas (mostly gas from reservoirs not produced before April 1977) will probably be decontrolled by January 1, 1985, when this becomes permissible. Thus, the incentive for drilling gas wells will clearly and rapidly increase over the next several years under existing legislation.

We have seen the impact of price incentives on domestic crude oil drilling in 1980 and 1981, following price decontrol of newly found oil in mid-1979 and all domestic oil in January 1981. The effect of the removal of these constraints together with the sharply rising world oil price in 1979/80 caused the number of oil wells drilled to increase by 39% in 1980 and 40% in 1981, to record heights in both years. Meanwhile, gas wells increased by only about 7% in each of these years. As we move beyond 1982 we can expect a somewhat similar upsurge in gas drilling and for somewhat similar reasons.

The higher drilling rate will most probably slow down the decline in natural gas reserves, since the economically recoverable potential gas resource base is estimated to be a multiple of current proved reserves. Optimistically, the higher drilling rate might even stabilize the existing reserve level. It is unlikely, however, that it will bring about a sustained increase in U.S. gas reserves during the 1980's. The reason is that the gas producing industry must run fast just to stay in place. The bulk of the currently flowing gas comes from fields discovered before 1970 whose flow is rapidly declining. Hence, without an accelerated drilling effort during the 1980's we would see a sharp drop in U.S. gas reserves and production in the second half of the 1980's.

It is difficult to forecast the actual level of U.S. natural gas production by 1990, given the opposing forces of substantially higher price incentives and the rapid depletion of most flowing wells. But our guess would be that the positive will not fully offset the negative so that by 1990 conventional domestic gas supplies (excluding Northern Alaska) are likely to be 1.5-2.5 Tcf below last year's available production of somewhat over 20 Tcf. Thus we expect the supply side to contribute modestly towards increasing the gap between domestic gas supply and demand.

Now let us look at the demand side. We know that from 1974 through 1977 U.S. gas demand was supply-limited, that is, if more gas had been available it would have been used, probably backing out oil. Since 1978 demand has stabilized within about 1.5 percent in either direction of 20 Tcf. In the last two years, available supplies have been perceptibly larger than actual demand so that some production had to be shut in. Current shut-in production is in excess of 1 Tcf. In the trade this is referred to as the "gas bubble", suggesting that it is a temporary phenomenon.

The occurrence of the gas bubble gives an insight into the factors influencing the U.S. gas market. The original reason was largely regulatory. Gas was forced out of electric power generating plants at a faster rate than it could be rechannelled into other markets. These regulations were somewhat mitigated in 1981 but the gas bubble has continued because gas consumers on the whole are currently using less gas than is available to them. In part this reflects the current economic recession and in part it is due to price-induced conservation, the latter being of course more permanent.

It is noteworthy that consumers should practice this conservation with a fuel whose price has been persistently substantially below that of its principal competitor -fuel oil and heating oil. The reason is that natural gas prices have risen enormously from their earlier very low levels. Thus, the average 1981 wellhead price of natural gas, about $ 1.85 per thousand cubic feet (Mcf), represents an 760% increase over the average 1973 price, or nearly five times the underlying U.S. inflation rate during this period. Gas prices to consumers also rose by multiples of the inflation rate. Hence, consumers looking at their rapidly rising gas bills had a strong incentive to conserve this fuel despite its low price relative to oil products. There is considerable evidence that they did conserve, in factories, homes and commercial establishments. This is a major reason that domestic natural gas demand is no longer supply limited. Prior to 1980 most forecasts had assumed that it would remain supply-limited throughout the current decade.

The energy conservation process in gas demand is by no means completed, since the price of gas is likely to continue to rise substantially faster than the U.S. inflation rate until it reaches its market clearing level. A recent study by the U.S. Department of Energy (DOE) projects a doubling in the real (constant) average annual wellhead price of natural gas between 1981 and 1985 under NGPA. Thus, the real price of gas will continue to soar during this period while that of oil will in all likelihood move at least slightly into the opposite direction. This means that switching from oil to gas will become less attractive than in the past, while gas conservation will become more attractive.

Of course, simultaneous with this downward pressure on demand there are also continuing upward pressures. For instance, with 41% of all new U.S. homes being gas heated, the eventual recovery in U.S. housing construction will undoubtedly increase demand. Similarly, most of the industries which use gas for industrial and process heating have an underlying secular growth trend which affects their longer terms energy requirements. Between now and 1985, we expect these opposing trends to approximately offset each other so that unconstrained demand for natural gas will show very little change from last year's level of about 20 Tcf.

As pointed out, U.S. natural gas prices will rise in real terms during this period but will remain below the market clearing level. By 1985 gas prices will approximate that level, either under existing legislation or under alternate legislation, proposed by various industry groups, which would phase out all gas price controls over the next three or four years.

Now let us define the term "market clearing" price, as it applies to U.S. natural gas. We believe it is the point at which the price of natural gas is at approximate Btu parity with residual fuel oil delivered to industrial and electric power plants in the South West. This price is then netted back to the wellhead (by deducting transportation cost) to establish the market clearing wellhead price.

Our reason for determining the market clearing price in this manner is that the industrial and power plant market, which accounts for over 60% of total U.S. gas consumption, represents the only real swing market between oil and gas, since many users are in a position to switch back and forth between these two fuels at relatively short notice.

Of course, this calculated parity at the user level could theoretically result in different gas wellhead prices for different geographic regions, partly because of variations in gas transportation cost and partly because of regional differences in the required quality (sulfur content) of residual fuel oil. We believe the pertinent point of reference is the Gulf Coast where gas has the minimum transportation cost and residual fuel oil quality is not significantly restricted. Interestingly, by setting the Gulf Coast wellhead price of gas at 70% of the Gulf Coast refiner acquisition cost of crude oil, one arrives at a similar parity with residual fuel oil at the described point of consumption.

In order to determine when parity between oil and gas, as we have defined it, will be reached we must make some price projections. For natural gas the DOE has recently projected an average U.S. wellhead price of $ 3.62/Mcf (in constant 1980 dollars) for 1985 under continuation of existing NGPA legislation. In nominal 1985 dollars this price is likely to amount to about $ 5/Mcf.

For future crude oil acquisition cost we must unfortunately make our own forecast which requires guessing at the future price of OPEC oil. Historically, such forecasts have hardly ever been correct. However, unless we do make assumptions about future oil prices we can say nothing about gas prices, since the former will affect the latter.

We believe that the average official OPEC market crude price will remain at its current nominal price level through 1983 and will then rise approximately in line with inflation in 1984 and 1985. This would yield a 1985 price of $ 39-$ 40/Bbl in nominal dollars

($ 28-29 in 1981 dollars). We expect U.S. refiner crude oil acquisition cost to rise in a similar fashion from an average of $ 35.25 in 1981 to about $ 41 in 1985. Under our assumed parity price, as already described, this would result in an average wellhead price of about $ 5/Mcf for natural gas, or about the same as the wellhead price forecast for 1985 by the DOE. Thus, if our oil price projection and the DOE's gas price projections are both correct, oil gas price parity will be reached by 1985.

How will U.S. gas demand fare from then on? As we have seen, conventional domestic gas supplies in the 1986-90 period are expected to be 17.5-18.5 Tcf. There is no doubt that this volume of gas will continue to find a ready market. Any growth in demand above this level would depend on the cost and availability of supplemental gas supplies. This is of course where imports come in. In fact, from now through 1990 imports will account for nearly all supplementary U.S. gas supplies.

Where will these imports come from? The answer is, primarily from Canada and Mexico by pipeline. In 1981 we imported 735 billion cubic feet (Bcf) of Canadian gas by pipeline. This was about 8% less than in the previous year which in turn, was 20% below the peak level of about 1 Tcf in 1979. The reason for the decline was not unavailability of Canadian supplies but lack of market demand in the U.S. at the Canadian border export price. This price is tied to a formula based largely on the F.O.B. cost of Canadian oil imports. Under the formula the current price could be about $ 1.00/Mcf higher than $ 4.94 actually paid. But the Canadian government has waived the increase to prevent further reductions in the export volume.

In addition to the 1 Tcf of Canadian gas available under existing contracts, 525 Bcf in export projects have been approved both by the Canadian and the U.S. governments, while another 325 Bcf are currently awaiting approval.

Canada has a substantial and growing volume of shut-in gas production. This has greatly reduced the incentive for exploration activities in western Canada. Furthermore, Canada's master plan to bring western gas to its eastern provinces, backing out imported oil, is likely to be affected by the discovery of gas off Nova Scotia and large oil deposits (with associated gas) off Newfoundland. Under these circumstances, Canada can be expected to become once again more export oriented in its gas policy. An available gas export volume to the U.S. of about 2 Tcf sometime after 1985 does not therefore seem unreasonable. The cost to the U.S. would probably be substantially lower than that of other supplementary gas sources such as new synthetic gas, gas from northern Alaska or, as we shall see, liquefied natural gas (LNG) from almost any source.

Another ready source for incremental gas imports is Mexico which last year supplied the U.S. with 108 Bcf. This volume is soon to be doubled and could probably be tripled within a few years, according to estimates by PEMEX officials and others. The country's proved and probable gas reserves are certainly large enough to permit such a level of exports. It should be recalled in this connection that in 1977 PEMEX signed a letter of intent with a U.S. gas pipeline consortium to deliver up to 700 Bcf annually. Final agreement was blocked by U.S. government objection to the border price of $ 2.60/Mcf demanded by PEMEX at the time. The current Mexican price tracks the Canadian price of $ 4.94.

Canada and Mexico, together with the small volume of existing and planned domestic synthetic gas production, could probably supply the U.S. with some 2.5 Tcf of supplementary gas in the later 1980's. This would enable the U.S. to maintain its current annual domestic demand of 20 Tcf, or do slightly better, until at least 1990. Any additional supplementary gas supplies (except for relatively small volumes of incremental seasonal peak requirements) could enter the U.S. oil/gas competitive market during this period only at prices approximately in line with the delivered cost of oil products. No new Eastern Hemisphere LNG project would meet this criterion. The current regasified delivered cost of LNG from Algeria, the nearest Eastern Hemisphere supply source, is quoted at $ 7.30/Mcf which is vastly above the cost of oil or Canadian pipeline gas. Some pipelines can pay this price, just as they can pay similar or even higher prices for some new domestic gas, because they can average it with other categories of gas which are kept low priced under existing legislation. Under NGPA some gas is to remain under price control as long as it continues to flow and thus will provide a continuing cushion for rolling in the cost of higher priced gas. However, this "old" gas production is of course irreversibly declining so that the cushion is getting progressively smaller. Hence, new LNG import projects which require substantial capital investment and can only become operative in the late 1980's will have virtually no benefit from the domestic price cushion. Furthermore, it is quite possible that sometime within the next few years new legislation will end all wellhead price controls on natural gas. In that case the cushion will disappear instantly.

One final point: If some incremental LNG supplies are required in the 1980's the U.S. will first look to such nearby sources as Trinidad for shipments to the East Coast and the Cook Inlet in southern Alaska for shipments to California. In both these places LNG export projects are under active consideration. Given the relatively high transportation cost of LNG, shipments from these locations are likely to be more competitive than those from Africa or Indonesia. For the same reason Europe and Japan provide more economic LNG markets for African or Asian exporters than the U.S. East or West Coast.

Let me conclude with one caveat which could turn around everything I have said. I have assumed that the real price of oil will not rise significantly during the remainder of the 1980's. If this assumption is wrong and we see another sharp real price increase, LNG from the Eastern Hemisphere could indeed be priced competitively in the U.S. because it may be able to sell at or below the cost of imported oil. I consider the odds for such a scenario fairly low but by no means zero. If it did occur the evolving problem for exporters would not be competition with other fuels but the shrinking markets for both oil and gas.

Finally, I would like to reemphasize that my analysis only covers the period through 1990. In the next decade U.S. demand for supplemental gas supplies can be expected to increase further. It remains to be seen whether LNG imports from the Eastern Hemisphere will then be able to play a part in providing these supplies.

EGYPTIAN ECONOMIC POLICY

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EGPC - IEOC

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EGYPTIAN ECONOMIC POLICY

ROBERT MABRO

1. Introduction

Since the subject of this seminar is gas, we have been talking relentlessly for two days about gas. I feel that we may be in danger of being slightly intoxicated. My function is to bring in some fresh air, that is to open up the subject and place it in a broader perspective.

Gas is Egypt's new resource; more precisely one of its new resources. It is a natural resource owned by the nation which should be used optimally for the maximum possible benefit of Egypt's economic development. This involves policy issues; and I am tempted to go further in suggesting that the government faces here a policy challenge. The optimum use of a publicly-owned scarce resource depends critically on appropriate economic management. Faulty policies lead to waste. Egypt cannot afford to waste economic opportunities: she cannot afford faulty policies which fail to extract the maximum benefits from the country's endowment of scarce resources.

I propose, therefore, to concentrate in this paper on policy issues. However, I do not believe that policy can be meaningfully divided into self-contained problems relating exclusively to this or that area of economic management. It would be wrong to discuss gas policy in isolation, and without reference to the whole policy framework which defines the path of economic development in Egypt. A particular policy issue cannot be properly analysed if treated in a vacuum, because all policies must relate to the main set of economic objectives pursued, for good or for worse, by the government; and because the effects of any particular policy extend beyond its own area through the complex network of inter-relationships which links together the national economy.

This perspective determines the contents and the structure of this paper. I shall begin, first, with a short presentation of the main objectives of economic policy in Egypt as revealed by a study of recent history. This is followed by an appraisal of the merits and shortcomings of the major policies pursued so far. I shall then argue that far reaching changes in policies are now due; some even say that a complete overhaul is required and is overdue. I shall then try to formulate the principles which may guide these changes and provide a few selected examples of possible reforms. Finally, in the light of this analysis, I shall attempt to draw specific conclusions about gas. Thus gas policy is put in the context of a broader theme and the rationale of the proposed changes is shown to derive from a fundamental need for policy reform.

2. The Objectives of Economic Policy

Any historical study of Egyptian economic policy in the past forty years reveals a remarkable degree of continuity in objectives. This may sound surprising given the considerable economic changes which have taken place during these past decades; and the fact that the economic system has been the subject, on at least two occasions, to radical transformations. Until the late 1950s, the economic system to a large extent was one of private free-enterprise. Between the late 1950s and the early 1970s, the system involved public ownership of means of production in the modern sector, planning and rigid regulations on foreign trade; since 1973 the system became characterised by liberalisation, open-door policies and the re-emergence of an active private sector. How is it possible to say, in the face of these transformations, that the objectives of economic policy have shown little change?

The thesis is that the objectives have remained qualitatively the same (though the emphasis placed on each of them and the determination with which this or that objective has been pursued by successive governments have varied from period to period), but that the means sought to implement these objectives have been radically different. The story begins with the Second World War. In Egypt, the government began to play an active economic role in the 1930s but this role was enhanced when the war broke out and has become significant ever since. A careful examination of economic history shows that the government's main economic concerns were:

(a) Economic development. This concern emerged in 1930 (introduction of the first tariff law and public works programme); it became more noticeable after 1945 (greater encouragement to industry through higher tariffs); and was emphatically pursued by the government since 1954. Planning was introduced for the purpose of economic development. The creation and expansion of the public sector was thought to favour economic development. Similarly, the liberalisation of the economy and the open-door policy introduced in the 1970s were inspired by the same dominant objective. There was no change in goals, but a change in methods and philosophy. I dare say that the main economic priority of the government today, as in the past, remains economic development.

(b) The protection of the consumption standards of low-income groups. World War II involved a price explosion. The retail price index trebled over a period of two years. The government responded to this situation by a set of measures, mainly price controls, cost of living allowances and ration cards. Clearly, the aim was to protect households from a sharp rise in the price of subsistence necessities by ensuring that minimum requirements for certain basic items are made available to all. This was the beginning of price regulation and food subsidies. They have continued ever since. They became more widespread in the 1960s and much more onerous for the government since the 1970s. The policy in both its objective and its instruments has survived radical changes in the economic system . Surely you must agree that history reveals remarkable continuity in this area.

(c) External Financing. Pre-occupations with foreign exchange and the balance of payments have dominated Egyptian economic policy from time immemorial. Since Mohammed Ali every government approached the problem in a different way. I shall spare you from a long digression in ancient history and shall only refer to the period starting in 1939. Because of the war, Egypt introduced foreign exchange controls and though these controls have been relaxed at times and tightened in other periods, they have always remained in one form or another the statute book. Since the mid-1950s, Egypt has faced the problem of financing a deficit on its balance of payments current account. A main economic objective of all governments was to secure larger foreign exchange in-flows and to curb whenever possible the rise in outflows. In the closed system of the 1960s, these objectives were pursued by seeking foreign aid and loans and by stern import and foreign exchange regulations. In the open-door system the same objectives are pursued with old means (aid and loans) and new methods (a liberal financial system which encourages repatriation of remittances and direct foreign investment). Export promotion has been tried by everybody with various degrees of success.

Let us now place gas in the context of these long-standing policy objectives. First, there is no doubt that gas, as a valuable domestic resource, can play a role in the economic development of the country. The question is what is the best use of gas in terms of this objective? Should gas resources be developed and processed for exports or for use as a substitute fuel domestically or for both purposes? If the latter question is answered affirmatively, we still face the issue of balance and proportion: how much domestic use and how much for exports. Secondly, a price tag must be attached to gas.

The pricing of gas cannot be divorced from that of other energy because gas is a close substitute to oil products in a wide variety of cases. But gas and oil are highly tradeable commodities, and they have an international price which defines their opportunity cost to the economy. In Egypt, however, major objectives of social policy have put in place a rigid system of price administration. Domestic prices of several tradeable commodities (of which oil and gas are but two examples) bear no relation to their opportunity costs. The social objectives of Egyptian economic policy pose an acute and difficult allocative problem, and gas is only one aspect of this complex issue.

Finally, gas whether exported or used domestically is foreign exchange. Any gas policy has a bearing on the balance of payments, and we have argued that one of the main objectives of government policy is to manage as best as possible the external current account. To sum up. The basic aims of economic policies have displayed features of permanence over several decades. These objectives are themselves inter-related. Development is constrained by the balance of payments and foreign exchange needs, hence the problems of external finance. Development pursued through fiscal deficits induces inflationary pressures (to which we must add the pressures transmitted by inflation in the world economy), hence the need to protect in all equity those segments of the population who stand to suffer most from price rises. Growth, prices and the balance of payments are therefore the basic issues whether we are concerned with gas or with anything else.

3. An Evaluation of the Policy Framework

The various objectives of economic policy, admirable as they may be, each by itself, may involve serious conflicts when they are pursued simultaneously. There is a clear conflict in Egypt between the development and the price strategy. And there is little doubt that the price policy has exacerbated the balance of payments problem. I am not suggesting that there is an easy solution to these conflicts. And I would like to stress from the outset that although I cannot but agree with the diagnosis of certain international organizations and economic experts who have showered Egypt with reports and studies on the distortions and side effects of the policies pursued over several decades, I do not agree with their insistence that prices should be swiftly raised to international levels, that subsidies should be rapidly phased out and that complete deregulation will solve all the economic ills of the country.

I do not agree with these rash recommendations because they ignore very serious socio-political difficulties involved in implementing them, they understate the length of time required to effect an orderly transition from the present to a new price regime, they over-emphasise the importance of a particular area of policy at the exclusion of others and they grossly under-estimate both the price-inflation (cost-push) and the output-deflation (aggregate demand drop) of the measures advocated.

But let us face it; impalatable as it may be, the diagnosis is correct. The controlled price regime leads to serious misallocation of resources. The examples abound. Controlled rents have killed the incentive to maintain the housing stock. Agricultural procurement prices have led to an inefficient crop pattern. Low energy prices have stimulated high rates of increase in the consumption of energy. And there must be something wrong in the allocative system when, in a poor country, taxis cease to be a luxury and become a necessity service. Not to mention that subsidised bread is said to be a cheaper feed for poultry and livestock than fodder.

This is not to deny that the price policy has achieved some of its distributional objectives. The poorer urban groups, especially the lower middle class,have been protected against the worse effects of immiserization. Those who have access to a shelter have not been driven out by a rent explosion (though some may have been driven out by a collapsed roof which the landlord has no incentive to repair), and those who thrive on fixed incomes have not been entirely deprived of basic food necessities. The fact that average nutritional levels are higher in Egypt than in other countries with similar per capita incomes may be attributed to a large part to the food subsidies.

4. New Policy Directions

I am inclined to argue that the need for a new policy outlook has arisen, not simply because of the allocative effects of present and past pricing policies but because of radical changes in economic opportunities and in the resource base of the Egyptian economy. To focus narrowly on price regulations and government subsidies, as international agencies tend to do, does not seem to be the correct approach. The view advocated here is that a broader change in outlook is required, and that the new philosophy must concern itself first with perspectives on economic development.

On economic development, Egyptian perceptions seem to be dominated by an old conventional wisdom. The main tenets of this wisdom are as follows. The locus of economic activity is the Nile Valley. Agriculture on the old land of the Valley has peaked. Industry has comparative advantages when it processes domestic resources (such as cotton in the textile sector). Emigration releases surplus labour, hence relieves some of the population pressures. Foreign exchange is more valuable than domestic resources; the former must be acquired (or saved) at any cost while the latter may be used up without reference to opportunity costs.

This conventional wisdom ought to give way to different perceptions. The old land in the Nile Valley still has enormous agricultural potential, and instead of shifting the locus of agricultural development to the desert which is highly unsuitable, it is the other activities now eating up the good soil that should migrate leaving the Valley for cultivation. But this agricultural potential is no longer in field crops. The long-term future of Egypt's agrarian system in its transformation into the fruit and vegetable garden of the Middle East and Western Europe. The government can play a considerable role in inducing this transformation, yet very little is being done in this respect.

The industrial future of Egypt depends on the skills of its people not on the natural-resources of the country. Egyptian cotton is not a good base for simple textile manufacturing simply because its quality is too good for that purpose. And there is no point in processing low quality iron ore at a loss even if iron ore is available. The industrial strategy which develops the skills required to transform the best cotton in the world into high quality textiles and to foster the growth of metal industries that may use imported iron to produce a wide range of appliances and tools adapted to Egyptian requirements would achieve better economic results. Governments tend to believe that their contribution to industrialisation is to build a factory. A more useful contribution would be to establish a technical or a management school.

I am no longer sure that emigration is an unmixed blessing. There are new economic opportunities in Egypt which are not sufficiently exploited because skilled workers have been attracted abroad. Emigration has drained industry and construction of manpower; in some instances to a critical degree. I would go as far as to argue that even tourism is suffering from the emigration of cooks. Egyptian cooks run the kitchens of hotels in the Gulf and Egypt imports cooks at high costs for its Sheratons and Meridiens. Everybody marvels at the remittances of emigrers; very few talk about the foreign exchange costs entailed in replacing them. Here again, the thesis is that the engine and factor of development is people, not so much foreign exchange. We all know of rich oil-exporting countries where development is constrained by manpower shortages and of countries poor in resources, such as Switzerland and Japan, where the highest rates of development have been achieved thanks to the efforts of man. I am <u>not</u> advocating emigration controls in Egypt, rather a policy designed to maximize the incentive to stay for those whom Egypt needs.

Finally, economic planners and policymakers have always been inclined to make an artificial distinction between domestic and foreign exchange resources. The correct approach is that all resources have an opportunity cost in foreign exchange. Egypt is an open economy and, apart from some services provided by the informal sector, all commodities, services and factors of production are potentially tradeable. They can either be exported or substituted for imports. This is particularly important for gas and oil, the commodities which concern us today. Thus, gas should be treated as a foreign exchange commodity even in the context of a policy which advocates its domestic use. Gas, when it is not exported, replaces oil which is easily exportable or other fuels which would be imported instead. These principles are readily understood when stated plainly but an examination of past policies in many fields suggest that they are not applied.

5. Principles of Policy Reforms

The main objectives of economic policies mentioned earlier on are perfectly appropriate and should continue to inspire the management of the economy. The emphasis on economic development and on equitable social objectives is of paramount importance; and the concern about external financing and the balance of payments is so closely related to the growth objective that it will remain with us for the foreseeable future. The aim of policy reforms is not to seek different objectives but to find improved means for their achievement. Thus, the first principle is to preserve the continuity of objectives.

