OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as "developed", "industrialized" and "developing" are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

D00290

United Nations Industrial Development Organization

Distr[illegible]
LIMITED

ID/WG.[illegible]
20 October [illegible]

ORIGINAL: ENGLISH

Interregional Petrochemical Symposium on the Development of the Petrochemical Industries in Developing Countries

Baku, USSR, 21 - 31 October 1969

PET.SYMP. A/32

DEVELOPMENT OF THE PETROCHEMICAL INDUSTRY IN IRAN[1]

by

S. Sharifi
Iran

[1] The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche

Introduction

In the past two decades we have witnessed an accelerated invasion of materials produced by petrochemical industries into the markets of the world which formerly dominated by the traditional natural products. Iran also will be making a marked contribution, on an accelerated basis, in the transition from traditional natural products to those produced through the petrochemical process. The feed for the petrochemical industries in Iran is derived from abundant reserves of petroleum, from natural gas or associated gas, refinery gases and by-products, and minerals such as sodium chloride.

Light hydrocarbon gases associated with the production of crude oil in Iran vary in quantity between 400 to 1,000 SCF per barrel of crude oil produced. At current crude oil production of about 3,000,000 BPD the associated gas approximates [illegible] MMSCFD, a substantial part of which is being flared. This associated gas contains about 100,000 BPD light condensate and light naphtha which if recovered would constitute a suitable petrochemical feedstock. Moreover, there are indigenous gas reserves (some containing high quantities of hydrogen sulphide) estimated among the largest in the world and as yet untapped. Additionally, minerals such as sodium chloride and other similar materials are available in substantial quantities.

To illustrate the extent of the vast gas resources available from the production of crude oil alone, it would suffice to point out that this gas from the point of view of heat value is equivalent to about 15 per cent of crude oil produced. Further these resources are sufficient, as an example, to make in excess of [illegible] tons of ammonia per year which is about two-thirds of the current production of the world. Of the [illegible],700 MMSCFD of gases associated with the production of crude oil, current plans in process of implementation will use approximately 1,[illegible] MMSCFD by 19[illegible]. With the production of crude oil expanding at a substantial rate, which would result in the increase of associated gases currently being flared, other outlets for the use of the gases must and are receiving serious considerations.

Apart from the availability of the required feedstock, there are certain other aspects for building petrochemical plants which entail certain problems. These problems can be best handled by adequate pre-evaluation of plant technology and economics, local and external markets, funding availa-

bilities, and, of course, labour supply in the required skills.

These problem areas are covered in the following paragraphs. It is further explained how problems are being resolved by presenting case histories of the petrochemical projects recently implemented in Iran.

I. Economy of size

Universally, the rapid rate of growth in consumption of petrochemical products and synthetic materials has provided a strong incentive for significant new investments into the industry. The extent of such new investments has generated severe competition requiring those engaged in the industry to seek ways and means to produce various materials at lower cost. For this purpose ever larger plants are being built so that the minimum economic size plant becomes increasingly larger. This principle holds true for practically all plants in the chemical industries. Therefore, a chemical plant considered to day, by highly industrialized countries, should be of such a size that its product (and by-products) could compete in the domestic and world markets. A developing country has to carefully weigh the advantages of buying its products from the world market, or building small size plants for its own domestic use which would result in a much higher priced commodity. Iran chooses to give priority consideration to participating with foreign partners having already firmly established world wide markets for both primary and by-products. This together with the domestic market permits economic size plants and so lowered prices to the consumer.

II. Technology and Obsolescence

It is recognized that it will be some time for the less developed countries to establish the required research and technological background and to reach a stage where the results of such research would be effectively utilized. Iran has endeavoured to meet the problem of a changing technology and relatively rapid obsolescence in petrochemicals by joining forces with well established foreign firms who have successful research and development capability, or by special arrangements in procurement of licences and patents to be kept abreast of any improvements made by the patent holder.

III. Establishment of petrochemical industries

The Law for the Development of Petrochemical Industries in Iran of July 1965

authorizes the National Petrochemical Company of Iran, (NPC), to enter into partnership with companies having necessary financial and technical qualifications. Such joint ventures benefit directly and significantly from the privileges granted under the Petrochemical Act as well as those of the Law for the Attraction and Protection of Foreign Investments. These law together with special tax exemptions for qualified industries contained in the Direct Income Tax Act of 1967 have played an important role in furthering the establishment of petrochemical industries in Iran.

The present petrochemical law requires that NPC should have not less than 51 per cent share in any joint venture. Consideration is now being given to reducing the NPC's 51 per cent minimum participation at present required, to permit the private sector to participate to a greater degree in the large petrochemical complexes.

IV. Prospects

The basic policy to promote the petrochemical industry in Iran is directed towards production of petrochemical building blocks in large core units. These basic chemicals or intermediates will serve to feed small size plants inside Iran and abroad for further processing or for the production of final consumer goods. The National Petrochemical Company encourages the private sector in Iran, both privately or in partnership with foreign companies to invest in companies designed to widen consumer products derived from petrochemical intermediates.