The second principle is that changes should be gradual but consistent in their application. The temptation to do nothing is strong because the conventional wisdom sticks like glue and because changes involve all the fears of a journey in the unknown. The temptation is to change things suddenly and radically arises sometimes. Governments are known to become impatient on occasions and to succumb either to whims or to external pressures; they push through fundamental reforms without sufficient preparation. Such reforms may backfire (as the price increases of January 1977) or cause unnecessary harm (like the sudden nationalisation wave of 1961/62 or the rapid liberalisation of 1973/4).

The third principle is that the policy reforms should be based on sound economics. Good economics distinguishes between allocative and redistributional objectives. Prices have an allocative role to perform and ideally should not be tampered with for the purpose of equity (except in the case of monopolies where regulation may be required). Taxes and direct income subsidies (not price subsidies) have a distributional role and can be used to promote an equitable distribution of income. Policy reform in Egypt should aim eventually at the separation of these roles. I would like to stress again, through fear of misunderstanding, that this is a long term aim which may take ten or fifteen years to achieve. Much time is needed to get there because it is proposed to undo a system which has been in operation for four long decades. The difficulties are enormous and require much patience and skills. But because much time is needed to perform this task, it is necessary to begin as soon as possible if we are to get there at all. To delay and postpone would simply increase the difficulties.

I would like to comment at this point on the problem of energy prices which is so central to the gas issue. It is well known that domestic prices of energy in Egypt are well below their international equivalent. The gap is so significant that certain oil products are sold to the consumer for 1/6th or less of their import price. I am aware of a study, financed by the World Bank and commissioned by EGPC, which examines the economic impact of energy price adjustments. The merit of the study is that it reveals the extent of what needs to be done. Its weakness, in my judgement, is that it underestimates the inflationary and the income impact of a rapid price adjustment scenario.

The study examines a scenario in which all petroleum prices are increased by 31% per year (23% in real terms) from 1980 to 1990 in order to reach world prices for that period. These rates of increase deemed necessary by the analyst graphically illustrate the fantastic magnitude of the adjustment required. My first proviso is that this rate of increase depends on an assumption about petroleum prices in 1990 which seems to be far too high. Still, the adjustments needed on a more reasonable 1990 price assumption are likely to be very significant.

The study purports to show, on the basis of input-output table, that the inflationary impact of a 31% rise in petroleum product prices is less than 5% per year. Some commentators have said that 'this is surprisingly small'. I disagree here on two points. First, the inflationary impact has been understated because the model used does not include a wage-price equation. It is absurd to assume that such price increases would have no effects whatsoever on wages, however much these are controlled by the government. Wages are bound to rise to some extent and these wage increases will in turn work themselves out through the import-output matrix and raise industrial costs and prices. The true inflationary impact is bound to be significantly higher than estimated in the study. I find it very odd indeed that western economists who argue that the oil price rises of 1973 and 1979 are responsible for a large proportion of inflation in the OECD accept without qualification the results of a study which purports to show that a 31% oil price increase in Egypt will only raise the price level by less than 5%.

The second point is that a 5% rise in the price level year after year - even if we accepted this figure - is by no means a small effect. This is a substantial addition to other inflationary pressures which cause the price level to go up in any case by 10-15% a year.

The upshot of this discussion is that even though price adjustments for petroleum products (which also means a consistent price policy for gas) are highly desirable and should be urgently implemented, great caution must be exercised in defining the rate of price increase.

One of the interesting findings of the study is that the allocation may be improved by altering the relative prices of various fuels even if equivalence with international prices is not attained. This result suggests the possibility of remedies which minimize both the inflationary and the distributional impact of price adjustments. The average energy price will still have to rise but this can be done gradually while attention is given to the price structure of fuel oil/LPG/gasolene/natural gas.

Sound economics also tell us that each resource should be used to its best advantage. It seems that gas is better used domestically because the net-back of exported gas is low owing to liquefaction and transportation costs. But one should be careful also not to equate gas, which is a premium source of energy, to dirty fuel oil used to raise steam and generate electricity. Thus, I profoundly disagree with the view, and I quote, that "Egypt's aim should be to replace the bulk of the 'black oil' used with gas". This is a view which relates to old perceptions about oil. They are no longer valid because the world price of fuel oil is tumbling down and will probably continue to fall. The correct reference for gas is the light (not the heavy) end of the oil barrel. A long-term plan for the domestic use of gas in Egypt should link this use to the development of a chemical industry and to urban use in the domestic sector. There are difficulties, of course, but they are not insuperable. Piped 'town' gas was available to households in parts of Cairo and Alexandria fifty years ago. Why should it be impossible to administer today a distribution network which our fathers and grandfathers found possible to manage in the past? Has economic development retarded us instead of improving our skills in that respect? If the answer is a sad yes, then we should concentrate our efforts first on the institutional reforms necessary to make the domestic use of gas possible.

6. Conclusions

My brief was to take a broad perspective. The disadvantage of this approach is that many issues are touched upon and raised, but complete answers cannot be provided. The aim was to place gas in context. An economic strategy of development, equity and optimization of resources is indivisible. To look at the issues, piecemeal can be misleading because it encourages a sterile advocary of unrealistic policies. It is easy to preach that energy prices should be raised. The real questions are how, by how much and can energy price adjustments be made without reference to other necessary price adjustments, to subsidies, inflation and the welfare of poor households struggling to ensure their subsistence. It is easy to say that gas should be used economically. But unless the whole perspective on economic development is reviewed, little improvement can be expected in any particular area.

My own inclination is to argue that policy reforms must begin at the level of the real economy: the factors of production, the human resources, the productive investments necessary to increase agricultural productivity, the planning of land use, the economic institutions. Price and fiscal adjustments are also necessary but they require a gradual approach, a carefully managed transition that takes Egypt from the present administered price regime to a market regime over a period of ten to fifteen years. This requires determination. A gradual approach is not a recipe for doing nothing or for doing so little and so late in the day that nothing is achieved. It involves a simultaneous price and income policy: those who are least able to cope with price increases should be compensated. But the logic of the approach is to change the nature of this compensation from a price subsidy to an income subsidy. This is far from easy and the difficulty is glossed over by well-intentioned advisers who follow the economic textbook.

Once again, institutional changes are the pre-requisite of such an approach.

We seem to have left gas well behind in this discussion. But this is precisely the message. A good gas policy begins outside the energy sector. Its foundations have to be established through a re-appraisal of the development perspective, through reforms of the institutional system and through preliminary attention to the problems of the 'real' economy.

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EGYPTIAN ENERGY PERSPECTIVES

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FOREWORD

During the '70s the Egyptian economy grew very rapidly, with the GDP rising in real terms at an annual rate of 6% between 1970 and 1978 (Table 2). This high rate of development - albeit inadequate to reduce the country's imbalances - was,helped amongst others,by the discovery of new oil resources and hence by the increasingly important role that this energy source has played in the economy as a whole.

While oil accounted for a very small share of GDP, government revenues and exports at the end of the '60s, its weight grew constantly during the course of the following decade. At the moment, there is no other viable alternative to oil in the State Budget and the balance of payments, and it has become one of the most dynamic sectors of the Egyptian economy. It is calculated that oil taxation accounts for over 25% of total public revenue and financial resources, and represents over 70% of total commodity exports. Even if one deducts the value of oil product imports and the oil companies' transfers from the total value of oil exports, there remains a healthy balance which has a positive influence on the balance of payments structure.

Obviously, the contribution of the petroleum industry to GDP formation is much smaller. Whereas the value added from the oil industry (production of oil and petroleum products) in 1970 was only 2% of the total value added at current prices, the figure in 1978 rose to 7.7% (Table 3) .

In real terms, the increase from the oil industry was lower, because its share of the GDP at 1965 prices only rose from 2.1% in 1970 to 2.3% in 1978 (Table 4). This rather small increase in the oil industry's share of the GDP, whether viewed in terms of current or constant prices, has to be appraised in the light of Egypt's system of pricing crude oil and oil products. Without wishing to pass judgement on the Egyptian authorities' choices in respect of the oil prices charged on the domestic market and the prices of oil products charged to the end-users,it is useful to emphasize the fact that the differences between international prices and those charged on the Egyptian market reduce the contribution of the oil sector to the Egyptian economy. Oil would obviously have a much greater weight if the prices of oil and oil products were brought more closely into line with those charged on the international market.

There is no doubt that any radical, brusque change in the oil product pricing system would send a shock wave throughout the whole Egyptian economic system: the repercussions would be serious on the income of the industrial and service sectors where energy accounts for a fairly high share of their operating costs. And it would also give a strong boost to inflation.

Since this is not a viable solution, because it would cause an upheaval throughout the whole pricing system of the Egyptian economy, it might be appropriate to mention the fact that even the present system produces distortions, particularly in regard to the rational use of such an important resource as oil is today to the economic development of Egypt.

ENERGY CONSUMPTION 1970-1978

Viewed from outside, the very slow rise in the price of oil products in particular, and energy in general, on the Egyptian market seems to be not entirely unrelated to the sharp rise in oil and energy consumption during the '70s. Between 1970 and 1978, commercial primary energy consumption rose from 6 million tonnes of oil equivalent to 13.1 million tonnes, at an annual rate of 10.3%. During the same period, oil consumption rose from 5.2m tonnes of oil equivalent to 10.7m tonnes, namely, an annual increase of 9.5% (Table 5).

These particularly sharp increases in energy and oil consumption are obviously due to a number of factors. First of all, there was the particular dynamism of the Egyptian economy during this period, and especially after the 1973 war. Another factor was represented by the stage at which the Egyptian economy was arrived, thereby justifying such a steep increase in energy consumption. Lastly, another important factor was the discovery of substantial oil deposits whose rapid exploitation boosted and sustained a comparatively high GDP growth rate, even when compared with the Egyptian economy's past performance.

During the '70s, however, Egypt's economic development seems to have been characterized by one very important fact as far as the country's energy prospects - and in the ultimate analysis, its economic prospects - are concerned: namely, the fact that the growth of the economic system as a whole seems to have been sustained by the dynamism of a few service sectors rather than agriculture or manufacturing. If this interpretation is correct, it raises a number of questions as to the economic development model and energy policy that Egypt should adopt in order to develop the economy to the full.

The rapid development of the services sector and the prominent role this sector occupies in the economy, above all in employment terms, are typical of 'mature' economies which are currently in the throes of employment problems. But the Egyptian economy is not a 'mature' one, and its employment problems are certainly much more serious than those confronting the industrial countries, especially if one considers Egypt's comparatively higher population growth rate.

This raises an initial question in relation to the country's future prospects; to see whether its economic development can be based on the relative dynamism of the tertiary sector rather than on stepping up the development of agriculture and manufacturing. A second important question refers to the energy policy to be adopted and the options to be taken, to fit the economic development model that is selected.

In other words, the central issue facing the Egyptian economy at the present time is how to optimize the use of the oil deposits discovered during the '70s, and of natural gas discovered more recently. The discovery of these important resources will certainly have a very beneficial effect on the country, providing it with comparatively abundant supplies of domestic energy for the very first time. Moreover, these supplies may prove to be an historic opportunity for the economic and social development of the country, provided that they are used to underpin and foster production.

Although the availability of comparatively cheap oil was one of the conditions that fostered rapid economic development in the '70s, there are a number of grounds for questioning whether this type of economic development is the most appropriate if the country is to create the right conditions for a sustained, lasting economic growth.

As far as the link between economic development and energy is concerned, it has to be said that the sharp rise in energy consumption in the '70s suggests that a different energy policy should be envisaged. The first sign that a change was taking place was the slow down in energy consumption in 1978 and 1979 - years in which the rate of increase fell considerably in comparison with earlier years, except for 1973. This means that if the pre-1978 trends had continued, it would have been very difficult for the country to cover its energy requirements, then as now.

An examination of primary energy consumption data, their percentage breakdown and, above all, the elasticity of energy consumption in terms of the GDP, reveals two fairly evident facts. Such a high degree of elasticity (1.7 in the period 1970-1978) and oil's coverage of such a large share of the country's energy requirements would very rapidly deplete domestic oil stocks, considering the fact that Egypt has to allocate part of the oil to exports because it is a valuable source of foreign exchange and helps to contain the commodities balance and balance of payments' deficits.

Nevertheless, the dilemma facing Egypt is not whether to exploit its energy resources rapidly or to do so more gradually. The problem is to know the purpose of adopting a policy of rapid energy resource exploitation. In other words, what is important is to discover whether there exist the conditions for accelerated economic growth for which the availability of fairly plentiful supplies of cheap energy could act as a strong incentive.

EGYPT'S ECONOMIC AND ENERGY PROSPECTS

ENI's Economic Studies' Department has produced a number of hypotheses on the future prospects of the Egyptian economy which it set out in the paper "The Interdependence Model", presented to the Rome Seminar on "Development through Cooperation" in April 1981.

For the sake of brevity, we shall not detail the structure of the econometric model that was designed for the Egyptian economy, but merely point out that it was used to create alternative scenarios for the growth of the country's economic system.

In formulating alterantive hypotheses on which to base growth scenarios, special attention was paid to those variables that analysis of past development showed to be most important.

In particular, the development of the chief macroeconomic aggregates is restrained by external account levels and by the system's ability to generate a sufficient level of saving.

The scenarios tend to confirm the impact of these two constraints. What must be borne in mind is that the growth of the Egyptian economy depends to a great extent on investment level, which is a function of the country's saving capacity. Furthermore, import requirements, and hence external accounts, are closely correlated to investment expansion.

Thus a vicious circle conditions the country's growth.

Given the particular features of Egypt's economy, the scenarios are based upon different hypotheses of national development policies and of evolution of the international scene.

In the "high scenario", the hypothesis is one of increased and more efficient development with a favourable evolution of the world economy; in the "low scenario", the development of the world economy is less dynamic, and national growth is slower and more closely linked with the endogenous forces of the Egyptian economic system.

The following hypotheses were assumed in preparing the "high scenario" forecast:

- - fairly substantial international demand, implying greater requirements of oil products on the part of the industrialized nations;
- - a lower level of world inflation, with lower increases in the price of oil;
- - substantial investment, aimed chiefly at more dynamic growth in productive activities rather than at satisfying social needs;
- - higher capital productivity, in relation to the kinds of investment assumed;
- - particularly substantial growth in the agricultural sector, based on the hypothesis that the sector will be modernized as a result of massive investments in mechanization;

- - greater growth in oil activities because of higher export quantities and a more substantial domestic demand.

In the "low scenario", the international situation is assumed to be less favourable (lower rate of demand growth; higher inflation; higher oil prices, etc.). The internal variables of the system are based on hypotheses that forecast a slower growth rate for gross capital formation, centred chiefly on social infrastructure and investment for agricultural expansion (land reclamation, higher employment, etc.)

The quantitative results of the exercise are set out in Tables 8 & 9.

In brief, in the 'high scenario', which is characterized by an investment strategy geared to an industrialization process, the rapid mechanization and modernization of agriculture and the creation of infrastructure to underpin production, the GDP at market prices should rise at a mean annual rate of 6.4% between 1977 and 1985, and by 9% between 1985 and 1990.

In the 'low scenario' in which the volume of resources to be allocated to investment is, at all events, smaller than in the 'high scenario', the distribution of investments would be quite different. First of all, agriculture and infrastucture would receive a higher share of overall investment. Moreover, agricultural investment would be used for land reclamation rather than modernizing the agricultural sector as it stands; this would increase production, but only in the second phase, between 1985 and 1990. As opposed the 'high scenario', infrastructure investment would be distributed to areas of social concern rather than underpinning production. Lastly, earmarking a comparatively small amount of investment for industry would be a further curb on economic growth. In the 'low scenario', therefore, the average annual GDP growth rate would be 4.8% between 1977 and 1985, and 5.9% between 1985 and 1990.

Whatever the accuracy of this rather complex exercise, it can provide the basis for a projection of the country's energy consumption between 1985 and 1990, in broad terms. Assuming a 1.4 energy elasticity for the period 1977-1985 and 1.1 for the period 1985-1990 for both scenarios, which is considerably lower than the 1.7 recorded for 1970-1978, one obtains the following results: By 1985, total consumption of commercial primary energy will amount to 26.5 million tonnes of oil equivalent under the 'high scenario' (Table 10), and 22.4 million under the 'low scenario' (Table 11). By 1990, the consumption of commercial primary energy will reach 42.5 million tonnes of oil equivalent under the 'high scenario' and 30.7 million under the 'low scenario'.

To take this simple arithmetical exercise a stage further, we can also try to estimate the possible oil consumption trends by 1985 and 1990, Assuming that under both scenarios 78% and 75% of energy consumption will be covered by oil in 1985 and 1990, respectively, which is considerably lower that of the average value for the period 1970-1979 (85%) and for 1977-1979 (81%), the results are as follows: in 1985 oil consumption will be 20.7m tonnes under the 'high scenario';and 17.5m tonnes under the 'low scenario'; in 1990 the corresponding oil consumption will be 42.5m and 31.9m tonnes, respectively.

In short, Egypt's energy consumption in 1985 could range from a minimum of 22.4m tonnes of oil equivalent to a maximum of 26.5m, and in 1990 from a minimum of 30.7m to a maximum of 42.5m tonnes. Accordingly, oil consumption could range between 17.5m and 20.7m tonnes in 1985, and between 23m and 31.9m tonnes in 1990.

I am willing to admit that the hypotheses for energy consumption elasticity to GDP and the share of consumption covered by crude oil may seem either too optimistic or too pessimistic, depending on our individual preferences. But the fact remains that the problem is huge, and that a way must be found to guaratee sufficient energy supplies to sustain accelerated economic growth, which is precisely what Egypt is in most need of.

A cursory survey of Egypt's potential energy resources shows that only hydrocarbons exist in relatively plentiful quantities; the country will therefore have to rely on them to meet its increasing energy requirements. Coal deposits seem to be very small, as does the spare hydroelectric potential capacity of the Aswan Dam and the future potential of the Quattara Depressien. Nuclear power is certainly an interesting long-term prospect, although nuclear energy poses the short term problem of scarce financial resource allocation. Renewable energy sources, such as solar and geothermal energy, can only make a small contribution to satisfying the energy demand.

This being the case, the role of oil and natural gas occupies a central place in the country's energy scenario, and their domestic use is one of the main conditions for accelerated economic growth.

The Egyptian Authorities' policy to foster intensive exploration of potential resources, even with the contribution of foreign capital investment, would appear to be the most appropriate policy under the present circumstances and in the light of the country's rising energy resource requirements. In the future, however, the Egyptian energy requirements cannot be adequately covered merely by reliance on oil. The country has rapidly to develop the other available natural energy resource, natural gas, whose technical and economic features are well-known, and have been widely illustrated in the course of this Conference.

If natural gas were to be used even at a very rapid rate, Egypt would benefit twice over: the general economy would improve, because it would become possible to create a new production sector that would have beneficial effects on employment in particular; and the country's energy situation would improve, because the domestic energy balance would become more steady instead of being overdependent on excessive oil consumption, as is the case at present.

CONCLUSION

We are all aware that the Egyptian Authorities are engaged in an unprecedented effort to define an economic policy to foster a high rate of development. The task that lies ahead is far from easy, when one views the numerous problems facing the country and the international economic situation which portends slower growth prospects for the world economy and trade than in the past.

Egypt's growth potential is, nevertheless, very high, and the abilities of its people are well known. At the present time, the country possesses comparatively plentiful energy resources; and their rational use can be an important condition for a faster, and above all a more lasting, development. In this way, an economically stronger Egypt will be in a position to play the role it deserves in the contemporary world with more self confidence.

TABLE 1 - EGYPT: GROSS DOMESTIC PRODUCT AT MARKET PRICES
(Million Current Egyptian Pounds)

	1970	1976	1977	1978	Average Annual Growth Rate 1970-1978
CONSUMPTION	2,771.5	5,629	6,470	7,379	13.0
- government	755.7	1,571	1,697	1,812	11.6
- private	2,015.8	4,058	4,773	5,567	13.5
GROSS CAPITAL FORMATION	426.6	1,545	1,910	2,400	24.1
EXPORTS OF GOODS AND SERVICES	433.8	1,117	1,447	1,475	16.5
IMPORTS OF GOODS AND SERVICES	573.5	2,015	2,276	2,652	21.1
TRADE BALANCE	-139.7	-898	-829	-1,177	-
GDP at m.p.	3,058.4	6,276	7,551	8,602	13.8

SOURCE: World Bank

TABLE 2 - EGYPT: GROSS DOMESTIC PRODUCT AT MARKET PRICES
(Million Egyptian Pounds of 1965)

	1970	1976	1977	1978	Average Annual Growth Rate 1970-1978
CONSUMPTION	2,602.3	3,548.3	3,876.1	4,197.8	6.2
- government	701.3	990.0	1,015.5	1,028.5	4.9
- private	1,901.0	2,558.3	2,860.6	3,169.3	6.6
GROSS CAPITAL FORMATION	338.9	911.8	1,057.7	1,195.4	17.1
EXPORTS OF GOODS AND SERVICES	355.5	831.9	767.9	911.8	12.5
IMPORTS OF GOODS AND SERVICES	613.9	1,617.0	1,760.1	2,040.2	16.2
TRADE BALANCE	-258.4	-785.1	-992.2	-1,128.4	-
GDP at m.p.	2,682.8	3,675.0	3,941.6	4,264.8	6.0

SOURCE: World Bank and ENI estimates

TABLE 3 - EGYPT: GROSS DOMESTIC PRODUCT AT FACTOR COST
(Million Current Egyptian Pounds)

	1970	1976	1977	1978	Average Annual Growth Rate 1970-1978
AGRICULTURE	779.9	1,744	2,038	2,241	14.1
OIL	53.9	317	468	601	35.2
MANUFACTURING	488.1	986	1,113	1,280	12.8
ELECTRICITY, GAS AND WATER	41.8	77	83	93	10.5
CONSTRUCTION	123.7	254	285	336	13.3
TRADE AND FINANCE	239.0	680	809	910	18.2
TRANSPORT AND COMMUNICATION	130.9	407	455	657	22.3
DWELLINGS	118.2	136	140	149	2.9
GOVERNMENT AND OTHER SERVICES	695.5	1,186	1,350	1,542	10.5
GDP at f.c.	2,663.0	5,787	6,741	7,809	14.4

SOURCE: World Bank

TABLE 4 - EGYPT: GROSS DOMESTIC PRODUCT AT FACTOR COST
(Million Egyptian Pounds of 1965)

	1970	1976	1977	1978	Average Annual Growth Rate 1970-1978
AGRICULTURE	640.8	629.4	616.9	613.7	-0.5
OIL	48.4	56.5	70.7	82.7	6.9
MANUFACTURING	438.5	597.0	660.3	705.1	6.1
ELECTRICITY, GAS AND WATER	44.3	85.8	90.2	98.6	10.5
CONSTRUCTION	114.1	121.3	134.5	140.3	2.6
TRADE AND FINANCE	209.6	365.6	393.7	418.3	9.3
TRANSPORT AND COMMUNICATION	127.8	362.6	417.5	582.1	20.9
DWELLINGS	118.0	121.3	123.2	126.6	0.9
GOVERNMENT AND OTHER SERVICES	570.8	820.2	883.2	900.5	5.9
GDP at f.c.	2,312.1	3,159.5	3,390.2	3,668.2	5.9

SOURCE: World Bank and ENI estimates

TABLE 5 - EGYPT: PRIMARY ENERGY CONSUMPTION
(Thousand of metric tons of oil equivalent)

	Solids	Liquids	Gas	Electricity	Total	Annual Rate of increase
1970	318	5,171	78	398	5,965	-
1971	237	5,734	77	428	6,475	8.6
1972	243	6,568	64	434	7,310	12.9
1973	233	6,050	80	436	6,798	-7.0
1974	400	6,785	39	518	7,742	13.9
1975	923	7,634	42	575	9,174	18.5
1976	592	9,016	348	683	10,638	16.0
1977	734	9,819	890	765	12,208	14.8
1978	631	10,673	961	788	13,053	6.9
1979	661	10,893	979	804	13,337	2.2

SOURCE: United Nations, Yearbook of World Energy Statistics.

TABLE 6 - EGYPT: PRIMARY ENERGY CONSUMPTION
(Percentage Composition)

	Solids	Liquids	Gas	Electricity	TOTAL
1970	5.3	86.7	1.3	6.7	100.0
1971	3.7	88.6	1.1	6.6	100.0
1972	3.3	89.9	0.9	5.9	100.0
1973	3.4	89.0	1.2	6.4	100.0
1974	5.2	87.6	0.5	6.7	100.0
1975	10.1	83.2	0.4	6.3	100.0
1976	5.6	84.8	3.2	6.4	100.0
1977	6.0	80.4	7.3	6.3	100.0
1978	4.8	81.8	7.4	6.0	100.0
1979	5.0	81.7	7.3	6.0	100.0

TABLE 7 - EGYPT: ENERGY CONSUMPTION ELASTICITY TO GDP

	Gross Domestic Product(a) (Annual Rate of Increase)	Primary Energy Consumption (Annual Rate of Increase)	Energy Consumption Elasticity to GDP
1971	4.2	8.6	2.1
1972	1.9	12.9	6.8
1973	2.8	-7.0	-2.5
1974	8.2	13.9	1.7
1975	7.7	18.5	2.4
1976	7.9	16.0	2.0
1977	7.3	14.8	2.0
1978	8.2	6.9	0.8

(a) The GDP increase rates have been calculated on the basis of a historic series which is given in the ENI paper "The Interdependence Model", submitted to the Rome Seminar "Development through cooperation". 7-9 April 1981

TABLE 8 -HIGH SCENARIO - SUPPLY AND EXPENDITURE OF GROSS DOMESTIC PRODUCT

	Million Egyptian Pounds			Annual Compound Growth Rates		Percent		
	1977	1985	1990	1977-85	1985-90	1977	1985	1990
				CONSTANT PRICES OF 1977				
GDP (f.c.)	6,741	11,410	17,315	6.8	8.7	100.0	100.0	100.0
- oil	468	1,126	1,451	11.6	5.2	6.9	9.9	8.4
- non oil	6,273	10,284	15,864	6.3	9.1	93.1	90.1	91.6
CONSUMPTION	6,470	11,034	16,984	6.9	9.0	85.7	88.9	88.9
- government	1,697	2,891	4,942	7.9	9.7	22.5	25.1	25.9
- private	4,773	8,143	12,042	6.5	8.7	63.2	63.8	63.0
GROSS CAPITAL FORMATION	1,910	3,406	5,611	7.5	10.5	25.3	27.4	29.3
EXPORTS OF GOODS & SERVICES	1,447	2,413	3,065	6.6	4.9	19.1	19.5	16.1
IMPORTS OF GOODS & SERVICES	2,276	4,436	6,548	8.7	8.1	30.1	35.8	34.3
TRADE BALANCE	-829	-2,023	-3,483	-	-	-	-	-
GDP (m.p.)	7,551	12,417	19,112	6.4	9.0	100.0	100.0	100.0
EXPORTS: OIL AND NATURAL GAS	119	498	447	19.6	-2.1			

SOURCE: ENI, The Interdependence Model

TABLE 9 - LOW SCENARIO - SUPPLY AND EXPENDITURE OF GROSS DOMESTIC PRODUCT

	Million Egyptian Pounds			Annual Compound Growth Rates		Percent		
	1977	1985	1990	1977-85	1985-90	1977	1985	1990
			CONSTANT PRICES OF 1977					
GDP (f.c.)	6,741	9,884	13,352	4.9	6.2	100.0	100.0	100.0
- oil	468	959	1,282	9.4	6.0	6.9	9.7	9.6
- non oil	6,273	8,925	12,070	4.5	6.2	93.1	90.3	90.4
CONSUMPTION	6,470	9,780	13,150	5.3	6.1	85.7	88.9	90.0
- government	1,697	2,700	3,745	6.0	6.8	22.5	24.5	25.6
- private	4,773	7,080	9,405	5.0	5.9	63.2	64.4	64.4
GROSS CAPITAL FORMATION	1,910	2,976	4,039	5.7	6.3	25.2	27.0	27.6
EXPORTS OF GOODS & SERVICES	1,447	2,106	2,599	4.8	4.3	19.2	19.2	17.8
IMPORTS OF GOODS & SERVICES	2,276	3,852	5,179	6.8	6.1	30.1	35.1	35.4
TRADE BALANCE	-829	-1,746	-2,580	-	-	-	-	-
GDP (m.p.)	7,551	11,010	14,609	4.8	5.9	100.0	100.0	100.0
EXPORTS OF OIL AND NATURAL GAS	119	415	366	16.9	-2.5			

SOURCE: ENI, The Interdependence Model

TABLE 10 - EGYPT: HIGH SCENARIO, PRIMARY ENERGY CONSUMPTION
(Thousand of metric tons of oil equivalent)

	1977	1985(a)	1990(b)
TOTAL CONSUMPTION OF PRIMARY ENERGY	13,337	26,497	42,480
Petroleum products consumption (c)	10,893	20,668	31,860

(a) For the period 1977-1985 it has been assumed an energy elasticity to GDP of 1.4

(b) For the period 1985-1990 it has been assumed an energy elasticity to GDP of 1.1

(c) It has been assumed that petroleum products would cover 78% of total energy consumption in 1985 and 75% in 1990

TABLE 11 - EGYPT: LOW SCENARIO, PRIMARY ENERGY CONSUMPTION
(Thousand of metric tons of oil equivalent)

	1977	1985(a)	1990(b)
TOTAL CONSUMPTION OF PRIMARY ENERGY	13,337	22,440	30,730
Petroleum products consumption (c)	10,893	17,503	23,048

(a) For the period 1977-1985 it has been assumed the same elasticity as in the high scenario

(b) For the period 1985-1990 it has been assumed the same elasticity as in the high scenario

(c) It has been assumed that petroleum products would cover 78% of total energy consumption in 1985 and 75% in 1990

CRITERIA FOR THE DESIGN OF A GAS NETWORK IN A DEVELOPING COUNTRY

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2/paper 2

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CRITERIA FOR THE DESIGN OF A GAS NETWORK IN A DEVELOPING COUNTRY

ALESSANDRO PAGNUZZATO

Natural gas, although one of the late-comers to the fuel market, possesses certain advantages over other fuels. Such advantages may be summarized as follows:

- lack of polluting and corrosive substances in combustion products
- possibility of improved combustion control
- no need for storage at consumer point.

All these advantages make natural gas a favourite fuel for town distribution as well as for industrial use and in particular ceramics, glassworks, food industries, steel works and heat-treatment of metals, where its qualities can be best appreciated.

Furthermore, when compared with other raw materials, natural gas offers consistent advantages even in the field of chemical synthesis, such as the production of ammonia, urea and fertilisers in general, as well as being an input for the production of polymers in other petrochemical sectors;

On the other hand, the absence of storage at consumer point, requires an efficient transport system capable of ensuring continuous supply and satisfying the off-take modulation diagramme.

Moreover, the pipeline system is notable for its particular inflexibility because it connects fixed production sites with the consumer and, in general, is not easily adapted for subsequent connection to other areas unless such an extension was foreseen when the system was originally designed.

In fact, considering the high costs involved in a pipeline system, it will be necessary to plan in terms of a period of 15 - 25 years so as to ensure amortization of investments. It is therefore obvious to stress the importance of a pipeline design study. Its main features can be summarized as follows:

a) evaluation of natural gas availability
b) estimate of the potential market and definition of the sales programme
c) basic design of the pipeline network
d) estimate of the system's profitability and selection of the optimal solution

A. EVALUATION OF NATURAL GAS AVAILABILITY

Assuming that natural gas is available from domestic production, the following main basic data is required:

- Amount of recoverable reserves
- Optimal production programme for each field from a technical and economic point of view, as well as the diverse production programme alternatives best suited to the requirements of the potential market. It will be necessary to define the programme in terms of years of annual production and relevant peak production levels, the pressure flow pattern from the gas gathering and treatment centre over that period and input to the pipeline network.
- Location of gas fields and relevant gathering and treatment centres

- Quality of the gas: In particular, the inter-changeability of the different types of gas must be ascertained; if the different types of natural gas are not inter-changeable separate transport networks will be required; measurement of the water and hydrocarbons on the dew-point curve to avoid condensation phenomena along the line; verification of the hydrogen sulphide, sulphur and carbon dioxide content so as not to exceed the maximum limits with resulting corrosion phenomena. On the whole, the said limits should be about 5 mg/m^3 (st) and 150 mg/m^3 (st) for hydrogen sulphide and sulphur respectively and 1.5% - 2% (in volume) for carbon dioxide.

B. ESTIMATE OF THE POTENTIAL MARKET AND DEFINITION OF THE SALES PROGRAMME

On the basis of a possible study of the existing market and the analysis of medium, as well as long term development programmes, it will be possible to estimate the equivalent gas consumption in the various sectors of utilization. Together with the annual volume and its geographical distribution, it is particularly important to define the day/year utilization coefficient(s). [1]

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(1) ratio between the average annual flow-rate and the maximum daily flow-rate

The typical pattern of daily flow-rate absorbed by industry on average during the year is shown in Fig. 1.

Once the potential market is defined, the market share for natural gas has to be determined. The role played by gas is, therefore, strictly related not only to its availability, but also to that of other energy sources within the country. On the basis of a general analysis it will be possible to determine roughly the role of each source so as to minimize costs and possibly maximize the export returns in case of surplus availability. Together with the above-mentioned economic aspect, it will be necessary, during the analysis, to take into account strategic aspects so as to guarantee supply to all vital sectors of the country. As far as Egypt is concerned, the possible gas surplus could be exported as LNG. In consideration of the favourable geographic position, the LNG could be unloaded at an Italian terminal on the Northern Adriatic coast and from there re-gasified and conveyed to the European markets. (Fig. 2)

In fact, today's price of natural gas on the European market, taking into account that the cost required for such a project could be charged either to the seller or to the buyers, allows such a margin as to make the whole enterprise interesting, even with the present price of energy.

On the basis of the results of such an analysis, it is therefore advisable to further examine the availability as well as the consumption of gas, so as to gear the production programme of each field, which tends to decrease in the course of time, to the expanding consumption pattern. In defining the sales programme, it is necessary to take into account that, as the pipeline system is mainly designed for the maximum flow-rate, it is more convenient to maintain this rate for as long as possible, in order to minimize slack periods with the resulting increase in transport costs. To obtain this, which conflicts with market dynamics, (and which develops gradually over time) it is convenient to supply for heat consumption, at least during the first stage, and only afterwards proceed to "quality" sales, gradually replacing heat consumption with other uses of gas at a high technological level which, as previously indicated, better exploit the advantages of natural gas.

C. BASIC DESIGN OF THE PIPELINE NETWORK

As a general rule, the pipeline system from production to the consumer can be regarded as a network consisting of one or more trunk lines, with feeder lines to the consumer areas.

This system consists of a main pipeline network of mostly large diametre pipes with a high pressure flow (65 - 80 bars). The pipeline system is then broken down into a series of small networks for the delivery of gas to the individual consumer.

This network, which can be designated as "secondary", is designed to transport gas at medium to low pressure (12 - 24 bars), since it usually crosses densely populated areas. Obviously, the two systems present greatly varying problems. As a rule, we can say that during the basic design stage, the trunk system involves greater problems from both the technical and the economic point of view, and it is therefore considered essential to examine these aspects. On the basis of what has been previously said, the following items will be clear: the maximum volume, stretches of pipe, input pressure, the minimum necessary pressure at outlet points,and the quality of the gas.

Basic design specifications will include the following: diametre of the pipeline; maximum pressure; pipe thickness; number of compression stations (if required) and the relative power installed.As far as the design flow-rate is concerned, account must be taken of the maximum flow-rate already foreseen in the previously worked out sales programme, especially for different peak times for various consumers, as well as the contribution of the pressurized gas pipe in meeting peaks of short duration (approx. 1 hour). This is generally accomplished by increasing the daily flow-rate by 10%. Modulation programmes on digital computers can be used for more accurate calculations.

Having determined the design flow-rate, a number of possible technical solutions become apparent, mainly in connection with the different pipe diametres.

Pressure and pipe specifications: The existing networks usually show values in the range of 65 - 80 bars. On the basis of completed projects or those under study, we can observe a certain trend towards the increase in the above value to improve economic profitability. This may be obtained without violating safety standards and technological limits through increasing the pipe thickness.

Having determined the maximum pressure and quality of the steel for the selected diametre, the theoretical thickness has then to be calculated according to the national safety standards and regulations. These specify a minimum ratio between the limit of yield point and the stress of the pipe at maximum pressure as a function of the population density of the areas crossed by the pipeline.

This ratio normally ranges between 1.4 and 1.8.[1]

Another parametre to be defined, before calculating the pressure loss along the system, is the pipe roughness. Pipes normally show roughness values of about 30-40 microns. Special treatment can, however, be adopted to reduce this value

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(1) $$s = \frac{P \times De \times C}{2\,\sigma}$$

where:

s = minimum pipe thickness (cm)
P = maximum operating pressure (kg/cm^2)
De = external diametre (cm)
σ = yield point (kg/cm^2)
C = safety coefficient

and consequently reduce pressure loss. At present the most widely used method, especially for pipe diametres of over 16", is that of internal coating with special epoxy resins, obtaining roughness values of about 10 - 15 microns. Whether or not to use internal coating depends mainly on economic considerations. As a general rule it can be estimated that, dimensions being equal, the friction reduction obtained by coating, results in an improved transport capacity of about 5 - 7%.

It is then possible to calculate the load loss along the pipeline and to define the possible recompression alternatives. As a general rule it can be stated that the alternatives to be taken into consideration for selecting the optimal solution will be those with compression ratios (ρ) from 1.3 to 1.5 and the spacing between two successive stations at not less than 100 - 150 km.(1)

After calculating the power required by each station, it will be necessary to define the power to be installed, taking into account an adequate margin for operating requirements.

The most widely adopted criterion is to provide each station with an auxilliary unit. Another criterion, adopted only for trunk lines of considerable extension, is to install surplus power from 30 - 40% so that, in the event of the failure of one station, the full pressure can be gradually recovered in the following stations without reduction in the flow-rate.

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(1) $\rho = \frac{Pi}{Po}$ Pi = pressure at compressor inlet
Po = pressure at compressor outlet

The presently preferred type of unit for installation is the centrifugal turbo-compressor; in particular, that using industrial-type turbines available in a wide range from 1000 to 30000 HP.

During the second half of the '70s, a certain number of aeronautical-type turbines were in use but are now mainly limited to about 28000 HP (turbines of 16000 HP have been used but in limited circumstances).

Another technical problem in a pipeline system is that of the gas temperature. In fact, the maximum temperature is strictly related to the selection of the external coating and also determines the maximum pipe stress and consequently the magnitude of anchorages and the radius of curvature.

As far as coating is concerned, bituminous or coal dust coating normally maintain their properties up to about 50°C, whereas polyethylene coating maintains its properties up to 60°C.

As a result, the gas can be injected into the pipeline at a maximum temperature of about 50 - 60°C.

When designing the compression station, one must make sure that the gas, at the compressor outlet does not reach a temperature in excess of the above mentioned. Otherwise one would have to use a gas cooling system (after coolers), amongst the most widely used of which is the system for using air as a cooling fluid.

D. THE ECONOMICS OF THE SYSTEM

The cost of the various technical alternatives must be quantified in order to select the optimal solution.

Firstly, investments must be quantified.

At this stage in the basic study, since no detailed solutions are known, it is normally advisable to adopt the standard cost evaluation to which adequate extra costs will be added to allow for the varying difficulties of implementation proper to different alternatives.

As far as the line is concerned, the cost items may be divided into three groups:

- material (pipes, special components, valves, coatings, cathodic protection, transport)
- trenching and assembly
- engineering and sundries (rights of way, damages, etc.)

The range of costs depending on the diametre and with reference to standard routes are shown in Fig. 3.

As far as the compression stations are concerned, investments are greatly affected by the type and size of the units installed.

Taking as an example a standard station equipped with three turbo units, the cost per installed HP can vary from $ 650/HP for a 30000 HP unit up to $ 1300/HP for a 5000 HP unit.

Once investments have been quantified, operating costs will be estimated principally as a function of the structure necessary for the operation of the system as well as the various maintenance costs.

Taking into particular consideration the long-term period (15 - 25 years), extraordinary maintenance costs both for pipelines (replacement and / or laying of new sections along modified routes) and for compression stations, must be considered.

Of total investment the average operating costs for the pipeline are 1% - 2% and 3% - 5% for the compression stations.

Unit costs may be calculated on the basis of the above mentioned estimated investment and operating costs, the estimated gas consumption and the amortization costs of investments.

These unit costs differ greatly according to the volume transported. In fact, as is shown in fig. 4, we may have factors related to scale economies even in the region of 50% ($ 0.7/MMBtu for 1000 km for the transport of 4 billion cu.m/year against $ 0.46/MMBtu for 1000 km for the transport of 12 billion cu.m/year).

Nevertheless, even within a defined technical solution, the costs still present noticeable variability, as is portrayed in fig. 5 (referring to a 34",1000 km-length pipeline - standard values).

Therefore, for meaningful economic comparisons, particularly accounting for the uncertainties inherent in the exact carrying out of the assumed programmes, it is useful to estimate costs also in relation to capacities other than those of the target.

It will thus be possible to evaluate the different economic risks involved in each solution.

The final choice of the solution to be adopted will, however, further take into account those factors difficult to quantify, such as the different reliability of alternatives,operational flexibility,etc.

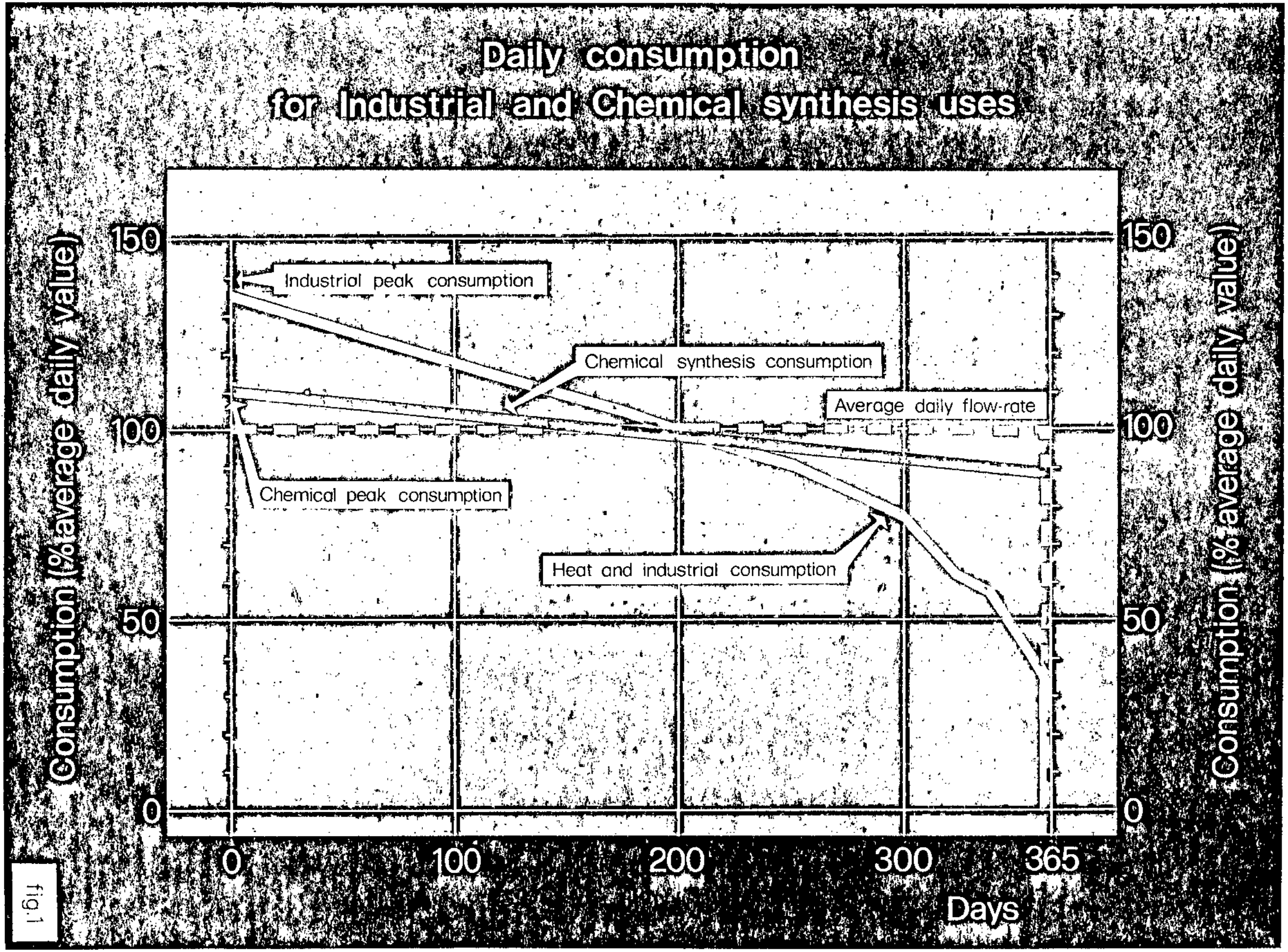
CONCLUSIONS

I hope that the above, even though expressed in general terms, may have outlined the main technical-economic aspects pertaining to the natural gas industry.

I wish to take this opportunity to confirm the utmost willingness on the part of the ENI Group, to cooperate on a broad basis and in particular of SNAM, AGIP, NUOVO PIGNONE and SNAMPROGETTI, all being ENI companies already operating in the gas industry.

In the light of the information so far provided, there is reason to believe that natural gas could play a leading role in the further development of your country and, indeed, I feel that careful attention should be paid to trends in energy demand and the evaluation of the various export possibilities.

In this case in particular, the geographic position of our two countries could make Italy not only a potential buyer but also a natural gateway to European markets.