An extensive petrochemical development programme has been embarked upon in the relatively short period of time. The National Petrochemical Company has been formed. At present there are large scale complexes for the production of sulphur, aromatics, fertilizers and liquid gases with emphasis on the export of these products. There are also plants for the production of fertilizers, chlor-alkali, polyvinyl chloride and dodecyl benzene designed primarily for domestic consumption.

The National Petrochemical Company has plans either completed or in process, for broadening the petrochemical industrial base in a variety of other chemical products and for expansion of present product lines as depicted in the appended chart. This planning envisages foreign participants who possess the necessary technical and financial qualifications and firm marketing prospects for the products.

Apart from the availability of cheap basic materials and favourable laws and regulations, formation of large scale petrochemical complexes in Iran is enhanced by:

1. Experienced and trainable personnel to construct and operate the complexes.
2. Existence of an attractive local market which is growing at a rapid pace.

Because of these factors Iran is in a position to build large scale plants not only to satisfy the rising domestic demand, but also to export the major portion of production at competitive prices.

V. Local market

A problem in the less developed countries such as Iran for developing a broad chemical industrial base aimed solely at the domestic market is the low local per capita consumption of the finished products.

The significance of the market potential in Iran and adjacent countries must relate to the development of new or the expansion of [illegible] industries. Iran has a population of some [illegible] million, [illegible] total population of the nations comprising the [illegible] Gulf [illegible].

Fortunately, growth of the domestic market [illegible] very [illegible] product lines [illegible] the Iranian economy continues to grow at the rate [illegible] for the future, the consumption of several chemical products will be sufficient to warrant their production in Iran on an economic basis.

VI. Export market

Nearby are some of the world's most populous areas. About one third of the world's population lives within 5,[illegible] nautical miles from Iran or roughly the distance from the U.S. Gulf coast to Europe, and well over half the population of the world lives within a distance of about [illegible],[illegible] miles from the Persian Gulf.

The Gross National [illegible] of all the [illegible] within the 7,000 mile limit is [illegible]. The people in much of this part of the world, [illegible]

The requirement for fertilizer within the [illegible] practice in order to feed adequately this population [illegible]

[illegible], and it is naturally a part of the development schedule of every nation [illegible] to break as rapidly as possible the cycle of "hungry soils, hungry [illegible], hungry people".

[illegible] natural gas [illegible] petrochemical into which such gases can be [illegible] transformed. It [illegible] basis for such nitrogeneous fertilizers as [illegible], ammonium phosphate, nitrate, and others. Shipment of ammonia in bulk [illegible] for fertilizer manufacture is the cheapest method in which na- [illegible] can be transported to [illegible] exceeding 1,000 miles. The Persian [illegible] a natural [illegible] advantage which results in significant saving [illegible] of this basic product to the larger part of the market east [illegible] as compared with cost of transport from either United States or European [illegible].

[illegible] of natural gas to ammonia as a basic product is a sound [illegible] way in which a part of the available natural gas of Iran can be used [illegible] fertilizer [illegible] the region.

[illegible]

[illegible] have the privilege of choosing among [illegible] their products, such as by cash alone, credits [illegible]. [illegible] available cash and foreign exchange resources [illegible] the number of projects that can be developed. [illegible] comprises a combination [illegible] 5 [illegible] of the investment [illegible] our foreign [illegible] pro rata [illegible]. The balance comes from credit [illegible].

[illegible] and thus [illegible] agency of the [illegible] the [illegible] have [illegible], with- [illegible] established petrochemical [illegible] but also [illegible] contractors in several [illegible], [illegible].

The credit arrangements for these joint ventures consist of two major types; "suppliers credits", i.e., credits obtained by the joint venture directly from the supplier or contractor, and "buyers credits", i.e., credits obtained directly from banks and administered by the joint venture rather than the supplier. As a general practice, suppliers credits with competitive bidding made on a lump sum or guaranteed maximum basis is preferred for the projects.

VIII. Summary

(a) Great quantities of natural gases continue to be flared and wasted in Iran despite urgent need of products derived from this gas particularly fertilizers for the deprived countries of the world.

(b) Whereas Iran has a rapidly growing market for petrochemical products the present economic size of most of the gas petrochemical plants require Iran, in order to be competitive, to look not only to the domestic market but also to shipping sizeable quantities abroad and to finding productive uses or markets for by-products.

(c) Geographically, Iran possesses substantial quantities of various raw materials, is situated in an area of the world representing high potential markets, and is in a position to market products at competitive prices and shipping costs. Consideration has yet to be given to the shipment of basic and intermediate products such as olefins, aromatics, ammonia, etc. to distances exceeding thousands of miles.

(d) Foreign capital can be invested in furthering petrochemical industries in Iran with adequate safeguards for such investment as represented by special laws, regulations and other formalized arrangements which have been found attractive to foreign investors.

(e) Because of the high capital intensive nature of establishing petrochemical industries the Government of Iran assists joint ventures in identifying financing sources and participates as appropriate in obtaining the necessary credits.