Daily consumption
for Industrial and Chemical synthesis uses
Industrial peak consumption
Chemical synthesis consumption
Average daily flow-rate
Chemical peak consumption
Heat and industrial consumption
Consumption (% average daily value)
Consumption (% average daily value)
150
100
50
0
0
100
200
300
365
Days
fig.1

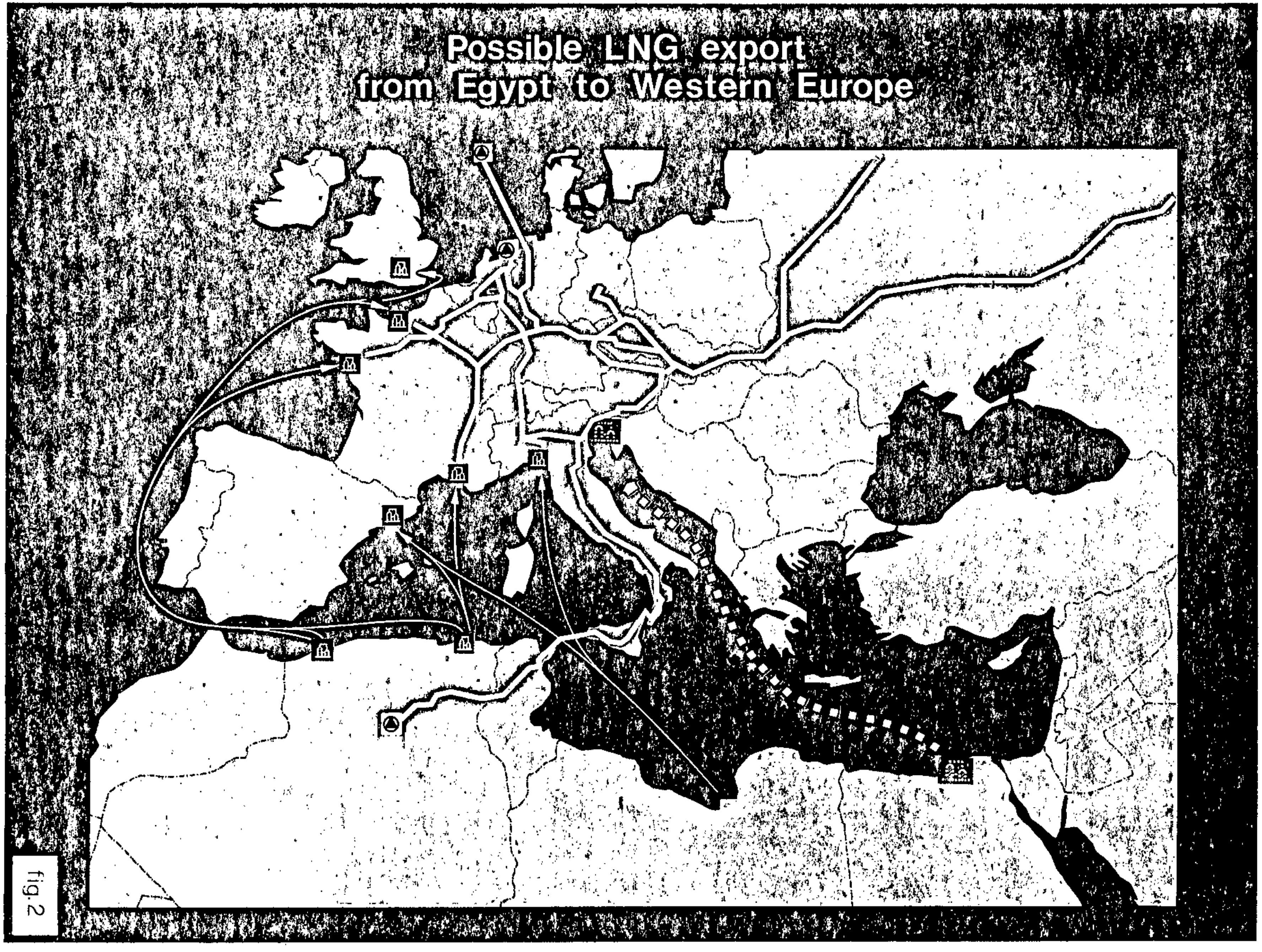


fig. 2

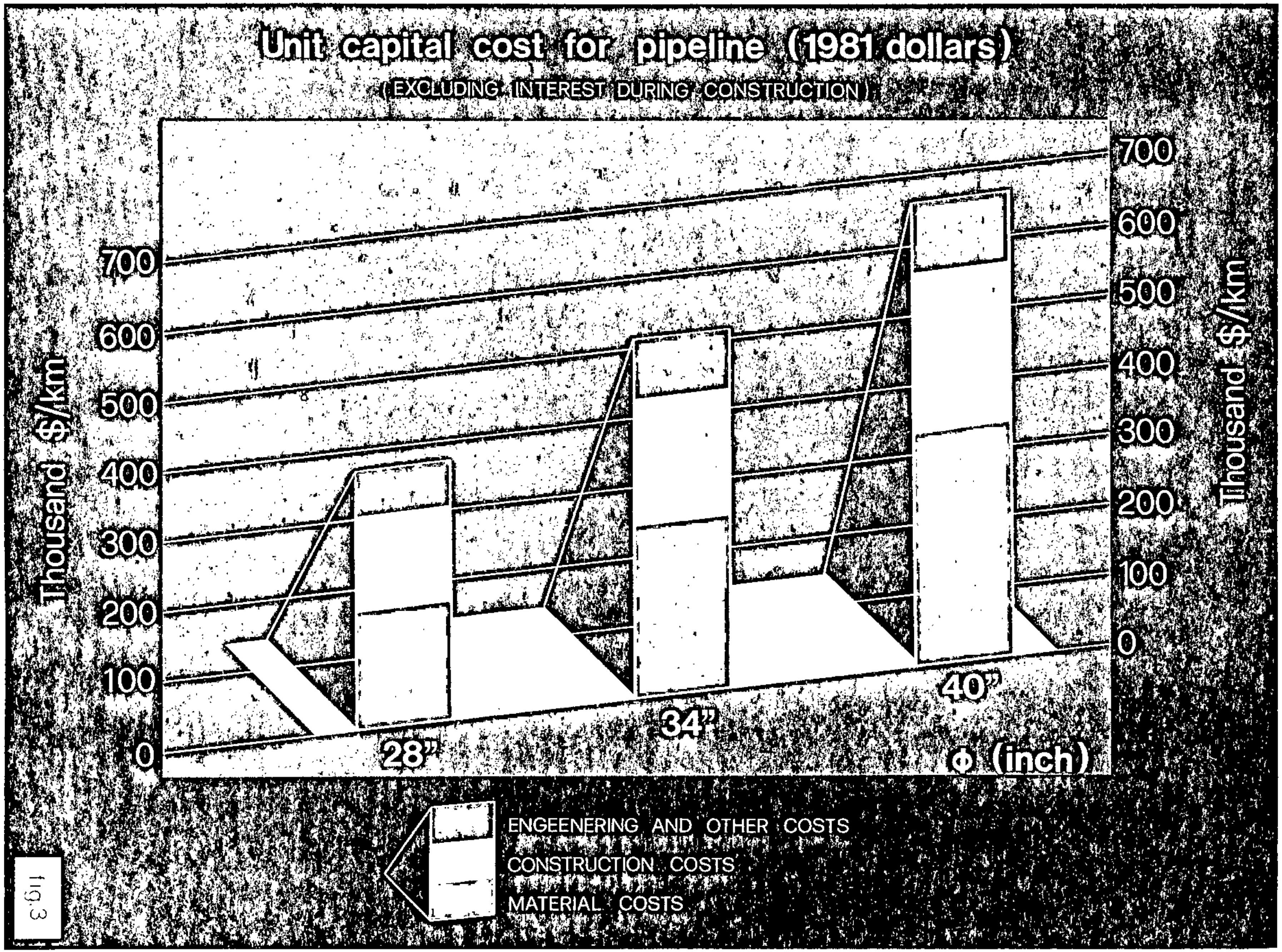
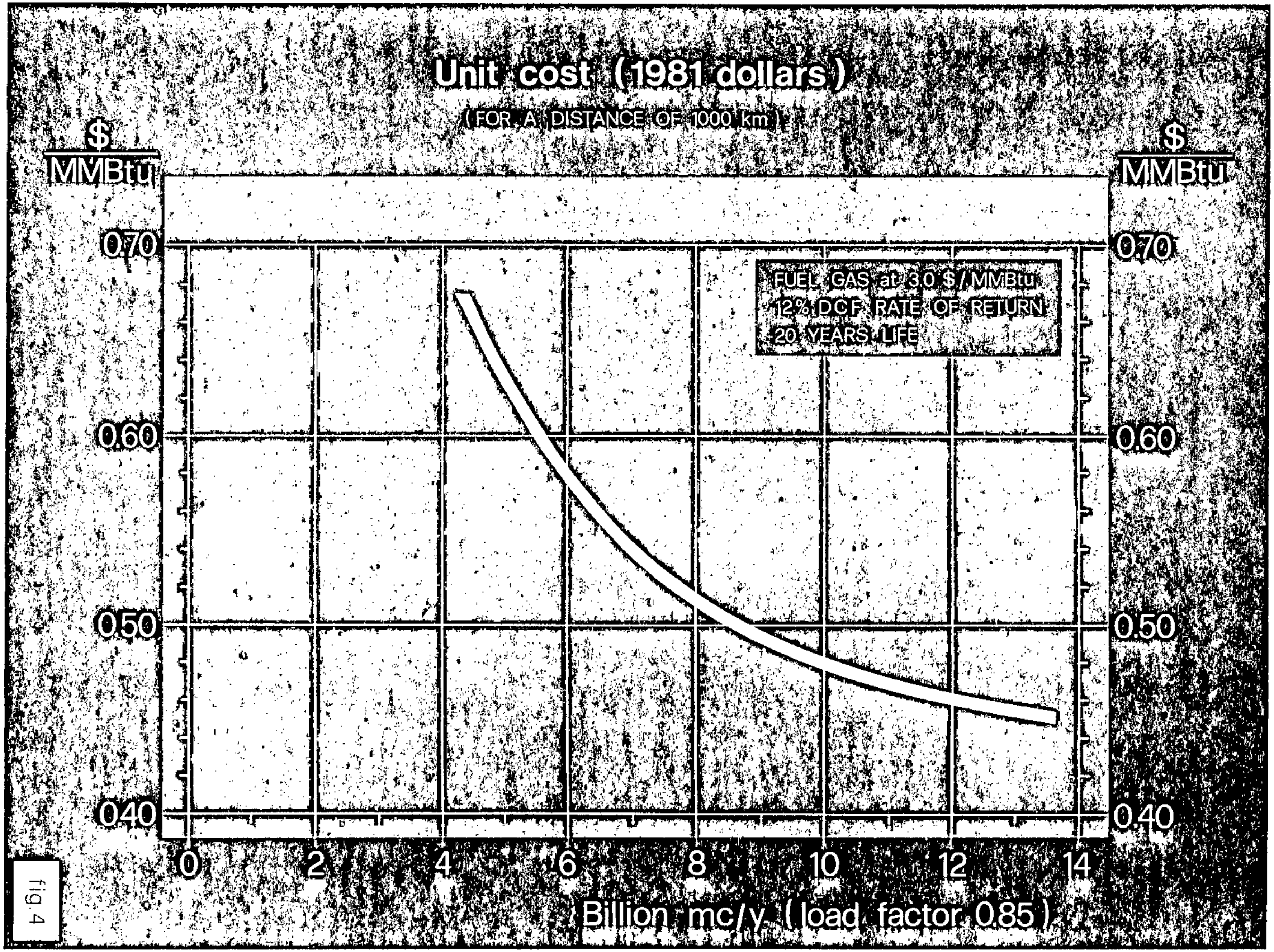
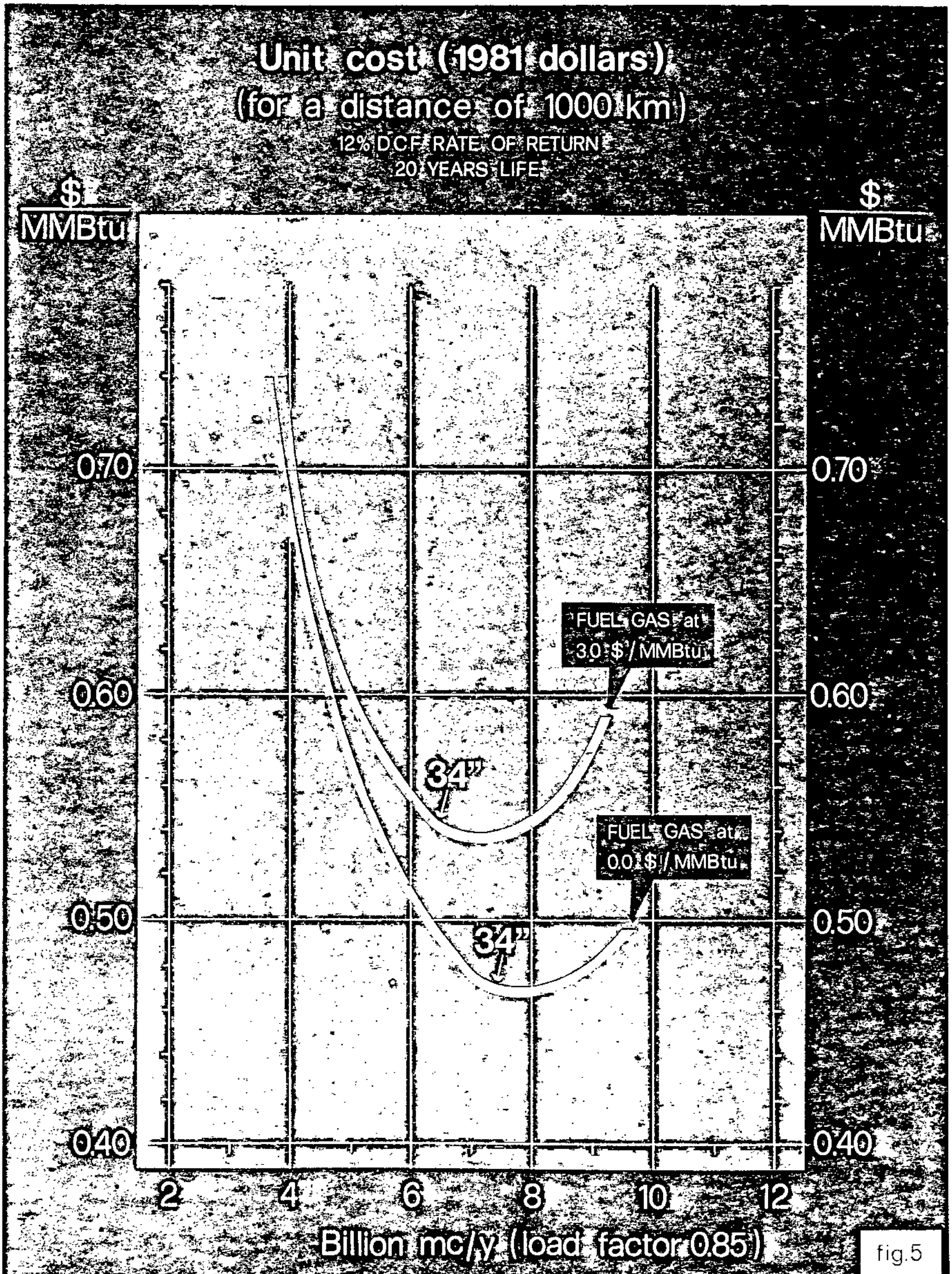

Unit capital cost for pipeline (1981 dollars)
(EXCLUDING INTEREST DURING CONSTRUCTION)
Thousand $/km
700
600
500
400
300
200
100
0
28"
34"
40"
Φ (inch)
ENGEENERING AND OTHER COSTS
CONSTRUCTION COSTS
MATERIAL COSTS

fig.3


Unit cost (1981 dollars)
(FOR A DISTANCE OF 1000 km)
$ / MMBtu
0.70
0.60
0.50
0.40
FUEL GAS at 3.0 $/MMBtu
12% DCF RATE OF RETURN
20 YEARS LIFE
0
2
4
6
8
10
12
14
Billion mc/y (load factor 0.85)
fig.4



Unit cost (1981 dollars)
(for a distance of 1000 km)
12% D.C.F. RATE OF RETURN
20 YEARS LIFE
$ / MMBtu
$ / MMBtu
0.70
0.60
0.50
0.40
0.70
0.60
0.50
0.40
FUEL GAS at 3.0 $/MMBtu
FUEL GAS at 0.0 $/MMBtu
34"
34"
2
4
6
8
10
12
Billion mc/y (load factor 0.85)

fig.5

THE POLICY OF THE EGYPTIAN GOVERNMENT FOR PROMOTING GAS EXPLORATION AND EXPLOITATION

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2/paper 1

EGPC - IEOC
INTERNATIONAL SEMINAR
ON NATURAL GAS AND ECONOMIC
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THE POLICY OF THE EGYPTIAN GOVERNMENT FOR PROMOTING GAS EXPLORATION AND EXPLOITATION

GIUSEPPE RUSTICI

FOREWORD

Over the past decade, natural gas has become increasingly important on the international market for four main reasons:

1) the reliability of large natural gas reserves which, in terms of T.O.E., are presently estimated to be higher than the remaining oil reserves, and to guarantee the international market supply over a period of several decades;

2) the proven availability of new technologies, such as liquefaction and intercontinental pipelines laid down in deep seas, which make gas trasportation economically feasible over a long distance;

3) the development and strengthening of the gas market in consumer countries through an integrated system which in Europe is widespread all over the continent and which in the U.S. supplies gas to the 48 lower States. These systems mainly rely on essential infrastructures such as LNG import terminals, underground mass storage, peak shaving facilities, interruptible industrial utilities, etc.;

4) the competitive gas market price which, nowadays, allows the producer to make a reasonable profit even on the natural gas produced far away from the consumer's market.

The increasing market opportunities for natural gas distribution immediately raised the interest of those producing and exporting countries where most of the associated gas is currently flared, and where considerable non-associated natural gas reserves were accidentally detected as a consequence of an intensive drilling activity aimed at finding accessible oil, and carried out by oil companies under concession agreements not including, in most cases, provisions for gas exploitation.

EGYPT was one of the first producing countries to accept the natural gas challenge on a nation-wide basis. The oil companies already operating in the country were asked actively to co-operate in setting up a "new deal" for gas exploration and exploitation. IEOC and, consequently AGIP, immediately answered and in 1979 the first proposals for a comprehensive gas policy were submitted to E.G.P.C. After intensive negotiations, the first gas clause was agreed upon and included in the "Nile Delta Concession Agreement" in September 1980. The same provisions, although slightly different, are being applied or are going to be applied to all the concession areas.

GAS PHILOSOPHY

The fundamental principles on which gas provisions were developed and materialized are the following:

1) To commit as many contractors as possible to explore potential gas bearing structures and appraise the discovered deposits of non-associated gas. Such an activity is to be encouraged over a fixed period of time in order to allow the country to have a substantial inventory of gas reserves by mid-87.

Out of the total amount of the original gas reserves available in Egypt, the country will have to allocate 345 billion st. cu. metres (12 trillion st. cu. ft) of gas reserves - the so-called "NATIONAL RESERVES" - for its domestic needs in the decades to come. Following the priority order, this volume will be made up by:

a) the Natural Gas Reserves on which E.G.P.C. has an exclusive title i.e. gas reserves already surrendered by contractors to E.G.P.C. or used to supply the home market under previous agreements; new discoveries made in areas where the activity is directly and exclusively carried out by E.G.P.C. and/or its affiliates; associated and dissolved gas currently delivered or planned to be delivered to the home market.

b) Insofar as this is necessary to make up the total volume of the National Gas Reserves, the contribution from gas reserves discovered and assessed by contractors in areas where gas provisions are applicable. Each contractor's contribution is proportional to the amount of reserves assessed by it in its concession area. The contribution, called "Domestic Allocation Percentage", will be determined and requested by E.G.P.C. on the basis of the above mentioned gas inventory and subject to adjustments on the basis of subsequent new discoveries which may occur before deciding to proceed with a gas export project. Each contractor's remaining gas reserves (namely the assessed gas reserves in the area, net of the domestic allocation percentage) will be available for export and, therefore, the provisions of the production sharing agreement will be applied to the exported gas.

2) To guarantee a fair compensation to contractors who have discovered and assessed gas reserves, totally or partially surrendered to E.G.P.C. as a contribution to the national reserves. This compensation is mainly based on two factors: (i) the exploration and appraisal costs incurred by contractor in the area, (ii) the amount of reserves surrendered to E.G.P.C. with the result of providing the necessary incentive for gas exploration. The compensation is particularly governed by the following rules:

a) There is right to compensation when in a concession area a certain amount of gas is assessed. The said amount takes into account the domestic gas pattern and the country's interest in the economic use of any reliable gas deposit, thus putting the equivalent amount of oil on the export market.

b) Up to seventy (70) billion st. cu mt (2.5 trillion st. cu ft) of gas reserves, the compensation will be represented by the sum of the exploration and appraisal costs incurred by contractor in the area, and the interest on such costs based on the LIBOR rate. Should the discovered gas reserves exceed 70 billion st. cu ft, the compensation will be represented by (i) the above mentioned interest plus (ii) the exploration and appraisal costs multiplied by the ratio between the discovered and assessed gas reserves (expressed in billion cu mt) and seventy (70), such a ratio being limited to two (2).

c) In the event that contractor surrenders to E.G.P.C. one hundred percent (100%) of the assessed gas reserves in its area, then, the compensation, calculated as above, shall be due and payable to contractor in equal quarterly instalments, either in cash or in kind, during the four years following the surrender date. In the event that contractor contributes to the national gas reserves by surrendering to E.G.P.C. a percentage of the total gas reserves assessed in its area, then, the same percentage of compensation, computed as above, shall be due and payable to contractor in equal quarterly instalments during the four years following the partial surrender.

The method of compensation, as discussed and agreed with E.G.P.C., provides the oil companies with the necessary incentive to explore and appraise gas reserves entailing for such companies' exploration risks and the supply of all the financial, technological and human resources which are required to carry out petroleum operations aimed on a priority basis, at securing for the country substantial and reliable reserves of first class energy such as natural gas.

Therefore, it is easy to figure out the country's advantages stemming from the above mentioned approach, if we considered all the risks the Egyptian Government would incur in carrying out such an exploratory activity on its own. E.G.P.C.'s acquisition cost of gas reserves, based on compensation, does not include all the exploration costs in any concession area where a minimum amount of gas reserves is not eventually assessed. This offsets, by far, any boosting effect of incentive which is, in any case, proportional to the amount of the discovered and assessed reserves. Even in case of oil production first achieved in a concession area, the incentive is always maintained, since without preventing contractor from recovering exploration costs from oil production, the compensation procedure still applies to gas reserves, and compensation, net of any sum previously recovered by contractor as exploration cost, will be calculated and payable.

3) By means of standard gas provisions to guarantee uniform legal and economic conditions to all contractors having exportable gas reserves, so that they may jointly undertake a nation-wide gas export project. The association of several contractors will allow for the stockpile and export of the necessary sizeable amounts of gas reserves, thus guaranteeing sound economics for the project. As a matter of fact, scale economy is thus achieved and sizeable and reli-reliable deliveries of gas, over a long period, will require the best price available on the market.

The main targets to be achieved by the national gas policy, namely the build up of national gas reserves and the export of considerable amounts of gas, require the simultaneous efforts of all contractors interested in the exploration and assessment of the country's gas resources within the fixed terms.

For this purpose the right of compensation is only granted to those contractors having assessed reserves exceeding the required minimum amount of gas and having notified these to E.G.P.C. by July 1987. This deadline does not prevent any contractor from continuing and terminating exploration and assessment activities within the terms of its concession agreement. Any further discovery and assessment of gas reserves will cause the adjustment of (i) the contribution to the national gas reserves, (ii) the relevant compensation and (iii) the amount of gas available for export.

Each contractor will always have the option to surrender the entire amount of its assessed gas reserves to E.G.P.C. and to be compensated, even if enough exportable gas is available after calculating the national gas reserves. The total surrender may occur:

a) before July 1987, at the end of the year following the expiry date of the exploration period last elected by contractor. Said year has been called "Assessment Period" and it is intended to be spent for reservoir studies in order to assess the gas reserves previously drilled;

b) <u>in July 1987</u> if, in contractor's opinion, the exportable reserves are not sufficient to enable it to take part in a future gas export project.Obviously, the date of the total surrender becomes mandatory if the entire amount of the reserves assessed by contractor is requested to make up the total volume of the national reserves;

c) <u>after July 1987,</u> over a seven-year period following the above mentioned date. After contributing to national gas reserves, the contractor can surrender the balance of its gas reserves which it retained in view of a future gas export project. The balance surrender will entitle contractor to get the compensation percentage it did not receive when the domestic allocation percentage was surrendered to E.G.P.C.

Any voluntary surrender of the gas reserves will, on a priority basis, make up the national gas reserves, thus reducing the mandatory contribution of other contractors interested in the gas export project. Any compensation for the surrendered gas reserves will be paid by E.G.P.C. in quarterly instalments, either in cash or in kind (oil), during the four years following the surrender date.

4) To co-ordinate contractors' actions in terms of time schedule, phase sequence and joint organisation, in order to incorporate them in a gas project. Such co-ordination is given by standard procedures which have legal force and included in the Production Sharing Agreement. These procedures include the following key provisions:

a) After the initial inventory of the Egyptian gas reserves, contractors having exportable reserves and willing to retain them in view of a possible gas export project, will be granted a seven-year feasibility study period starting from July 1987. During this period contractors will maintain rights on said reserves, encompassed in 3' x 3' blocks, and will furnish a comprehensive and updated study to find out whether a gas export project is economically feasible (Gas Export Project Feasibility Study). For this purpose the interested contractors and E.G.P.C. will appoint a Gas Project Co-ordination Committee whose task it is to achieve the following fundamental targets, once the above project proves to be feasible:

- The setting-up of a joint organisation supplying and operating the project joint facilities. Such joint facilities are those necessary to:
  - Collect gas from concession areas, where the gas reserves for the export project are located, thus equalizing individual transportation costs.
  - Process and deliver gas to the FOB delivery point. An LNG plant was considered to be the basic solution, but the possibility of exporting gas derivatives such as methanol, methyl fuel and synthetic gasoline was also taken into due consideration.

These facilities have been called "Downstream Facilities". All upstream facilities, such as production wells, flow lines, field facilities and gathering stations, have been called "Development Facilities". They will be provided for each area by the relevant contractor pursuant to the provision of its agreement. For the construction and management of downstream facilities a joint operating company (JOCO) will be set up. Its statutes are included in the Concession Agreements and the Company is governed by a board formed by E.G.P.C. (50%) and the companies (50%) owning exportable gas reserves to be devoted to the joint project. Each contractor's voting rights will be proportional to the reserves it devotes to the project. The financing of downstream facilities, proportional to the gas reserves devoted to export, is supplied by the contracting oil companies participating in the project. Operating costs will be shared on a quarterly basis and will be proportional to the gas delivered by each contractor to JOCO in the same quarter. Investments and operating costs charged to each contractor for JOCO's activities will be included in the recoverable costs under the respective production sharing agreement and consolidated with the homogeneous costs deriving from the activity undertaken by each contractor for gas development in its concession. An Operating Company, responsible for the gas development operations, will be set up between contractor and EGPC for each concession. In case of contemporaneous oil and gas production from the same area, said operating company will also run the oil production operations from the wells to the oil loading terminal, in compliance with the production sharing agreement. When the export level is reached it will be JOCO's task to return LNG, gas products and/or natural gas derivatives to each contractor on the basis of the amount of gas delivered by it to JOCO and pursuant to the sharing provisions set forth in its concession agreement.

Obviously, the concentration, in a single plant, of gas coming from different areas adds flexibility to the overall production system, allowing a mutual support in sales commitments in case of a temporary reduction in the output from any concession area. Other forms of associations, different from JOCO, are not excluded if they can improve the economics and facilitate the financing and the market of the gas produced.

b) To co-ordinate development and production plants.

c) To obtain contractors' commitment to develop and supply gas within the fixed terms and established amounts. For this purpose, a homogeneous throughput agreement will be undersigned between JOCO and the operating companies engaged in the development.

d) To check that the necessary access to financing is guaranteed by contractors.

e) To obtain all the guarantees, authorizations and assistance from the Government necessary for the financing and achievement of the gas project.

5) The provisions concerning oil production sharing, set forth in the agreements, have been amended for gas in order to take into account the burden of huge investments required by the gas project, and to allow an entrepreneurial activity in this field.

The main innovations are as follows:

a) The annual ceiling for the production, which contractor can use to recover costs (Cost Recovery Gas), equals 50% of the annual production. Should the costs require it, this value can be increased up to 60%, thus facilitating access to loans, provided however, that the total production used for cost recovery in the first 12 years does not exceed 50% of the total production over the same period.

b) 50% of the interests on financing, actually paid by contractor, is considered as "cost" and, therefore, recoverable under the concession agreement provisions.

c) The cost recovery gas valorization will actually be based on the average of FOB prices realized by the exporters, including E.G.P.C., to which a considerable share of the exported gas belongs.

d) For the remaining 50% of the exported gas (profit gas), a split in connection with production levels has been set up. For the first level, the split is fixed as follows: 32,5% contractor and 67,5% E.G.P.C.

6) The Gas Export Project, achieved through joint structures by a group of contractors (Early Producers), is not a "closed" project. Contractors obtaining a title to export gas after the beginning of said project, will be able to have access to downstream facilities at fair conditions. The access is only subject to the processing capacity of the downstream facilities, capacity which may be provided, if necessary, by increasing the existing facilities.

7) Gas Recycling

Should the necessary conditions for gas export be lacking and should contractor have sizeable exportable gas condensate reserves, then, contractor may carry out a recycling project to recover and export gas condensates and to re-inject dry gas in the reservoir, should this project be deemed economically viable.

The export of condensates, thus produced, will be subject to the production sharing agreement and, in particular, to the contractual provisions set forth for gas.

8) Domestic Market Development

Contractor undertakes to develop the national reserves, located in its concession, for domestic supply by signing a "Gas Domestic Supply Agreement" with E.G.P.C. Such an agreement would be based on the production sharing agreement provisions supplemented by appropriate guarantees concerning the production level and unit value. This value will have to be calculated in dollars for the purpose of determining the amount due to contractor for cost recovery and profit; such amounts are to be paid to contractor either in cash or in oil. In case of gas recycling, E.G.P.C.'s association, as regards the use of its share of national reserves, is covered by the agreement.

CONCLUSIONS

The complex and original gas provisions represent serious and tangible grounds for the exploration of a valuable energy source to meet the world's needs.

As a matter of fact, such provisions are aimed at safeguarding Egypt's interests in energy reserves which represent the basis of any economic growth. Such provisions constitute a guarantee for the oil companies investing funds and human resources in hydrocarbons exploration by allowing them to take calculated and acceptable risks in gas exploration and development investments.

Moreover, gas provisions pave the way to a regional cooperation whose benefits range from the guarantees of adequate financing to the reliability of supplies.

However, this does not deprive the oil companies of their autonomy in exploration and development, and of their rights to benefit from a share of the exported product.

What has been achieved so far is primarily due to E.G.P.C. and its negotiators.They were never discouraged by the new and difficult subject. They approached it with an open and far-sighted mind, realizing both the needs of the country and oil companies. Aware of providing a tangible and valuable contribution for the secure energy supply, on which both producer and consumer countries depend, they allowed the above mentioned provisions to become effective.

THE FUTURE ROLE OF NATURAL GAS IN EUROPE

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2/paper 4

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INTERNATIONAL SEMINAR
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DEVELOPMENT - Cairo - February 26 - 27, 1982

THE FUTURE ROLE OF NATURAL GAS IN EUROPE

HANS K. SCHNEIDER

I. Past Development and Present State

1. At the time, Western Europe[1] has at its disposal a widely extended grid of interconnected national natural gas (NG) pipelines with a significant capacity of transportation. This NG grid mainly emerged in the last two decades. Up to the sixties, NG was important only in certain regions of W. Europe (Northern Italy, Gaz de Lacq in France, Northern W. Germany) and for national energy supplies it was only of secondary importance. Especially in W. Germany, France, the U.K. and Belgium, manufactured gas, mainly coke oven gas, was more important than NG. The rapid development since the end of the sixties was triggered by the discovery of the super-giant gasfield near Groningen, Netherlands. The increases of natural gas production in W. Germany, Italy and France contributed to this development too. With the exploitation of NG in the UK and the Norway sector of the North Sea, indigenous natural gas production was again substantially increased. In the last decade, the increase in NG consumption which surpassed its indigenous supply had to be met by rapidly growing imports from the USSR, Algeria and Libya (Figure 1). In 1980, these countries (USSR 22, Algeria 4, Libya 2 mtoe) accounted for as much as 15% (28 mtoe)

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1) Austria, Belgium, Denmark, Finland, France, Greece, Ireland, Italy, Luxembourg, Norway, Portugal, Spain, Sweden, Switzerland, The Netherlands, United Kingdom, West Germany, Yugoslavia

of W. European gas consumption (181 mtoe). At the same time, intra-European trade with NG was more than twice the size of the imports from outside W. Europe. The share of NG in W. European primary energy consumption attained a maximum of 15% in the year 1980.

2. It is instructive to analyse the development of the sectoral structure of NG consumption, as is here done for the 9 countries of the European Community, the industrial centre of N.W Europe.

<u>Figure 2</u>: The structure of NG consumption in the 9 countries of the European Community

Striking, and far above average is the increase of NG consumption of households by almost five times. Also a tendency emerging in the mid-70ies towards a decreasing use of NG for electricity generation is noticeable. For the industry, an increase by more than 1 1/2 times is reported during the period of observation. The non-energetic use of NG as a feedstock in the chemical industry doubled and it amounted to 11 mtoe in 1979, viz. 6% of total NG consumption.

3. It must be remembered that the NG from the different gas fields is not homogeneous. The difference in heating value and in the chemical contents of, for example, Dutch, Norwegian, W. German, Russian gas and LNG have consequences on the operation of the gas supply systems concerned. However,

these operational problems can be managed, so that the addition of NG from further sources is practically not limited.

4. In the whole range of its applications, the NG meets the competition of other forms of energy. Most important is, and will be in the foreseeable future, the use of NG for the generation of heat; more than 70% of W. European primary energy is needed for heating purposes, (including process heat). As a feedstock for chemical processes, it plays a minor role. The rapid development of the W. European NG market in the last two decades was decisively influenced by the fact that this form of energy with outstanding technical qualities had been made available in large quantities at rather low prices.

Thanks to low wellhead and city gate prices, the customer prices of NG were competitive even with the prices of (heavy) fuel oil in most regions of W. Europe until the mid 70ies. Following the first oil price boost in 1973/74, the producers strongly increased the prices of delivery adjusting to the new market situation. The second jump in oil prices led to further large price advances of NG which eliminated, or at least strongly diminished the competitiveness of NG in comparison to fuel oil and coal in most regions of N.W. Europe. In competition with gas oil, electricity, heat pumps and district heating, to-day's relative gas price is still low enough for a continuation of the gas penetration, although its speed will certainly be reduced.

Table 1: Import prices of NG 1975/79

Table 1 exposes expert estimates of the development of NG import prices of some W. European countries. Most of the prices of NG from national production are considerably lower than those of imported gas in each of the years. The present negotiations on price adjustments of existing contracts, prices of new contracts and the use of the escalation clauses (vide para 5) will not only lead to an increase of the indigenous W. European gas production but also to an increase of the import prices considerably above the level of the year 1980.

5. The price formulae agreed upon in the NG supply contracts reflect the common evaluation of the NG final user market conditions at the time the contracts were made. Up to the mid '70ies, heavy fuel oil was regarded as the main competitor of NG, however - contrary to the '60ies - an oil with low sulphur content (due to stricter environmental requirements).

Since the latest oil price shock, a re-evaluation of NG market conditions has started, of which the outcome is still uncertain. The price formula of the Ekofisk II contract (Norwegian gas) in 1975 may be taken as an illustration of the expectations prevailing on the NG market development at that time. The NG price p results from the formula;

$$p = 16{,}80\left(0{,}50 \cdot \frac{A}{200{,}-} + 0{,}20 \cdot \frac{B}{275{,}-} + 0{,}30\ \frac{C}{170{,}-}\right) \cdot \text{DM/Gcal}$$

with A = price of heavy fuel oil (up to 1% sulphur content) for German gas customers at Dusseldorf, etc., plus 60% of the difference between a standard fuel oil and low sulphur fuel oil;

B = price of gas oil;

C = fob-price of heavy fuel oil (up to 1% sulphur content) in Rotterdam.

The price agreement also contains clauses on lower price limits and their escalation, price increases due to some additional fiscal burdens and other issues as well.

II Prospects of Primary Energy and NG Demand in W. Europe, 1990 and 2000

1. The further development of NG demand will on the one hand be

dependent upon the general factors determining the growth of primary energy demand. These are the growth of Gross Domestic Product (GDP), the real price of energy and the non-price policy measures of energy conservation. Dependencies exist between GDP growth and the other determinants of energy demand insofar as a high real price of energy and as cost effective measures to save energy will reduce GDP growth. On the other hand, the further development of NG demand will be influenced by the relative price of NG compared to the main competing forms of energy.

2. The real GDP growth of W. Europe which amounted to 4,6% p.a. from 1965 - 73 dropped by more than a half of this figure in the period 1973 - 79. The leading institutes of economic research in W. Europe prevailingly expect an average real GDP growth of about 2,5%p.a. in the 1980ies and a rate a little above that from then on until the turn of the century. These projections are based on several assumptions; successful structural reshaping and modernization of national economies, absence of further exogenous shocks, improved control of inflation, continuation of a productivity stimulating international division of labour...

The prevailing expectation with respect to the real price of energy is one of a further increase. The size of this increase is subject to considerable differences of opinion. Lower estimates of the key price - the real price of crude oil - arrive at a total increase of 30 to 50%, higher ones at 100 or even more percent in the next two decades. This would respectively lead to a real price of crude oil of - at the lowest - 70 dollars per barrel (in 1980 US dollars) in the year 2000. The higher rate of price increase would correspond to a real interest rate of 3 to 4%, which does not seem unplausible for industrialized countries.

The price of the other forms of primary energy will follow the price of crude oil more or less strictly. The factors relevant have been the subject of an analysis by the author[1]. The various alternatives to conventional oil will however not be able to prevent further price increases of crude oil in the next two decades (vide ibidem).

The future time profile of the real crude oil price and the total primary energy price index cannot be forecast. There are good reasons for the hypothesis, that the price increase will also in future take place in form of stages, reflecting the momentary level of tensions in the market. As soon as an increasing demand for oil exceeds its supply (or if a supply shortage causes such an excess demand) in e.g. Rotterdam, a place which reflects the mood of the market, opportunities are good for raising the price of crude oil. The magnitude of this increase should be the larger, the stronger the rise in spot-prices. In times of depressed economic activity, enforced energy saving and/or oil

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1) See the analysis of the coefficient of interfuel price interdependency, in: Hans K. Schneider, Comments on the Paper of Jean-Marie Chevalier "New Energy Technologies - Their Impact on Energy Prices." Conference. Emerging Technology. Consequences for Economic Growth, Structural Change, and Employment in Advanced Open Economies. Kiel June 1981 (in print).

substitution - as e.g. to-day - one can on the contrary expect declining or at least stable real oil and energy prices.

Under certain, though in my personal opinion, unrealistic conditions, an international agreement as the one suggested by the OAPEC on the escalation of the crude oil price, could stabilize the oil price path and thereby the total price development of primary energy.

3. Rising real energy prices and measures taken by governments to cut down energy consumption will further reduce the energy intensity of the W. European GDP. Primary energy consumption will therefore grow less strongly than GDP. A plausible estimate is an average growth of 1,5% for the next two decades[1].

In absolute terms, an average rate of growth of 1,5% is equivalent to an increase of primary energy demand in W. Europe by about 200 M toe until 1990 and another 230M toe until 2000.

4. With a presumably stagnating or even slightly declining use of oil, mainly three supplies of energy will become important in covering the additional primary energy demand of W. Europe: natural gas, coal, nuclear power. The size of their contributions to future

1) This corresponds to a rate of growth of a little more than 1% for final energy demand. The difference between the two growth rates results from the rising share of electricity in final energy demand.

supply depends not only on their price ratios but also on political decisions; as in the case of NG e.g. on a decision concerning the political acceptability of increased imports from Russia. Presupposing that the price of NG will continue to adjust to the price of its main competitors, gas and low sulphur fuel oil, one can nevertheless expect an expansion of natural gas consumption at least as large as the average increase of primary energy demand. Therefore, NG would at least maintain its share of the supply.

At the time, there are no projections of NG consumption encompassing all of W. Europe and taking into account the present state of macroeconomic and energy economic expectations and evaluations.

One point of reference may be an investigation for the FRG by our institute; which is based on a sectoral analysis of demand and competitive conditions of NG under consideration of different applications of NG. The result of this investigation is, that total NG consumption of the FRG will rise by as much as 1/3 (referring to 1978) until 1995 in spite of a reduction of NG input in electricity production by one half. At the same time, considerable structural shifts towards higher quality applications can be expected. Non-energetic consumption will more than double but it will still be of minor importance in absolute terms. The largest absolute increase is expected within the residential sector and for small customers; for the industry, the increase will be somewhat lower.

These estimates are consistent with earlier national projections of NG consumption. Assuming competitive NG prices, it is not unrealistic to project a development of NG consumption in W. Europe as the one reported in Table 2 (figures in brackets: total primary energy; +1,5% p.a.):

Table 2: NG-consumption in W. Europe

1980	1990	2000
181	230-250	245-275
(1220)	(1420)	(1650)

The lower estimates correspond to a high relative price of NG and an implementation of nuclear and coal investments as they are planned to-day. The higher estimates correspond to more favourable conditions for the expansion of NG in W. Europe.

III NG Supply and the Pricing Problem

1. The indigenous NG production can presumably only be increased slightly and it will hardly reach its present level towards the end of the century. Production from old fields will shrink; new fields, predominantly offshore (Southern North Sea, et alia), will on the whole only compensate for this decline in production. Of course, it is conceivable that advances in exploration and transport technology will bring about positive surprises and a somewhat larger production (especially in the Northern North Sea). But judged from a 1981 point of view, it is not realistic to expect more than temporary increases of production from W. European sources. Therefore, an increase of NG consumption compared to the level of 1980 will have to be met predominantly by imports during the 1980ies and completely so in the years afterwards.

Figure 3: The NG supply of West Europe

2. The range of potential NG suppliers for the W. European market has been widened so much since the oil price shock in 1979/80, that - with the exception of the Far East, Australia/New Zealand and maybe Alaska and Northern Canada - it includes all countries of the world which already have or might have exportable excess gas production at their disposal. The increase in the prices of oil has opened the potential for further NG price increases and

thereby made it possible to cope with even very high costs of transportation.

Table 3: Potential NG exporters

3. The technical problems of the NG transport over largest distances have been solved. The pipeline can nowadays not only be used for onshore transport across more than 5000 km but also as a submarine pipeline in water depths of up to 600 m (to-day)[1]. Since 1964, when the Algerian deliveries of LNG to Great Britain were taken up, LNG transport has proven its technical security.

As far as it is possible to choose between an actual delivery by pipeline (onshore or offshore) and by LNG tanker, the relative profitability of the means of transportation will primarily depend upon the amount to be delivered (total and per year) and the distance of transportation (onshore and by sea). The cost behaviour of the various NG transport systems shows basic differences (Figure 4.)

An impression of the size of the transport costs in dependence of various parameters can be gained by a look at Table 4. Converted to $/b, the unit transportation costs amount to 12 to 20 $/b (1980 US$). Thus it becomes clear that based on crude oil prices prior to 1979, it was economically difficult if not impossible to use NG from more remote regions for the W. European market.

1) As a result of a technology developed by the ENI-group and used for the construction of the Algeria-Italy pipeline.

4. The realization of the export potential of NG is essentially dependent upon its price. In the following, the basic problem of price formation will be described, simplifying with the conception of a demand and supply price.

Let the demand price (cif) be defined as the maximum price the importer is willing and able to pay at the inlet of his transportation system.

The average demand price results from the difference between the weighted average selling price attainable on the market and the average costs of transportation, storage and distribution in the importers gas system. The selling prices which can be realized on the market differ considerably, depending on the customer group and/or the kind of gas use. The highest selling prices can be received by sales to residentials and small customers, the lowest ones for interruptible uses (power plant, boilers in industry), where they correspond to the counter value of the heavy fuel oil or coal saved. The costs of the gas distribution system attributable to individual customer groups are also different. The highest are regularly the costs of households and small customers.

The difference between the demand price cif derived above and the costs of the gas transport from the exporting to the importing country yields the demand price fob NG export country.

The supply price fob NG export country is defined as the minimum price - by economic criteria - at which the export country is willing to export NG. The average supply price is the sum of direct costs and opportunity costs of the gas export supply. The direct costs are composed of transportation costs and, if necessary, of the costs of liquefaction of the gas. The opportunity costs equal the net value of NG in the best alternative use excluded by the direct gas export[1].

The opportunity costs of an associated gas will practically equal zero in a country where there are no long-term possibilities of domestic use to account economically for the direct costs of gathering and transportation. On the other hand, the opportunity costs can amount to several times the direct costs in those countries planning extensive investments in chemical production. In general, it can be concluded that the opportunity cost element of the supply price has risen strongly in the last years, as industrial investment projects in countries with large gas resources make an increased domestic use of gas seem economically appropriate.

5. An export of NG can economically be justified only to the extent that the demand price exceeds the supply price (fob). Obviously this is an issue which does not lend itself to generalizations and which has to be investigated from case to case.

1) In contrast to the indirect export of gas, where NG is a content of the product exported (ethylene, methanol.....)

It can, however, be generally established that the increase of the average demand price for imported NG in W. Europe has mainly been caused by rising prices of gas oil and other forms of competing energy. Moreover, it has also been a shift in the pattern of consumption from low premium uses to high premium uses which has contributed to this development. This shift will continue to be effective in future. To a certain extent, however, which depends upon the given storage opportunities and their costs, and other things, interruptible supplies will also be provided in future.

With prices of competing forms of energy further increasing, the general forecast for the demand side looks favourable. If the potential exporters of gas evaluate correctly the alternative domestic uses of NG open to them - which means above all to calculate the economic feasibility of the projects on the base of world market prices and realistic market volumes[1)] an increased amount of gas could by economic standards be made available for countries with large reserves and a small home

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1) In their paper "Economics of Gas Utilization in Different Fields," the authors G. Bonfiglioli and F. Cima arrive at interesting estimates of the net yield (net back value) of NG which is converted to various export products. The net yield of NG especially when converted into ethylene products exported to W. Europe is accordingly much higher than when directly exported. It should however not be overlooked that the export volume achievable <u>without</u> causing a price collapse of the industrial export product concerned figures only a few billion (US) m^3.

consumption.

The estimates regarding the increase of W. European gas consumption and the possibilities of its coverage therefore do not seem unrealistic.

6. The reflections made on the demand side and the demand price will now have to be supplemented by quantitative estimates.

The projections refer to the mid 90ies, thus to a time at which the availability of additional NG imports could be crucial for the provision of supply in the W. European market. The price estimates were made at the Institute for Energy Economics at the University of Cologne and they apply to the German market. Alternative crude oil price scenarios will not be reproduced here. In its tendency, the statement may be applied to the other industrial countries of W. Europe as well.

Table 5: Prices of Energy

Under these price assumptions, the estimated development of NG until 1995 will lead to the following structure of NG consumption.

resid./small industry	large industry	electric. generat.
42	43	15

Total 100

The average selling price of NG around 1995 will then lie in the range of 422 - 482 $/toe, or 9,8 - 11,2 $/MMBTU. Compared to this, the maximum average selling price in 1980 could have figured 6 $MMBTU taking into account the structure of demand existing at this time.

Supposing an average selling price of 10 $/MMBTU, we derive the demand price cif inlet German grid for 1995 as follows:

	10,- $/MMBTU
./. transport and storage costs	1,1 - " -
./. local distribution costs	1,3 - " -
	7,6 $/MMBTU

Referring to the year 1980 the demand price cif German grid should be valued at an order of magnitude of 4 $/MMBTU. This is in accordance with Bonfiglioli's estimation for the whole W. European market[1].

It has to be emphasised strongly that all estimations of the future price development are extremely speculative. Even with sophisticated methods, prices cannot be forecasted. Although there are good reasons to expect an increase of the real oil and energy prices and accordingly a demand price for NG imports in the order of magnitude derived in the exemplary calculations above, one cannot rely on their occurence.

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1) ibidem Fig. 4

7. On the other hand, it seems very probable that the price ratios crude oil/gas and crude oil/heavy fuel oil will continue to shift: Gas, oil and heavy fuel oil will,in the long run, not show the same real price increases as crude oil, but smaller ones. Although intensifying competition in the heat market cannot prevent an increase of the real prices of competing forms of energy, this increase will be less than the one for oil products (gasoline, naphta, etc.), as they are not subject to such an intensive competition by energy supplies with relatively low costs. The reduction of the sales of heavy oil and gas oil will be comparatively strong in W. Europe, whereas for light products it will be a minor one, necessitating the construction of the appropriate conversion plants. With an increasing share of light products the correlation between the crude oil price and the average price of light products will tighten while that between the price of crude oil and the price of heavy fuel oil, but also of gas oil will continally loosen.

8. As a consequence of the crude oil price parity, competitiveness of the imported NG will be eliminated on the seller's markets, either immediately or at least with time going. This is so because the maximum average selling price for NG is by and large equal to the weighted average price of gas oil and heavy oil, these only reluctantly following the increase of the crude oil price as reasoned above. Considering the costs for transport, storage and distribution, a current NG price cif importers

grid determined by the crude oil price parity cif may exceed the demand price. This is particularly true if a very expensive crude oil (Algeria e.g.) is taken as a basis;
A crude oil price parity fob will all the more eliminate sale-ability. NG transport is more expensive than the transport of crude oil, the LNG transport most often even by a multiple.

An escalation of the prices of imported NG according to a crude oil parity can only be taken into consideration by importers if the initial price (base price) is clearly below the crude oil parity cif. By way of general revision clauses, the price level and the escalation clauses will then have to be reviewed in intervals of a few years.

IV. Concluding Remarks

The paper attempts to provide an overview on the conditions of the W. European NG market and its development. The economic chances for a further increase of NG demand and supply can - on the whole - be evaluated as favourable. But many important determinants are not yet clear. For the future development it is essential that importers and potential suppliers make efforts to recognize the long-term economic interests of their potential partners and that they show a willingness to make trade agreements which in this sense can be regarded as a fair deal; NG is too valuable to be wasted by selling at prices too low. On the other hand, by preventing an economically sensible international NG trade due to excessive prices, this energy supply would not make as large a contribution to solving the world-wide energy problem as it should - lastly to the disadvantage of all.

Table I:

IMPORT PRICES OF NATURAL GAS 1975 - 1980

(US $/million Btu)

Country	1975	1977	1979	I/1980	I / 1981
AUSTRIA					
USSR	1,37	1,86	2,70	3,79	
BELGIUM					
Algeria					5,28
Netherlands	0,96	1,56	2,28		
Norway			2,31		
FRANCE					
Algeria(LNG)	0,96	1,47	2,42		4,27
Netherlands	1,07	1,57	2,16		
Norway		1,62	1,91		
ITALY					
Libya(LNG)	0,79	0,92	1,45	2,82	3,34
Netherlands	0,63	0,77	1,25		
USSR	0,54	0,73	1,15		
NETHERLANDS					
Norway			2,25	2,80	
SPAIN					
Algeria(LNG)	--	0,64	2,50		
Libya(LNG)	0,52	0,56	2,20		
SWITZERLAND					
Netherlands	1,30	1,84	3,65		
UK					
Algeria (LNG)	0,91	0,98	1,15	3,09	
Norway			2,20		
WEST GERMANY					
Netherlands	0,93	1,43	1,90		
Norway			2,15		
USSR	0,64	1,09	2,50		
Grenzübergangswert	0,85	1,44	2,07	2,50	

Source: J. Segal & F.E. Niering in Petroleum Economist, Sept. 1980
Energiewirtschaftliches Institut an der Universität Köln
World Gas Report, July 20, 1981

Table 3:

POTENTIAL NATURAL GAS - SUPPLIERS [1)]

	Distance to Central Europe -km-	NG proven reserves - in mtoe -	domestic consumption - 1979 -	
Iran	7888[2]	13 870	Middle East	31.0
Qatar	7901[2]	3 100		
Abu Dhabi	7760[2]	1 580		
Saudi Arabia	8251[2]	2 640		
Algeria	3361[2]	3 540	Africa	16.5
Egypt	2396[2]	240		
Libya	1840[2]	960		
Cameroon	8665[2]	180		
Nigeria	8488[2]	1 160		
U.S.S.R.	5000[3]	25 470		307.0
Norway	1000[3]	1 050		—

1) exept those potential NG-exporting countries, wich are of importance for the supply of the american or japanese market (Canada, Mexico, Indonesia, Australia)

2) LNG

3) Pipelines

Source: Burckhard Bergmann,North Sea Gas and its Importance for Continental Europe, June 1980;

BP statistical review , 1980, S.28

Table 4:

EXPORT EXAMPLE

	ARABIAN GULF-EUROPE		
	Gas pipeline	LNG	Gas pipeline LNG
Route	Area of Gulf Iraq Turkey Greece Yugoslavia Central North Europe	Via Suez	Lique-facton at Mediter-ranean coast
Length of route,km...	5,200	11,300	7,000
Land gas pipelines.	5,200		2,300
Sea gas pipelines ...	...	...	...
Quantity at the inlet of the system($10^9 m^3/a$) ..	18	18	18
Quantity delivered to market ($10^9 m^3/a$)	16,3	14,8	14,4
Investment at April 1980 cost without interest during construction (10^9 \$)	5,9	6,5	7,1
Transportation unit cost at April 1980 value, (\$/MMBTU)			
Fuel gas value \$2/MMBTU	2,0	2,9	3,1
Fuel gas value \$3/MMBTU	2,1	3,1	3,3
Fuel gas value \$4/MMBTU	2,2	3,3	3,5

Source: Gianpaolo Bonfiglioli, OIL & GAS JOURNAL - 4, 1980

Table 5:

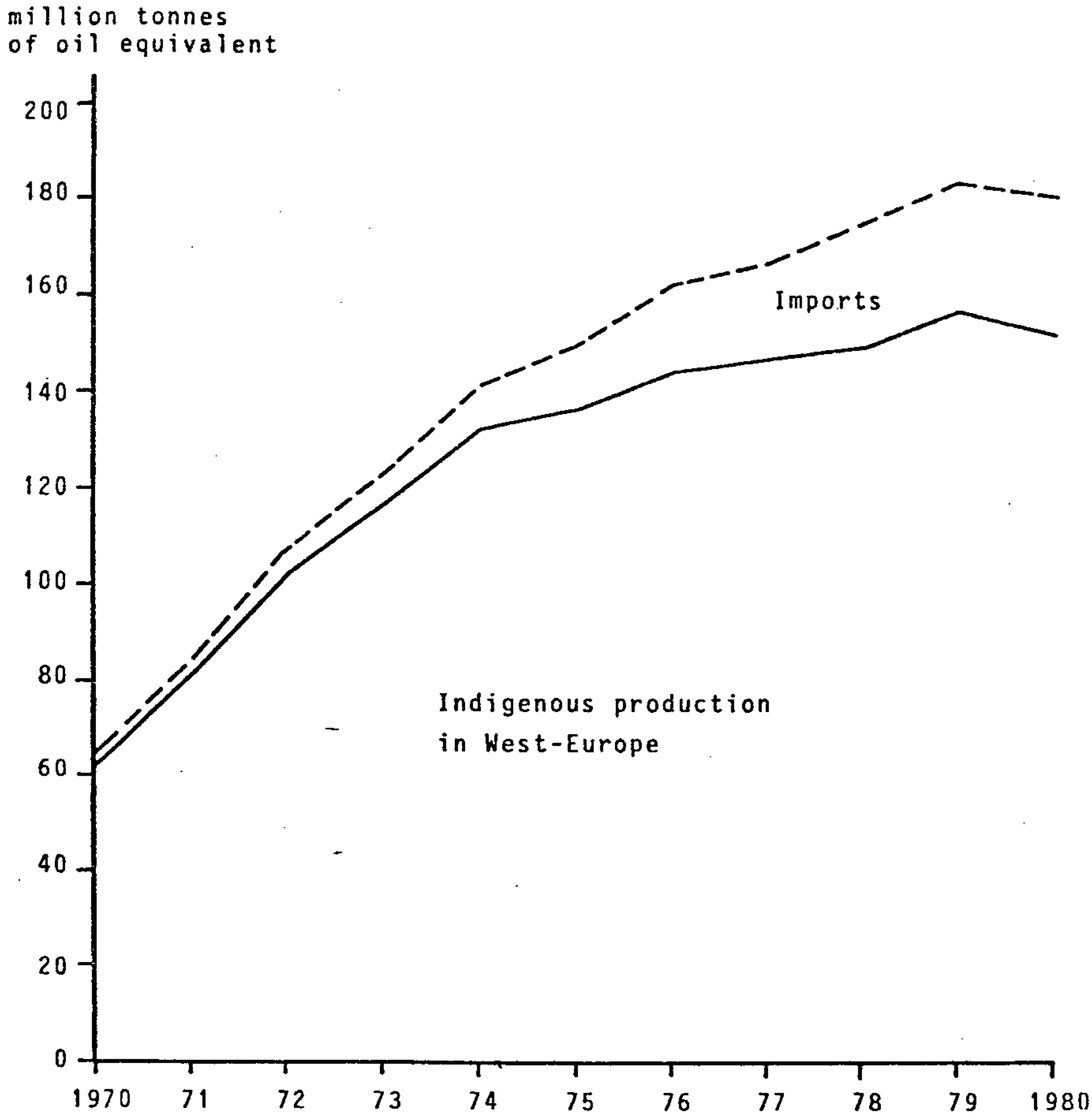
PRICES OF SOME FORMS OF ENERGY IN THE FRG

- all prices in 1980 $[1] -

	1980	1995
crude oil cif	252 $/toe	415 $/toe
gasoline (station price)	0,67 $/l	1 - 1,10 $/l
diesel (station price)	0,64 $/l	0,9 - 1,05 $/l
gas oil (customer price)	410 $/t	550 - 610 $/t
heavy fuel oil (customer price)	220 $/t	330 - 390 $/t
natural gas		
- residential and small industry	gas oil	±5%
- large industry, power plants	fuel oil	±5%
Indigen. hard coal	160 $/toe	280 - 300 $/toe
Imported coal	105 $/toe	225 - 240 $/toe
electricity		+1,5 - 2%/a

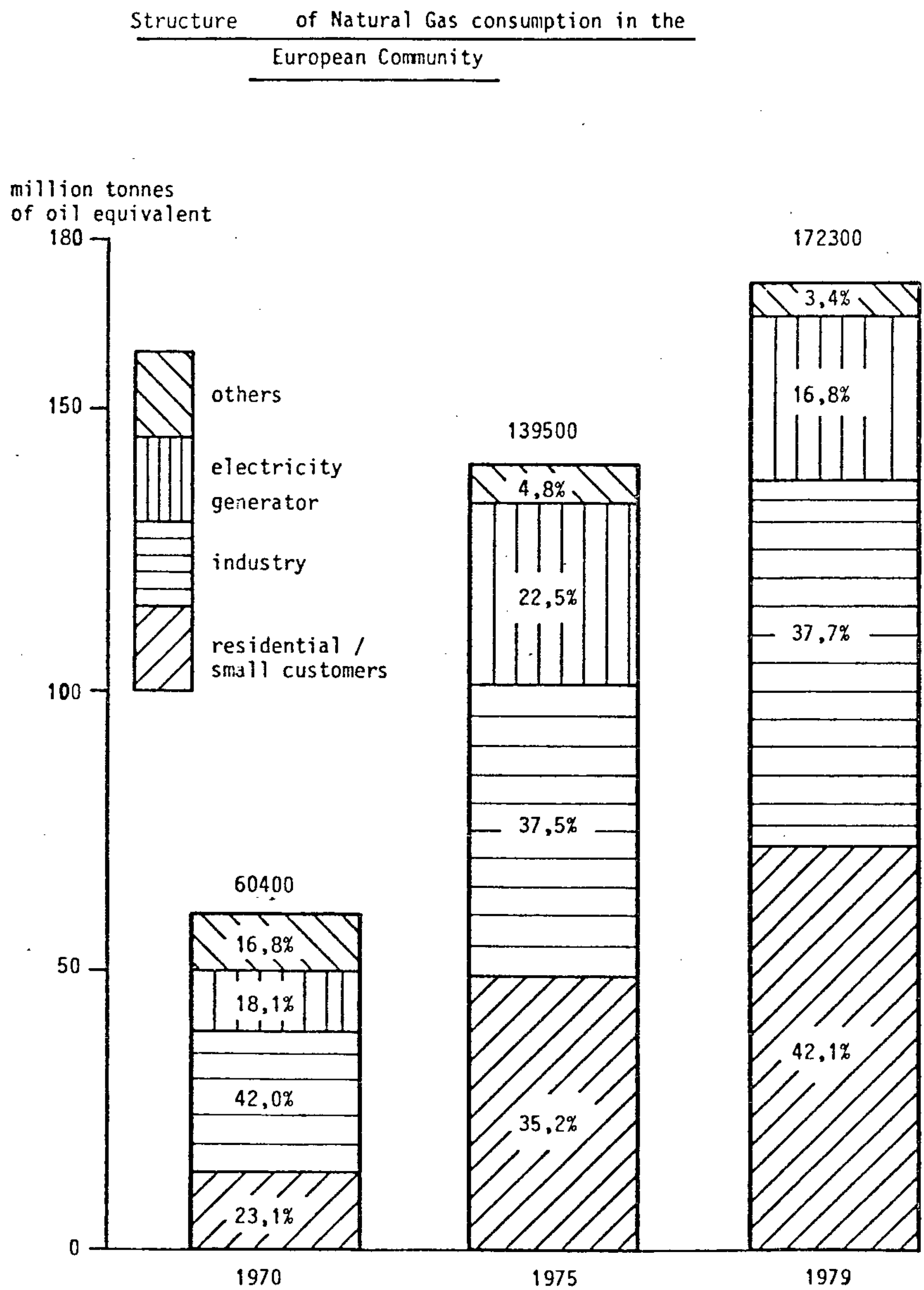
Figure I:

NATURAL GAS CONSUMPTION AND SUPPLIES IN WESTERN EUROPE



Source: Burckhard Bergmann in
WESTERN EUROPE AND THE INTERNATIONAL NATURAL GAS TRADE; May, 1980

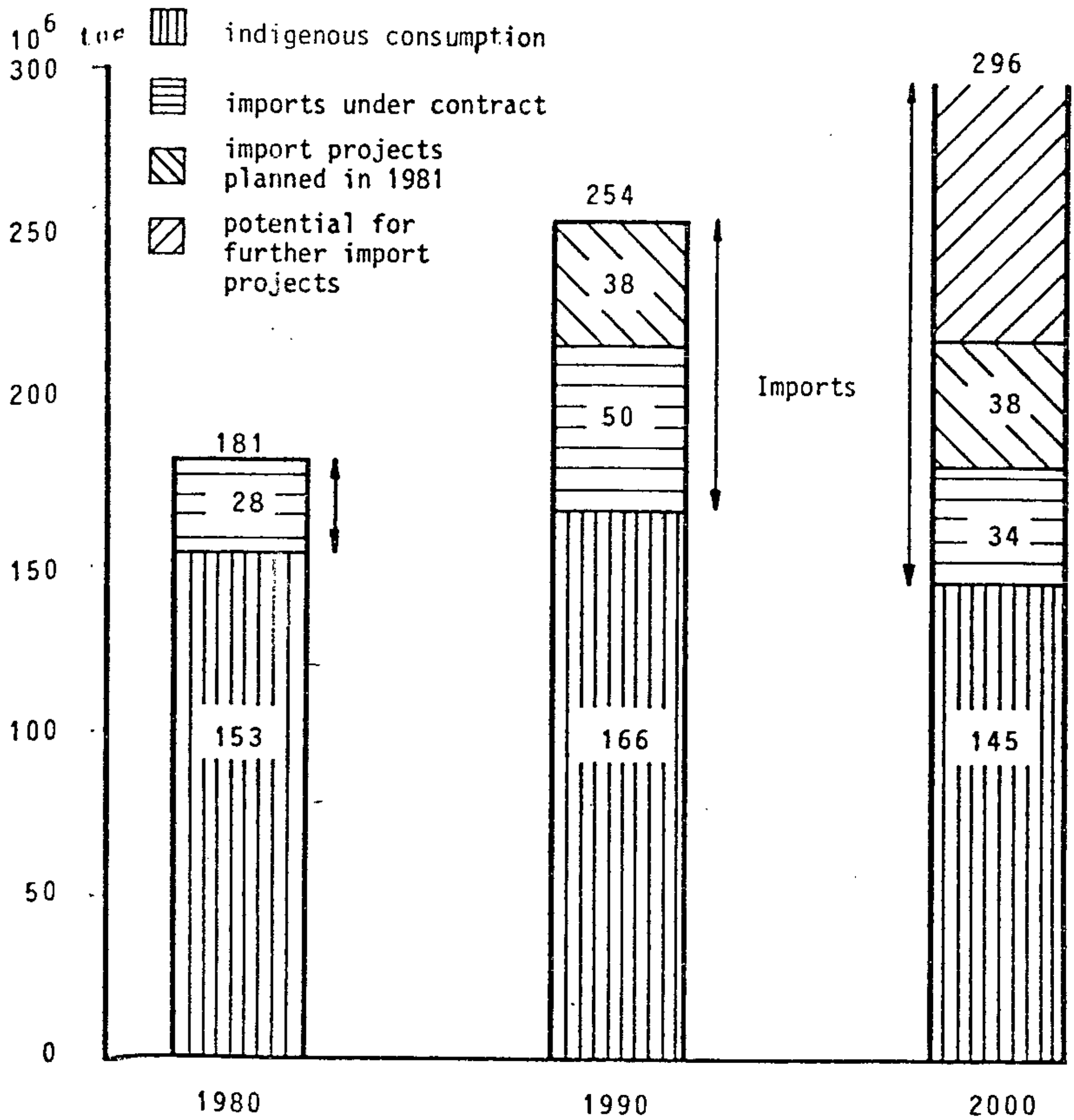
Figure 2:



Source: eurostat; BILANS DE L'ENERGIE EN EQUIVALENT PRIMAIRE 1970 - 1979, 1981

Figure 3:

THE NATURAL GAS SUPPLY OF WEST EUROPE

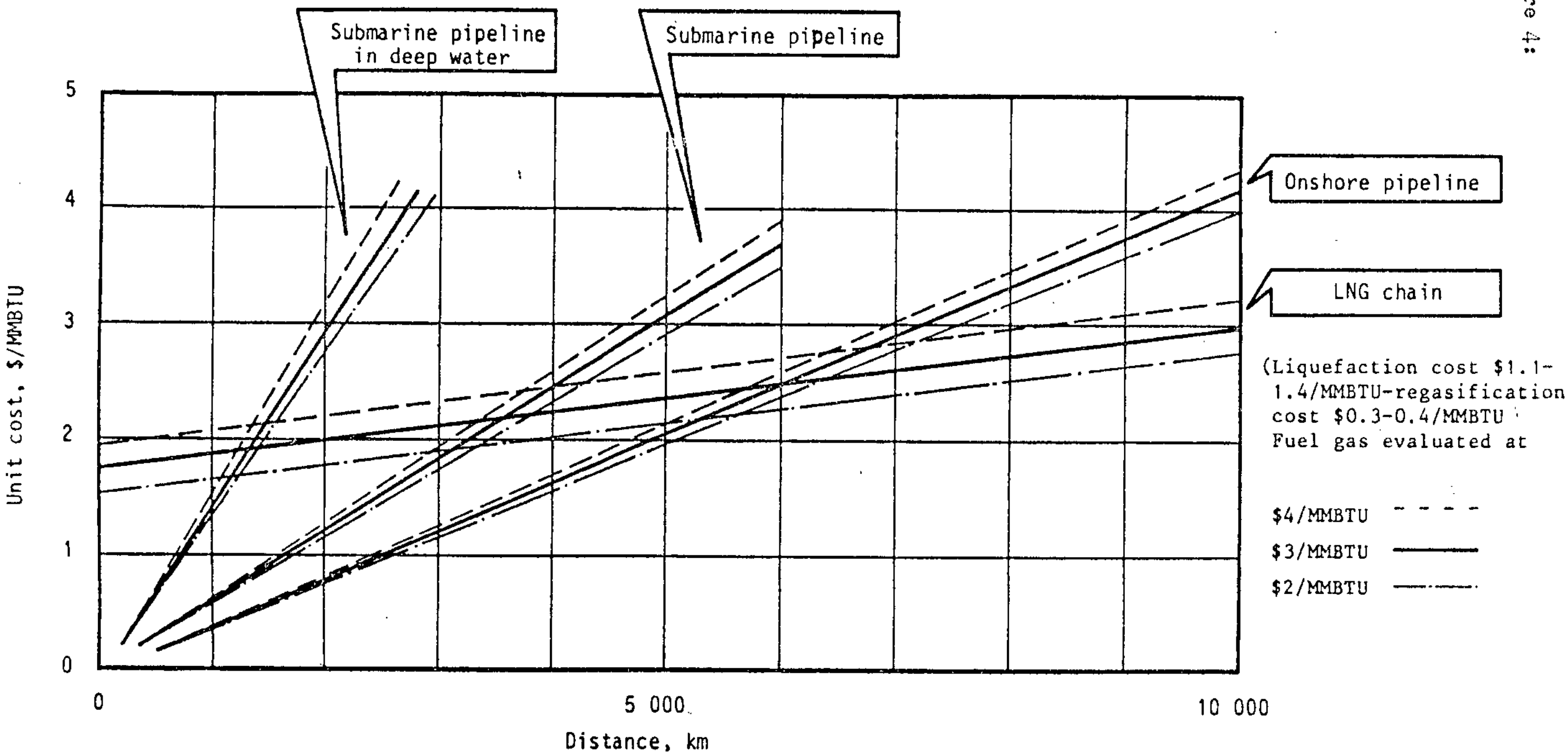


Source: Burckhard Bergmann in
WESTERN EUROPE AND THE INTERNATIONAL NATURAL GAS TRADE, May, 1980

Figure 4:

Cost of natural gas transport

(Values as of April 1980, referred to outlet quantities considering 18 billion m³/year at inlet of pipeline or liquefaction plant)



Source: Gianpaolo Bonfiglioli in OIL & GAS JOURNAL, AUG.4,1980

SINTESI DELLE RELAZIONI

EGPC - IEOC

INTERNATIONAL SEMINAR
ON NATURAL GAS AND ECONOMIC
DEVELOPMENT - Cairo - February 26 - 27, 1982

GAS NATURALE E SVILUPPO ECONOMICO

MARCELLO COLITTI

Dopo aver sottolineato l'importanza di questo incontro nel promuovere una più spinta cooperazione tra le due sponde nord-sud del Mediterraneo, l'autore si sofferma ad esaminare le qualità tecniche e la flessibilità di utilizzazione del gas naturale, riscontrate attraverso anni di esperienza nei paesi europei ed in particolare in Italia. Il caso italiano è infatti tipico di un paese che ha spinto le attività di ricerca e di utilizzazione delle proprie risorse energetiche, e cioè del gas naturale della Valle del Po, per ricavarne una rendita da investire in progetti di sviluppo e rivitalizzare la propria economia del dopoguerra soprattutto nel settore industriale. Molti economisti oggi pensano che il cosiddetto "miracolo italiano" degli anni '50 - '60 e che portò l'Italia nel gruppo dei primi dieci paesi industrializzati, sia stato in parte dovuto alla crescente disponibilità di questa nuova fonte di energia. L'esperienza italiana nel settore del gas naturale, sia dal punto di vista tecnologico che della sua utilizzazione come vettore dello sviluppo economico del paese, potrà oggi risultare molto utile all'Egitto lanciato in un programma di valorizzazione del proprio potenziale di risorse energetiche. L'Egitto possiede infatti riserve accertate di gas naturale che offrono al paese prospettive importanti, tenuto conto della rivalutazione che il mercato internazionale dell'energia e quindi del gas naturale hanno acquisito, delle più avanzate tecniche di produzione e delle migliori possibilità di distribuzione sui mercati interni oggi raggiunte. L'utilizzazione del gas potrà quindi fornire all'Egitto quella "rendita" determinante al suo sviluppo economico, purchè il prezzo del gas si mantenga competitivo con quello di altre fonti di energia.

L'autore passa ad esaminare la situazione attuale del sistema energetico egiziano.

Partendo da una ipotesi di lunga prospettiva in termini di riserve, produzione, consumi interni e probabilità di esportazione del gas naturale, l'autore raggiunge le seguenti condizioni:

l'utilizzazione intensiva del gas naturale egiziano darà un grande contributo allo sviluppo economico del paese,pertanto:

nuove iniziative dovranno essere intraprese nel campo dell'esplorazione e della produzione, per mettere alla luce i potenziali esistenti; inoltre:

nel quadro di una completa utilizzazione delle riserve di gas potranno essere previsti dei quantitativi all'esportazione

anche nell'ipotesi di consumo massimo interno di gas naturale ed all'esportazione, notevoli quantitativi di riserve saranno ancora disponibili dopo l'anno 2000.

CURRICULUM VITAE

MARCELLO COLITTI è nato a Reggio Emilia il 29 Luglio 1932.

Si è laureato in Giurisprudenza all'Università di Parma nel 1954.

Nel 1956 è entrato all'ENI come economista junior allo Ufficio Studi Economici; nel 1967 è stato nominato Direttore del Servizio Pubbliche Relazioni.

Dal 1971 è Direttore del Servizio Studi Economici.

Dal 1974 è membro del Sindacato Dirigenti dell'ENI.

Nel Gennaio 1976 è stato nominato Direttore della Programmazione; nel 1978 è diventato Direttore della Programmazione e Sviluppo e nel 1980 Vice-Presidente dell'AGIP S.p.A.

Libri pubblicati:

- "La Politica Petrolifera Italiana", in collaborazione con Luigi Bruni - Ed. Giuffrè - 1967
- "Le Grandi Imprese e Lo Stato" - Ed. Einaudi, 1971.
- "Gli Stati Uniti alla Deriva" - Ed. Buffetti - 1975.
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ESPERIENZE RECENTI E PROSPETTIVE DELL'INDUSTRIA INTERNAZIONALE DEL GAS NATURALE

J.E. HARTSHORN

Le riserve di gas naturale, dovunque siano situate, sono diventate improvvisamente e potenzialmente molto più proficue da sviluppare per l'esportazione o per l'uso interno in seguito all'impennata dei prezzi del petrolio nel 1979 - 1980. Ma i paesi esportatori di gas hanno risposto rapidamente, non soltanto per richiedere aumenti proporzionali dei prezzi del gas, ma anche per esigere una piena parità con i prezzi del greggio esportato. Questo, insieme alla riduzione delle esportazioni iraniane, ha frenato la rapida crescita che si era verificata finora nel commercio internazionale del gas naturale. Infatti il consumo di gas nel mondo non comunista nel 1980 ha appena superato la cifra relativa al 1979 e nel 1981 esso potrebbe essere diminuito.

Attualmente i prezzi del greggio si sono livellati. In termini reali le previsioni in materia di prezzi petroliferi sono orientate al ribasso fino a dopo il 1985. Inoltre la domanda di energia in generale nelle economie industrializzate dell'O S C E importatrici di gas si è indebolita a causa della recessione e dell'elasticità dei prezzi. Le imprese di produzione e distribuzione di gas in Europa, dove la produzione locale presumibilmente diminuirà negli anni '90, ritengono attualmente che il gas non sarà in grado di raggiungere l'incremento della quota del mercato energetico - da meno del 15 per cento a circa il 20 per cento - che esse avevano programmato, se dovranno pagare prezzi per le importazioni di gas equivalenti a quelli del greggio. Gli Stati Uniti stanno cercando politicamente anche di persuadere i loro alleati a non importare maggiori quantità di gas dalla Russia che ha le più vaste riserve del mondo e che è l'unico esportatore che offre il gas a prezzi che l'Europa considera sostenibili.

La Russia e l'Iran insieme possiedono oltre il 70 per cento di tutte le riserve di gas che possono essere considerate praticamente esportabili. (Questo "surplus esportabile" rappresenta soltanto circa un terzo delle riserve di gas totali accertate nel mondo). Se, per differenti ragioni politiche, l'eccezionale potenziale di esportazione di questi due paesi dovesse essere escluso per un lungo periodo, le prospettive del commercio internazionale del gas sarebbero fortemente pregiudicate.

In effetti, salvo un ulteriore intervento diretto sovietico oltre le sue frontiere, in Polonia o altrove, il progetto di enormi importazioni di gas sovietico nell'Europa Occidentale oltre le importazioni correnti, sembra probabilmente andare avanti. Lo stesso può dirsi dei progetti di esportazione di gas naturale liquefatto da Nigeria, Australia, Camerun e Trinidad. Inoltre agli attuali prezzi del petrolio le economie delle esportazioni di gas naturale liquefatto dalle enormi riserve dei paesi del Golfo arabo - particolarmente dal Qatar e dal Bahrain - sembrano finalmente pienamente possibili. Le esportazioni algerine cominceranno probabilmente ad aumentare, per quanto più attraverso gasdotti che non come gas naturale liquefatto. In questo decennio anche l'Iran potrebbe decidere di riprendere le esportazioni.

Il potenziale di espansione del commercio d'esportazione di gas - che negli anni '70 è stato il fattore in crescita più rapida dell'intero commercio mondiale di gas naturale - rimane molto considerevole. Ma oggi la maggior parte degli importatori e esportatori hanno aspettative divergenti in materia di prezzi; e poichè tutti i programmi di esportazione di gas richiedono diversi anni per diventare operativi, le trattative sui prezzi dovrebbero svilupparsi a partire dalla metà degli anni '80 in poi. Questo ci riporta alle aspettative ed alle incertezze sui prezzi del petrolio in quell'epoca. Così per il momento le prospettive di crescita del commercio internazionale di gas sembrano più dubbie, non meno di quanto lo fossero tre anni fa prima dell'impennata dei prezzi del petrolio.

Tuttavia, oltre l'85 per cento del gas naturale commerciato nel mondo è prodotto negli stessi paesi dove esso è consumato. Gli elevati prezzi del petrolio hanno inoltre notevolmente migliorato l'economia dello sviluppo del gas per l'uso locale. (Il gas è idealmente una forma di energia legato al mercato, come il carbone: non può essere trasportato per lunghe distanze in modo altrettanto economico del petrolio. A pari contenuto calorifico il trasporto del gas mediante gasdotto costa circa il doppio di quello del petrolio e circa sette volte tanto con le cisterne per gas naturale liquefatto).

Anche prima del 1979, le previsioni suggerivano che oltre la metà della crescita della produzione di gas naturale per il resto del secolo sarebbe stata destinata al consumo locale. (E buona parte del commercio previsto avrebbe riguardato il trasporto di gas verso regioni quali l'Europa Occidentale e gli Stati Uniti, i cui mercati del gas si sono sviluppati su una produzione propria su vasta scala e continuano a basarsi su di essa.

Nei paesi in via di sviluppo, buona parte della produzione di gas naturale sviluppata negli anni '80 sarà destinata all'industrializzazione locale. Diversi paesi dell'OPEC si stanno orientando a raccogliere e a trattare enormi quantità di gas associato alla produzione di petrolio che finora si era bruciato. (Per quanto riguarda le riserve di gas non associate ma in giacimenti autonomi il loro sviluppo può essere differito in relazione alle programmazioni nel tempo delle necessità locali; oppure possono essere create riserve sufficienti a sostenere i programmi d'esportazione. Non può essere differita l'utilizzazione del gas associato: se non può essere recuperato all'atto della produzione del petrolio, deve essere considerato irrimediabilmente perduto).

La maggior parte delle riserve mondiali di gas naturale accertate finora sono state scoperte attraverso ricerche nel campo petrolifero. Nei paesi industrializzati tutte le forme di convenzione di ricerca in vigore finora sono state predisposte in linea principale avendo presente il petrolio. Poichè il gas che le società straniere di ricerca hanno scoperto può essere riservato al consumo locale o può trovarsi in aree remote dalle quali sarebbe economico il trasporto del petrolio ma non quello del gas, tali convenzioni offrono scarsi incentivi alla ricerca specifica del gas. Questo vale anche per regioni nelle quali le prospettive relative al gas appaiono migliori che per il petrolio, e indipendentemente dal fatto che le economie locali che importano petrolio a prezzi elevati possono beneficiare in misura notevole dal gas scoperto, sia esso usato in sede locale o esportato. Il governo egiziano ha ora concordato con alcune società che stanno effettuando esplorazioni nel Delta del Nilo e al largo della costa del Delta, nuove disposizioni destinate specificamente ad offrire incentivi per effettuare esplorazioni relative al gas. Se queste innovazioni in materia di petrolio daranno buoni risultati, questo rivestirà un'importanza pionieristica per l'esplorazione in materia di petrolio nei paesi in via di sviluppo.

CURRICULUM VITAE

JACK HARTSHORN è il vice presidente della Jensen Associates Inc. per l'emisfero orientale. La Jensen Associates Inc. è una Società di consulenza in economia energetica, specializzata in campo petrolifero e nel settore riguardante il gas, con Sede a Boston e filiali a Washington e Ginevra.

Il Sig. HARTSHORN è uno scrittore internazionalmente noto ed un analista dell'industria petrolifera mondiale, nonchè autore di vari libri e scritti di economia petrolifera.

Prima di entrare alla Jensen Associates Inc., nel 1975, è stato per 10 anni il responsabile della Walter J. Levy, S.A. per l'emisfero orientale.

Dal 1951 al 1965 è stato prima l'editore industriale e successivamente l'editore commerciale della rivista inglese "The Economist".

Nei periodi successivi della sua attività di consulenza petrolifera il Sig. HARTSHORN ha prestato la sua opera a favore di vari governi, tra i quali quelli di Brunei, Danimarca, Irlanda, Malaysia, Filippine, Arabia Saudita, Tailandia, Tonga e Regno Unito, nonchè di alcune società petrolifere nazionali e private. (Di investitori e consumatori di energia, in materia di mercati energetici e prezzi, politiche energetiche governative, prospettive energetiche a lungo termine, e legislazione petrolifera)

E' stato anche consultato dall'OPEC e dalla EEC.

In qualità di consulente a lungo termine del governo di Brunei, ha collaborato con il governo stesso nelle trattative per uno dei primi progetti relativi al gas naturale liquido realizzati.

Alla fine degli anni '60 ha prestato la sua opera consultiva a favore del governo britannico in materia di prezzi del gas e più tardi ha collaborato allo studio delle condizioni in materia di esplorazione nel Mare del Nord.

Da quando è iniziata la sua collaborazione con la Jensen Associates - la cui direzione generale è specializzata nell'analisi dell'economia del gas naturale negli Stati Uniti - ha partecipato a vari studi sul commercio internazionale del gas naturale liquido per conto dell'ufficio americano per l'accertamento tecnologico, nonchè a studi sulle prospettive di esportazione e sui mercati per quanto riguarda i progetti L.P.G. (gas liquido di petrolio) nel prossimo decennio.

Dal 1977 al 1980 è stato professore esterno alla scuola di studi orientali dell'Università di Londra.

E' uno dei membri fondatori dell'"Oxford Energy Club" e membro del Consiglio di Amministrazione dell'"Energy Journal", organo dell'associazione internazionale degli economisti dell'energia.

L'ESPERIENZA DELL'INDUSTRIA ITALIANA DI GAS E IL FUTURO RUOLO DEL GAS NATURALE

GIAMPAOLO BONFIGLIOLI

L'utilizzazione a livello industriale del gas naturale in Italia è iniziata negli anni '40, con lo sfruttamento dei giacimenti della Valle Padana.

Da allora l'industria italiana del gas naturale ha acquisito una vasta esperienza. Il gas naturale è penetrato capillarmente nel mercato, mediante una efficiente rete di metanodotti collegati alla rete europea ed ai giacimenti di stoccaggio. Un ruolo particolare ha l'assistenza prestata ai consumatori finali, onde risolvere i problemi di una efficiente ed economica utilizzazione del gas naturale.

Alle due dorsali transalpine che importano gas naturale dalla Olanda e dall'Unione Sovietica ed al sistema di importazione del gas naturale liquefatto di provenienza libica sta per innestarsi il gasdotto Transmediterraneo che collega Algeria-Tunisia ed Italia.

Altri progetti di importazione sono in fase avanzata di attuazione ed, altri sono allo studio.

Il Piano Energetico Nazionale approvato dal Parlamento nel Novembre scorso, prevede in linea con le direttive della CEE, un aumento del ruolo del gas naturale nel soddisfacimento del fabbisogno energetico italiano. Si dovrà passare dall'attuale livello di copertura del fabbisogno energetico italiano pari al 15,5% (con

27 miliardi di m^3 l'anno) ad un livello circa pari al 20% nel 1990 (con 45 miliardi di m^3 l'anno).

L'industria italiana del gas sta lavorando attivamente per raggiungere questi obiettivi. E' però indispensabile che il gas naturale venga offerto agli utilizzatori finali (famiglie ed industrie) ad un prezzo competitivo con quello dei combustibili sostitutivi (principalmente gasolio per gli usi civili ed olio combustibile per gli usi industriali). Naturalmente il gas, per i suoi pregi all'atto dell'utilizzazione, in molti settori può essere venduto con un adeguato premio, rispetto agli altri combustibili. Il confronto con questi ultimi deve portare alla massima valorizzazione possibile del gas naturale.

La SNAM, Società del Gruppo ENI responsabile dell'approvvigionamento di gas naturale per il mercato italiano, ritiene che il consumatore finale (famiglia ed industria) debba pagare tale prezzo, allineato con il mercato ed è disposta a riconoscere al venditore estero il prezzo che risulta deducendo dal prezzo di vendita al consumatore finale i costi di trasporto, distribuzione e stoccaggio, a valle del punto di consegna del gas importato.

Le grandi riserve e disponibilità mondiali di gas naturale, i progressi tecnologici e l'aumento del valore dell'energia degli ultimi anni rendono economici gli scambi internazionali di gas naturale, anche nel caso delle maggiori distanze.

Dovrebbe pertanto essere possibile, dopo aver soddisfatto in via prioritaria i fabbisogni interni di gas naturale dei Paesi produttori, raggiungere volumi di scambio internazionale notevolmente elevati, con beneficio economico e sociale di entrambe le parti interessate (Paesi esportatori e Paesi importatori).

Per contro questo sviluppo degli scambi internazionali non potrà concretizzarsi, se verranno richiesti prezzi di cessione del gas naturale che non ne consentono una utilizzazione economica nel mercato finale. E' questo il caso della pretesa uguaglianza del prezzo del gas naturale con quello del grezzo, a parità di contenuto termico, al confine del Paese produttore. Per quanto riguarda i rapporti tra Egitto ed Italia, l'esperienza acquisita dall'industria italiana del gas può essere messa a servizio dell'Egitto, onde unire gli sforzi per sviluppare il sistema di produzione, trasporto ed utilizzazione egiziana di gas naturale. Qualora si rendessero poi disponibili surplus di gas naturale per l'esportazione, si potrebbe esaminare assieme la possibilità di esportazione in Italia ed in altri paesi europei. La posizione geografica dell'Italia e la connessione con i gasdotti degli altri paesi europei suggerisce di considerare un terminale di ricezione, stoccaggio e rigassificazione di gas naturale liquefatto egiziano ubicato sulle coste italiane, specialmente nell'Alto Adriatico, come punto ideale per servire il mercato europeo.

CURRICULUM VITAE

GIAMPAOLO BONFIGLIOLI é nato a Bologna il 19.8.1931.

Laureato in Ingegneria Elettrotecnica all'Università di Bologna nel 1956, ha lavorato come esperto in automazione in un'industria elettromeccanica e quindi, dal 1959, nella SNAM.

In questa Società ha poi ricoperto la carica di capo Servizio Programmazione Metano, capo Servizio Sviluppo Metano e dal 1981, è Direttore Pianificazione e Sviluppo Attività Metano.

Partecipa attivamente ai lávori dell'Unione Internazionale della Industria del Gas, nella quale è stato per 6 anni presidente del Comitato Trasporto ed è attualmente presidente del Gruppo di Lavoro sugli Usi Razionali dell'Energia.

ESPLORAZIONE E SCOPERTE DI GAS IN EGITTO

MOSTAFA KAMAL EL AYOUTY

L'evoluzione nella storia della ricerca petrolifera è basata sui miglioramenti delle tecnologie e delle tecniche di ricerca specifiche. Seguendo questo processo storico in Egitto, dove la ricerca petrolifera è iniziata il secolo scorso, possiamo arrivare all'epoca attuale e considerare le scoperte di gas come un risultato dell'attività esplorativa principale relativa al petrolio.

In Egitto vi potrebbe essere un numero considerevole di scoperte, alcune delle quali indirizzate a gas. Allo scopo di ottenere una maggiore disponibilità di gas naturale, sia per il consumo interno, che per l'esportazione, si è ritenuto necessario incrementare l'interesse in questo campo. L'EGPC ha quindi negoziato e stipulato accordi con alcune società petrolifere introducendo nuovi amendamenti per stimolare questa attività.

CURRICULUM VITAE

MOSTAFA KAMAL EL AYOUTY è nato a Mansoura il 5 marzo 1923. Ha compiuto i suoi studi alla Facoltà di Scienze dell'Università del Cairo, ove si è laureato in Geologia (con lode) nel 1944.

Ha continuato i suoi studi post-universitari presso la stessa facoltà, specializzandosi in geologia nel 1952, ed esercitando la libera docenza dal 1956.

Si è occupato del campo petrolifero da più di trentatre anni. Durante tutta la prima parte di questo periodo, vale a dire sino al 1967, è stato impiegato in qualità di geologo, geologo territoriale, Assistente del Direttore per l'Esplorazione e, successivamente, Direttore per l'Esplorazione presso la Compagnie Orientale Des Pétroles d'Egypte (ora Petrobel).

Nel 1967 è stato assunto dalla Egyptian General Petroleum Corporation come Vice Direttore Generale per l'Esplorazione.

Dal 1974 al 1976 ha avuto l'incarico di Direttore Generale presso la EGPC, e da allora è stato nominato Vice Presidente della EGPC per l'Esplorazione e la Produzione. Questa qualifica lo rende responsabile degli accordi petroliferi, unitamente al settore esplorativo e produttivo.

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E' membro del Consiglio d'Amministrazione della EGPC, dell'Ispettorato per la Geologia, dell'Ente per i Materiali Nucleari e della Facoltà delle Scienze presso l'Università del Cairo. Per quanto riguarda l'attività scientifica egli è membro del Comitato Nazionale delle Scienze Territoriali e del Comitato Nazionale di Idrologia. E' inoltre membro del Consiglio d'Amministrazione della Società Geologica Egiziana e Presidente della Società Egiziana di Esplorazione Petrolifera.

POLITICA AMERICANA SU GAS NATURALE E

PROSPETTIVE IMPORTAZIONE

JOHN H. LICHTBLAU

Gli Stati Uniti sono il più grande produttore e consumatore di gas naturale del mondo. Nel 1981 i consumi sono stati di 20 trilioni di piedi cubi (tcf) e la produzione di 19.6 trilioni - pari al 38% della produzione mondiale.

Tuttavia, sin dal 1968, le riserve statunitensi sono in declino - e sono attualmente pari al 7% delle riserve mondiali. L'andamento contrastante tra riserve e produzione ha fatto ritenere inevitabile il ricorso ad importazioni di gas naturale.

Il declino delle riserve é tuttavia, almeno in parte, attribuibile a politiche che hanno disincentivato la ricerca. La liberalizzazione dei prezzi e l'eliminazione dei controlli governativi - processo che sarà completato il 1 gennaio 1985 - dovrebbe portare ad una ripresa delle ricerche di gas naturale simile a quella verificatasi tra il 1978-81 nel settore petrolifero ed ad un miglioramento dei rapporti riserve/produzione.

Anche tenendo presente tutto ciò, é probabile che la produzione americana (esclusa quella dell'Alaska del Nord) scenda del 10-15% sotto i livelli del 1981.

Dopo il 1978, i consumi interni sono calati e, al momento attuale, le disponibilità sono superiori al livello dei consumi. Il declino della domanda é dovuto sia alla recessione economica sia al processo di conservazione determinato dall'aumento dei prezzi. Benché inferiore a quello di altri combustibili il prezzo del gas naturale negli USA é salito del 760% dopo il 1973($ 1.85 per mcf). La certezza di ulteriori aumenti del prezzo del gas naturale e la aspettativa di una stabilizzazione dei prezzi petroliferi garantiscono la continuazione dei processi di conservazione.

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La ripresa economica porterà, probabilmente, ad un aumento dei consumi complessivi che in parte bilanceranno gli effetti della conservazione con il risultato che nel 1985 i consumi di gas naturale dovrebbero rimanere attorno agli attuali livelli.

Il prezzo americano a bocca di pozza dovrebbe raggiungere, nel 1985, $ 3.62 mcf (in dollari costanti 1980) e $ 5.00 in dollari correnti. La stabilizzazione dei prezzi petroliferi e l'aumento di quelli del gas naturale dovrebbe portare il costo dei due combustibili allo stesso livello. La produzione USA di gas tra il 1986-90 dovrebbe essere di circa 17.5-18.5 tcf. Il divario tra consumi e produzione dovrà essere compensato dall'importazione di gas naturale, molto probabilmente dal Canada e dal Messico. Le riserve esistono: il Canada dovrebbe incoraggiare le sue esportazioni che potrebbero arrivare ad almeno 2 tcf. Il costo del gas canadese sarà, con ogni probabilità, molto inferiore a quello di altre possibili fonti di approvigionamento comprese l'Alaska o il GNL proveniente dall'Africa.

Lo stesso discorso vale per il Messico: le importazioni dai due paesi, a cui si deve aggiungere la produzione di gas sintetico negli Stati Uniti, potrebbero superare i 2.5 mcf. Ciò garantirebbe il soddisfacimento della domanda USA almeno fino al 1990. Le forniture da altre aree potrebbero accedere al mercato USA solo se concorrenziali con il petrolio. Ciò sembra indicare che le forniture provenienti dall'emisfero orientale - stimate attualmente a $ 7.30 mcf - non sarebbero competitive.

Eventuali forniture aggiuntive che si rendessero necessarie potrebbero venire da aree più vicine al mercato USA: ad esempio da Trinidad e dall'Alaska. Per questi motivi, appare più economico per gli esportatori africani e asiatici cercare sbocchi sul mercato europeo e giapponese.

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Alla base di queste valutazioni vi é la previsione di una stabilità dei prezzi petroliferi. Un nuovo forte aumento di quest'ultimi potrebbe rendere concorrenziale il GNL proveniente dall'emisfero orientale. Le probabilità che ciò avvenga sono minime ma esistono. In questo caso il problema non sarebbe tanto quello della concorrenza tra una fonte e l'altra, ma quello di una contrazione del mercato degli idrocarburi.

CURRICULUM VITAE

JOHN H. LICHTBLAU: Diploma al College of the City of New York (1949).

Libera docenza in Economia all'Università di New York.

Dal 1955 ad oggi lavora alla "Petroleum Industry Research Foundation, Inc.", della quale è direttore esecutivo dal 1961.

Dal 1976 è altresì presidente del "Petroleum Industry Research Associates, Inc.".

Dal 1954 al 1955 economista specializzato nel settore petrolifero alla "Walter J. Levy Inc.".

Nel 1953 analista economico alla "National Industrial Conference Board".

Dal 1951 al 1953 analista economico al Ministero del Lavoro degli Stati Uniti.

Ha svolto le seguenti attività di consulenza in materia di economia petrolifera per conto di enti statali:

- dal 1974 ad oggi consulente dell'Agenzia per l'Energia dello Stato di New York;
- dal 1977 al 1978 ha collaborato con la biblioteca del Congresso - Congressional Research Service;
- nel 1977 consulente del Ministero degli Interni degli Stati Uniti;
- nel 1974 ha prestato la sua consulenza a favore dell'Ente americano per la protezione dell'ambiente;

- dal 1972 al 1973 ha collaborato con l'Amministrazione per lo sviluppo economico di Portorico;
- dal 1970 al 1973 ha collaborato con l'Ufficio di Programmazione per l'Emergenza - Ufficio esecutivo del Presidente degli USA.

E' stato anche relatore di economia petrolifera in conferenze e seminari (di seguito i più importanti):

- American Institute of Mining and Metallurgical Engineers - New York, USA;
- Università di Londra - School of Economics - Londra - Inghilterra;
- Middle East Institute - Washington - D.C. USA;
- New York Society of Security Analysts - New York, USA;
- Rocky Mountain Institute on Petroleum Economics - Colorado Spring - Colorado, USA;
- Seminario economico - Venezuelan Management Association - Caracas - Venezuela;
- Università John Hopkins - School of Advanced International Studies - Washington - D.C., USA;
- Istituto svedese del petrolio - Stoccolma - Svezia;
- Istituto giapponese dell'energia - Tokio - Giappone;
- Istituto britannico del petrolio - Londra - Inghilterra;
- Istituto per l'esplorazione e l'economia petrolifera - Southwestern Legal Foundation - Dallas - Texas;
- Gruppo di studio nord-americano sul Medio Oriente - Columbia University - New York;
- Centro dell'Università di Harvard per gli studi sul Medio Oriente;

- Congresso annuale dell'Associazione nazionale dei raffinatori di petrolio - Sant'Antonio - Texas, USA;
- Seminario annuale sull'economia petrolifera - Transportation Center at Northwestern University - Evanston - Illinois, USA (dal 1966 ad oggi).

E' autore di articoli e monografie sull'importazione del petrolio, sulla politica energetica, sull'imposizione fiscale nel settore petrolifero, ecc.

Ha collaborato al progetto di politica energetica della Ford Foundation (1975).

E' stato coautore e direttore di progettazione dello studio dell'Istituto di ricerca sull'energia elettrica "Prospettive per il petrolio nel mondo nel XXI secolo" (1978).

E' stato ascoltato frequentemente in qualità di esperto in udienze conoscitive del Congresso degli Stati Uniti sulla politica energetica.

Ha partecipato a:

- convegno della Brookings Institution degli esperti in materia di imposizione fiscale sul petrolio e sul gas (1962);
- seminario delle Nazioni Unite sulle politiche petrolifere latino-americane a Santiago - Cile (1967);
- convegno "Time-Life" sull'energia di Nassau - Bahamas (1973) e di Williamsburg, Va. (1977);
- simposio internazionale sul petrolio e su problemi energetici, patrocinato dal Ministro degli Affari Esteri - Tokio - Giappone (1975);

- convegno della coalizione dei Northeastern Governors (1976);
- convegno della "Ditchley Foundation" sulla produzione dell'energia - Inghilterra (1977);
- seminari OPEC sulle attività downstream(1978) e sui mercati energetici del futuro (1979) Vienna - Austria.

E' stato nominato componente del Consiglio nazionale per il petrolio dal Ministro degli Interni/Ministro dell'Energia (USA) (dal 1968 ad oggi).

E' stato membro del Consiglio intergovernativo di esperti del Segretariato generale delle Naioni Unite sull'esplorazione nel settore minerario ed energetico nei paesi in via di sviluppo (1978).

E' stato membro del Gruppo operativo transitorio sulla politica energetica del Governatore dello Stato di New York (USA) (dicembre 1974 - aprile 1975).

E' membro del Consiglio dei Rapporti con l'Estero degli Stati Uniti.

LA POLITICA DELL'EGITTO PER PROMUOVERE L'ESPLORAZIONE DI GIACIMENTI A GAS ED IL LORO SVILUPPO

GIUSEPPE RUSTICI

Nel 1979, su iniziativa del Governo Egiziano, la IEOC ha elaborato e proposto una nuova normativa per regolare, nell'ambito dei Production Sharing Agreements, l'esplorazione e lo sviluppo di riserve gas. Tale normativa, da applicarsi su scala nazionale, ha i seguenti fondamentali obiettivi.

1) Incentivare l'esplorazione e l'accertamento delle riserve gas garantendo ai Contrattisti stranieri che ne hanno accertato l'esistenza in quantità commerciali, una equa compensazione nella misura in cui tali riserve vengono cedute in toto o in parte all'Egitto a titolo di Riserve Nazionali.

2) Garantire, su base prioritaria, l'accantonamento di Riserve Nazionali, per un totale di 350 miliardi di mc. di gas. Queste riserve saranno costituite anzitutto da quelle sulle quali la EGPC ha o avrà titolo esclusivo e, successivamente, da un contributo che i Contrattisti sono obbligati a fornire. Tale contributo sarà proporzionale alle riserve gas rinvenute e accertate, sotto la nuova normativa, da ciascuno di essi. Le Riserve Nazionali saranno dedicate allo sviluppo industriale del paese e alla distribuzione di gas per uso domestico.

3) Stabilire un chiaro diritto di ciascun Contrattista ad esportare, in forma liquida, le riserve gas ancora dis-

ponibili nella propria Concessione dopo la contribuzione alle Riserve Nazionali. Il diritto all'esportazione si applica anche agli idrocarburi liquidi estratti dal gas e ai prodotti derivati (metanolo, benzina sintetica ecc.).

4) Definire le regole per un'associazione tra diversi Contrattisti aventi riserve gas esportabili al fine di realizzare un progetto per l'esportazione del gas unico e su scala nazionale. Tale progetto avrebbe la dimensione necessaria per consentire la produzione e l'esportazione del gas, in forma liquida o derivata, su base economica e per un periodo di tempo ragionevolmente lungo.

   I costi e i ricavi relativi all'esportazione del gas saranno trattati secondo i principi classici del Production Sharing Agreement.

Attualmente, la maggior parte degli Accordi di Concessione relativi ad aree ubicate nel Nord dell'Egitto e nell'offshore mediterraneo includono la normativa illustrata in questa relazione.

CURRICULUM VITAE

GIUSEPPE M. RUSTICI è nato ad Ancona il 7 Gennaio 1930. Si è laureato in Ingegneria all'Università di Padova nel 1954 con una tesi sull'attività di progettazione. E' entrato all'AGIP nel 1956 ed ha ricoperto diversi incarichi nel campo delle attività tecniche, produttive e di marketing.

E' stato per gli ultimi 12 anni il rappresentante italiano nel Comitato Nazionale del Gas, sponsorizzato dall'Unione Internazionale del Gas;

E' stato per diversi anni lettore all'Istituto Minerario dell'Università di Bologna.

Attualmente, ricopre l'incarico di responsabile commerciale delle attività progetti gas naturale.

DIMENSIONAMENTO DI UNA RETE DI GASDOTTI IN UN PAESE IN VIA DI SVILUPPO

ALESSANDRO PAGNUZZATO

Per poter procedere al dimensionamento di una rete di gasdotti occorre definire innanzi tutto il ruolo che compete al gas naturale. Pertanto è necessario un'esame delle disponibilità non solo del gas naturale, ma anche delle altre fonti energetiche del Paese. Queste dovranno essere confrontate con le esigenze del mercato in modo da definire uno sfruttamento ottimale delle risorse. Nel caso poi di eventuali surplus dovrà essere valutata la convenienza di una loro esportazione.

Nel caso specifico dell'Egitto, eventuali surplus di gas naturali potrebbero essere esportati sotto forma di GNL e, in considerazione della favorevole collocazione geografica, sbarcati in un terminale italiano ubicato nel Nord Adriatico e da qui, una volta rigassificati, convogliati ai mercati Europei. Definito quindi a grandi linee il ruolo del gas naturale, occorre procedere ad una più accurata analisi delle esigenze di trasporto che dovranno riferirsi ad un arco di tempo di 15 - 25 anni. Ciò sia per motivi economici, in modo da assicurare un economico ammortamento degli ingenti investimenti che una rete di gasdotti comporta, sia per ragioni tecniche. Infatti una rete di gasdotti è caratterizzata da una notevole rigidità e non è facilmente adattabile ad ampliamenti successivi, se questi non sono previsti sin dalla stesura originaria del progetto.

Tenendo conto di quanto sopra esposto si può quindi procedere alla definizione delle possibili soluzioni tecniche, tra le quali scegliere quella che si ritiene più conveniente. A tal fine è necessario procedere ad una quantizzazione dei costi che le varie alternative considerate comportano ed ad una loro comparazione. Va però segnalato che la scelta definitiva delle soluzioni da adottare non deve essere improntata esclusivamente a valutazioni di carattere economico, ma deve tenere in debito conto tutte quelle considerazioni di carattere operativo che devono avere peso nella scelta della soluzione ottimale.

Sulla base di quanto sopra esposto, anche se in termini generali, appare evidente che l'industria del gas è caratterizzata da problematiche quanto mai complesse. Pertanto è auspicabile che nel quadro di una collaborazione già in atto tra Egitto ed Italia, l'esperienza acquisita da parte delle società del gruppo ENI ed in particolare da parte della SNAM, AGIP, NUOVO PIGNONE, SAIPEM e SNAMPROGETTI possa essere messa a servizio dell'Egitto per collaborare fattivamente allo sviluppo del sistema di produzione, trasporto ed utilizzazione egiziana di gas naturale.

CURRICULUM VITAE

ALESSANDRO PAGNUZZATO è nato il 4 febbraio 1944.

Si è laureato in ingegneria elettrotecnica presso l'Istituto Politecnico di Milano nel 1969.

Assunto alla SNAM nel 1971, è stato incaricato dello studio di fattibilità per le importazioni ed ha partecipato, essendovi direttamente coinvolto, a problemi di natura tecnica ed economica relativi alle importazioni dai Paesi Bassi, l'URSS e l'Algeria verso l'Italia.

Da alcuni anni si interessa anche di programmazione a lungo termine. Attualmente è Responsabile della Pianificazione per il Gas Naturale della SNAM.

I PROBLEMI DI FINANZIAMENTO DEI PROGETTI PER LO SFRUTTAMENTO DEL GAS NATURALE

LUIGI ARCUTI

1. Come noto, l'IMI è il principale istituto italiano per il credito speciale a medio e lungo termine: esso eroga finanziamenti per le imprese industriali e di servizi e per le forniture italiane all'estero. L'IMI - nell'arco di un cinquantennio - ha maturato una significativa esperienza nel finanziamento di progetti di investimento, anche di grandi dimensioni.

In particolare, nel campo dei progetti per lo sfruttamento del gas naturale, l'Istituto ha agito da capofila nei consorzi di banche italiane che hanno fornito crediti all'esportazione, per un totale di circa 800 milioni di $, per finanziare una notevole parte del gasdotto che collega l'Algeria all'Italia.

2. L'esperienza italiana, come pure quella di altri paesi, ha dimostrato come l'investimento in una rete di gasdotti induca una serie di favorevoli effetti - sia di breve che di lungo periodo - sulla struttura industriale.

Le infrastrutture per contenere i costi energetici e diversificare le fonti di approvvigionamento sono particolarmente rilevanti per favorire la nascita e lo sviluppo delle piccole e medie imprese che, a loro volta, costituiscono un elemento fondamentale per lo sviluppo industriale. La metanizzazione del Mezzogiorno e della Sicilia, prevista dal piano energetico nazionale, dovrebbe pertanto apportare un significativo contributo allo sviluppo economico di tali aree.

3. Il rapido sviluppo della domanda e dell'offerta di gas naturale dovrebbe continuare anche in futuro, a condizione che venga mantenuto un adeguato differenziale tra il prezzo del gas e quello del petrolio. Gli investimenti attesi per lo sfruttamento delle riserve di gas naturale sono pertanto di dimensioni estremamente rilevanti.

4. L'enorme volume degli investimenti energetici renderà necessario per molti paesi il ricorso ai mercati finanziari internazionali. Tali mercati hanno, a loro volta, conosciuto uno sviluppo senza precedenti, derivante dall'opportunità di riciclare il crescente surplus di alcuni paesi OPEC.

Il riciclaggio dei surplus petroliferi è stato, fino ad oggi, condotto con notevole efficienza. Al proposito, sussistono taluni ostacoli, di cui si teme un possibile aggravio e che dovranno essere superati (il restringersi dei margini di convenienza economica per le attività bancarie internazionali, l'accumulo di liquidità dovuto al persistere di un elevato livello di inflazione, la possibilità di un eccesso di intermediazione bancaria a livello mondiale dovuto al crescente avanzo di alcuni paesi OPEC).

5. Il finanziamento di grandi progetti energetici rappresenta un tipico esempio di project financing. E' interessante ricordare, al proposito, come i primi schemi

operativi di project financing siano stati sviluppati, negli anni cinquanta, dalle principali banche americane, soprattutto per finanziare progetti energetici e minerari negli Stati Uniti.

Senza affrontare in questa sede complessi dettagli tecnici, si può definire il project financing come il finanziamento di un progetto di investimento, considerato come una entità economica a se stante, il cui cash flow viene valutato indipendentemente da quello dell'impresa che attua il progetto stesso.

Le banche dovranno, pertanto, effettuare una valutazione del progetto di investimento assai più approfondita di quella richiesta per l'ordinaria valutazione del merito di credito: ciò comporta un elevato livello di competenza tecnica e finanziaria.

6. L'analisi dei progetti di investimento dal punto di vista economico tende ad ottimizzare, tenendo conto dei vincoli imposti dalla capacità produttiva, il valore attuale netto dello sfruttamento nel tempo delle risorse di gas naturale.

Molti elementi rilevanti per la pianificazione economica non sono peraltro associabili ad un prezzo di mercato. Ciò avviene sia a causa della mancanza di un mercato (come nel caso delle valutazioni attinenti la distribuzione intergenerazionale delle risorse) che a motivo della scarsa significatività del prezzo di mercato (come, ad esempio, nel caso di salari industriali in uno scenario di sottoccupazione).

La valutazione e la pianificazione economica debbono logicamente precedere la pianificazione finanziaria. Si deve peraltro tener conto del fatto che quegli elementi che non contribuiscono al cash flow dell'investimento (valutazioni sulla base dei prezzi ombra) debbono necessariamente essere considerati come irrilevanti sotto il profilo della finanziabilità del progetto. I vincoli di finanziabilità interagiscono pertanto con la pianificazione economica e debbono essere tenuti in debito conto per una ottimizzazione globale.

CURRICULUM VITAE

LUIGI ARCUTI è nato a Torino nel 1924. Ha conseguito la laurea in materie letterarie presso l'Università di Torino.

Entrato all'Istituto Bancario San Paolo di Torino nel 1945 ne è divenuto Direttore Generale nel 1974 dopo essere stato responsabile dapprima del Servizio Studi ed Organizzazione e poi della Direzione Operativa con sovraintendenza delle attività in Italia ed all'estero.

Con decreto del Presidente della Repubblica, in data 16 ottobre 1980, viene nominato Presidente dell'I.M.I. Ricopre inoltre la carica di Consigliere dell'Istituto Bancario San Paolo di Torino e di Membro del Comitato Esecutivo del suddetto Istituto.

E' titolare dell'onorificenza di Cavaliere del Lavoro.

IL RUOLO FUTURO DEL GAS NATURALE IN EUROPA

Hans K. Schneider

L'importanza del gas naturale nel bilancio energetico europeo ed il rapido sviluppo della sua utilizzazione e commercializzazione a partire dalla fine degli anni '60, ricevè impulso dalla scoperta del vastissimo giacimento di Groningen in Olanda ed, in seguito, dall'aumento della produzione locale in Italia, Francia e nella RFT ed alla messa in produzione dei giacimenti di NG nei settori britannico e norvegese del Mare del Nord.

Grazie alle sue ampie possibilità di utilizzazione il GN entrò subito in competizione con altre fonti di energia, soprattutto come generatore di calore essendo più del 70% dei bisogni di energia primaria dell'Europa occidentale assorbiti a scopo di riscaldamento. Negli ultimi dieci anni i consumi europei di NG hanno pertanto subito un sensibile aumento che ha superato le possibilità di produzione locale europea ed attivato correnti di importazione crescenti da URSS, Algeria e Libia. Grazie ai bassi costi di produzione "well-head" e di distribuzione "city gate", i prezzi al consumo del GN rimasero competitivi nella maggior parte dell'Europa occidentale anche rispetto a quelli dell'olio combustibile fino alla metà degli anni '70, permettendo un forte sviluppo della sua commercializzazione attraverso una vasta ed integrata rete di gasdotti intereuropea.

Il boom dei prezzi petroliferi nei due periodi '73/'74 e 1979 ha avuto come conseguenza adeguamenti al rialzo nei prezzi delle forniture di GN da parte dei paesi produttori. Questo effetto ha in gran parte ridotto la forza competitiva di questa fonte energetica rispetto all'olio combustibile ed al carbone; tuttavia i prezzi relativamente più bassi del gas rispetto ad altre forme di calore (gasolio, elettricità, pompe di calore, ecc.) hanno permesso e permettono ancora la sua crescente penetrazione sul mercato europeo. La quota del GN nei consumi di energia primaria nell'Europa Occidentale ha raggiunto un massimo del 15% nel 1980. La rivalutazione del GN avvenuta soprattutto dopo l'ultimo shock petrolifero ha aperto un quadro di mercato dalle prospettive molto incerte; tuttavia, i negoziati in corso per l'adeguamento dei prezzi e la definizione delle clausole di indicizzazione fanno senz'altro prevedere sia un aumento della produzione europea di gas sia un considerevole incremento dei suoi prezzi di importazione rispetto alle quotazioni del 1980.

Lo sviluppo ulteriore di domanda di GN in Europa Occidentale dipenderà in generale dal complesso di fattori che determinano la crescita della domanda di energia primaria quali in particolare la crescita del PNL ed il prezzo reale dell'energia ma anche, specificamente, dal prezzo del GN in rapporto alle forme di energia più competitive.

Le valutazioni dei più qualificati istituti di ricerche economiche europei concordano per una crescita media del PNL di circa il 2,5% per gli anni '80 e di poco lievemente inferiore fino al 2000; quanto al prezzo reale dell'energia e del suo fattore chiave - il prezzo del greggio, l'autore esclude la possibilità di stabilire un profilo lineare delle sue quotazioni future, pur ipotizzandone un incremento variabile tra il 30 ed il 50% entro il prossimo ventennio. L'aumento dei prezzi reali dell'energia e le misure restrittive sui consumi adottate dai governi ridurranno la "energy intensity" del PNL dell'Europa Occidentale stabilizzandola intorno ad un tasso di crescita media del 1,5%, cui corrisponderà un aumento della domanda di energia primaria pari a +430 M toe alla fine del prossimo ventennio.

Ipotizzando una certa stagnazione, ovvero un lento declino dei consumi petroliferi, tra le forme di energia che assumeranno crescente importanza a copertura della addizionale domanda di energia primaria dell'Europea Occidentale ci sarà, oltre al carbone e all'energia nucleare, appunto il gas naturale per il quale ci si attende una notevole espansione dei consumi soprattutto nel settore abitativo e della piccola utenza. Assumendo che il GN mantenga una certa competitività di prezzi (in particolare rispetto all'olio combustibile a basso tenore di zolfo), l'autore prevede che lo sviluppo dei consumi di GN in Europa Occidentale possa passare dalle 181 M toe del 1980 a 245 - 275 M toe nel 2000 (nelle migliori o peggiori condizioni di competitività del GN sul mercato).

CURRICULUM VITAE

Nome:	Prof. Dott. Hans K. Schneider
nato:	26 maggio 1920 a Remscheid, Germania
1938-1944:	servizio militare
1944-1946:	corsi di Economia presso le Università di Monaco e di Marburg, Germania
1946-1947:	impiegato presso la Camera di Commercio e Industria di Remscheid, Germania
1948:	laurea in economia (Dr. rer. pol.)
1948-1958:	assistente incaricato presso l'Università di Colonia, Germania
1958:	libera docenza in economia (Dr. habil.)
1958-1959:	impiegato presso il Ministero Federale di Economia
1963-1970:	professore di economia, Università di Münster, Germania
dal 1970:	professore di economia, direttore esecutivo del Seminario "Staatswissenschaftliches", nonchè direttore dell'Istituto per l'Economia Energetica presso l'Università di Colonia, Germania

Altri incarichi:

1969:	Professore di ricerca all'Università di California, Berkeley (USA)
1970-1972:	Vice-Presidente del Comitato Federale per il Riordinamento della Struttura Regionale della Germania Occidentale

1971-1974:	Presidente dell'Associazione per l'Economia e le Scienze Sociali (Verein für Sozialpolitik)
1975-1981:	Membro del Consiglio di Consulenza del Progetto Qattara della R.A.E. (Repubblica Araba Egiziana)
dal 1972:	Presidente del Comitato Energetico del Governo dello Stato del "Nordrhein-Westfalen"
dal 1975:	Presidente del Consiglio d'Amministrazione del "Rheinisch-Westfälisches Institut" per la Ricerca Economica di Essen
dal 1977:	Presidente del Cosniglio dei Consulenti Economici del Ministero Federale di Economia

Principali campi di ricerca:

teoria di politica economica, politica economica, politica economica settoriale, particolarmente la economia energetica.

EGYPTIAN ENERGY PERSPECTIVES

GABRIELE MARRUZZO

Dopo un breve cenno al ruolo crescente del petrolio nell'economia egiziana, la relazione si sofferma a sottolineare le principali caratteristiche dello sviluppo economico dell'Egitto nel corso degli anni '70 e della evoluzione dei consumi di energia.

La crescita del GDP ad un tasso relativamente elevato nel corso degli anni '70, è stata sostenuta dal dinamism di alcuni settori del terziario piuttosto che da quello del settore agricolo e del settore industriale. Nello stesso periodo, i consumi di energia sono aumentati ad un tasso particolarmente elevato, anche in funzione del basso livello dei prezzi dell'energia praticati sul mercato interno.

L'analisi dell'economia egiziana mostra che essa ha potenzialità di sviluppo anche più accelerato di quello del recente passato. A questo fine vengono illustrati due "scenari" di sviluppo economico del paese, risultanti dalla formulazione di due ipotesi distinte relativamente alla distribuzione degli investimenti tra i vari settori. Nel primo scenario, viene ipotizzata una strategia degli investimenti soprattutto orientata al settore industriale, all'ammodernamento dell'agricoltura ed alla creazione di infrastrutture al sostegno dei settori produttivi. Nel secondo scenario la strategia degli investimenti è piuttosto orientata al sostegno del settore agricolo, soprattutto mediante il recupero di terre (land reclamation) ed alla creazione di infrastrutture di natura sociale, con un impegno relativamente modesto nel settore industriale.

In funzione dei due scenari descritti, vengono effettuate proiezioni sui consumi di energia e di petrolio al 1985 ed al 1990. Esse mostrano che l'Egitto potrebbe avere, a medio termine, un problema di coperatura del fabbisogno energetico. E', perciò, necessario che il Paese utilizzi le sue risorse energetiche in modo più razionale che nel corso degli anni '70 e in modo più finalizzato allo sviluppo economico.

CURRICULUM VITAE

GABRIELE MARRUZZO è nato a Napoli (Italia) nel 1937. Si è laureato in Scienze Politiche all'Università di Roma nel 1960. Ha poi frequentato la London School of Economics per due anni.

Dopo alcune esperienze alla Bassetti (Industria tessile) a Milano, è poi passato all'industria Zanussi S.p.A., la più importante industria italiana di elettrodomestici.

Nel 1967 è entrato all'ENI, dove ha svolto diverse attività.

Attualmente, lavora all'Ufficio Programmazione in qualità di senior economista ed ha di recente completato una ricerca sulle compagnie petrolifere internazionali e sui cambiamenti strutturali che avvengono nell'industria petrolifera.

POLITICA ECONOMICA EGIZIANA

ROBERT MABRO

1) Breve sunto storico sulla politica economica egiziana. Politiche determinate dai seguenti obiettivi:

   A. Promuovere lo sviluppo economico

   B. Rimediare alle conseguenze dell'inflazione sui gruppi a basso reddito.

   C. Gestire la bilancia dei pagamenti. Variazioni nel sistema economico dalla nazionalizzazione alla liberalizzazione non hanno alterato tali priorità.

2) Valutazione economica del quadro politico. Risultati. Conflitti di obiettivi. Distorsioni economiche che portano ad una errata ripartizione delle risorse.

3) Necessità di nuove direttive nella politica economica, non soltanto a causa degli effetti laterali non auspicati di certe politiche attuali, bensì per via di mutamenti radicali nelle possibilità economiche e nella base di risorsa. Petrolio e gas sono nuove risorse. Rimesse in valuta straniera. Fosfati, etc. Esistono nuove possibilità nel campo dell'agricoltura, turismo, industria e finanza.

4) Nuove politiche per attuare con esito più positivo il vecchio obiettivo dello sviluppo economico, di un'equa distribuzione

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del reddito e di gestione macroeconomica. Le caratteristiche principali del cambiamento auspicato sono quelle di separare le politiche redistribuzionali da quelle allocative. Usare mezzi fiscali e reddito piuttosto di sovvenzioni di prezzo per scopi distribuzionali e lasciare che i prezzi adempiano al loro ruolo allocativo. Integrare nuove risorse nello schema di sviluppo. Impiegare ogni risorsa secondo il suo potenziale.

Esempi:

A. E' più facile esportare il greggio del gas. Quindi l'uso domestico del gas può venir aumentato, al fine di gravare meno sul greggio.

B. L'agricoltura egiziana ha un vantaggio comparativo nel ramo ortofrutticoli nei confronti di quello di coltivazioni di altro tipo.

C. Il deserto dovrebbe venir utilizzato per l'edilizia ed i terreni agricoli riservati alle coltivazioni, etc.

5) Conclusioni sulla gestione della politica transitoria.

CURRICULUM VITAE

ROBERT E. MABRO

Nato:	1934 ad Alessandria, Egitto Sposato con due figlie
Studi:	St. Marc College, Facoltà di ingegneria, (Università di Alessandria) Aix en Provence, Parigi e Londra. B.Sc. (Ingegneria), DU (Filosofia), M.Sc. (Economia) M.A.

Esperienza professionale:

1956 - 1960	Ingegnere Civile
1960 - 1964	Studi in Francia
1964 - 1966	Studi presso l'Università di Londra
1966 - 1969	Research Fellow presso l'Università di Londra
dall'1969 ad oggi	Esperto dell'economia del Medio Oriente e Professore al St. Antony's College, Oxford
1977 - 1980	Direttore, Middle East Centre, Università di Oxford
dall'1978 ad oggi	Direttore, Oxford Energy Seminar
dall'1978 ad oggi	Segretario Onorario dell'Oxford Energy Policy Club

Pubblicazioni principali:

"The Egyptian Economy" (1974)

"The Industrialisation of Egypt" (1976)

"World Energy: Issues and Policies" (1980)