IX. Current projects

To relate certain of the foregoing problem areas to actual projects in Iran there are attached brief summaries of such problems encountered in each of our

petrochemical plants which have gone on stream or are in the process of going on stream at this particular moment. These plants are:

1. Shiraz Fertilizer Company
2. Shahpur Chemical Company
3. Abadan Petrochemical Company
4. Kharg Chemical Company

SHIRAZ FERTILIZER COMPANY

The Shiraz plant was designed to make 120 tons per day of ammonia, all of which is converted to yield some 50,000 tons urea and 30,000 to 35,000 tons nitrate annually. It also has facilities for mixed fertilizers.

The Shiraz project was primarily conceived with the local fertilizer requirements in mind. These, incidentally, have long since outgrown its production capacity.

The trials and tribulations we have gone through at Shiraz present an interesting case history. We have learned from the experience, which has served us in the subsequent reappraisal of our petrochemical policy and planning. We would not duplicate Shiraz. It was built at the eve of a technical revolution in fertilizer plant design, and so was obsolete almost from the start of operations.

The location is unsatisfactory from the point of view of both markets and raw materials. The Shiraz fertilizer plant was a first, not only for Iran but for the Persian Gulf. Project management time was neglected in the excitement of solving the many pressing technical problems. As a result, a good deal of the output has had to be exported at a loss.

However, Iranian workers gained experience and proved themselves in chemical construction, including the difficult welding of alloy steel for high-pressure vessels in hydrogen service. The plant was put on stream and operated entirely by Iranian staff.

After a poor start, during which much production was lost through mechanical and other difficulties, performance of the unit has been above design for several years.

In spite - or perhaps because of - the problems, Shiraz has given us confidence. We have learned of some of the pitfalls and have trained an excellent

cadre for petrochemical construction, maintenance, operation and marketing.

SHAHPUR CHEMICAL COMPANY

In the spring of 1966, an agreement was signed between the National Petrochemical Company of Iran and Allied Chemical Corporation of New York to establish a joint petrochemical venture on a 50 - 50 equity basis.

The project involved the construction of seven process units and supporting off-sites on an area along the Persian Gulf next to the town of Bandar Shahpur.

From a combination of natural sour gas and imported phosphate rocks, the following products are to be produced:

Ammonia	1,000 metric tons/day
Sulphur	1,500 metric tons/day
Sulphuric acid	1,300 metric tons/day
Urea	500 metric tons/day
Phosphoric acid	460 metric tons/day
DAP (diammonium phosphate)	300 metric tons/day
o r	
TSP (triple superphosphate)	430 metric tons/day.

The Shahpur complex utilizes the sour gas of Masjid-i-Suleiman. It was there, at the start of this century, that the first oilfield of the Middle East was located and worked. This marked the birth of the oil industry in Iran. It is significant that the abundant gas reserves of this field should now be tapped to give birth to a promising new industry in Iran, which will certainly play a role in achieving the national target of a better Iranian life.

This gas derives from five gas wells specially drilled to provide the gas supply for the Shahpur complex. It passes through separators and a dehydration unit, then continues into the sour gas transmission lines, which is 108 miles long, carrying the sour gas to the industrial site at Bandar Shahpur.

The Shahpur industrial complex is a complete "grassroots" project entailing an initial investment of over $200 million. It encompassed the preparation of the site, and the driving of piling on a large scale to carry the weight of the seven process units and other heavy installations, along with a power generation unit, distribution facilities, a marine terminal, a railroad spur, water supplies workshops, laboratories, administration buildings etc.

Shahpur has capacity to produce 37,000 KVA of electricity utilizing natural gas in its turbine drives. The nine million cubic meters per year of clarified water required for operating the plant are obtained by means of a 60 mile long, 24 inch diameter water pipeline that runs from the Karun River to the plant site. The Shahpur area terminal has three berths: one for liquid loading, another for bagged products and general cargo and the third for loading and unloading bulk materials. The terminal has a handling capacity for ships with a draft of up to 40 ft.

Construction, with a peak workforce of some 5,000 engineers and labourers, is proceeding rapidly ahead. Sulphur production is scheduled for October 1969 and the remainder of the complex will go on stream thereafter, with full operation scheduled in May 1970.

When fully operational in 1970, the industrial complex will be manned by a workforce in excess of 1,000 staff and labourers.

The problems so far encountered in the realization of the Shahpur complex were those which were typically inherent in a project of this magnitude in a developing country. These problems included the organization of the financing, co-ordination of purchase of supplies and equipment and their transportation to the site, recruitment and the mobilization of local manpower and training of local workers.

Financing for the huge project was obtained from seven countries. These are the United States, France, West Germany, Italy, the United Kingdom, Japan and Iran. As the procurement of supplies and equipment was restricted to the countries where the financing was obtained, this created delicate and highly complicated problems of co-ordination of procurement with construction schedules and transportation.

Additional challenges were encountered in the construction of the project as a result of the closure of the Suez Canal, labour turmoil in the course of the student riots in France, and the longshoremen strikes in the United States.

As this was a new industry in Iran, training of personnel in special skills, both in the United States for selected Iranians and at the site for the labour force, was also a significant factor requiring due attention.

Lack of adequate housing has raised numerous problems including renovation of old houses at Mahshahr, previously used by the oil industry, and construction

of new houses, along with all the required civic amenities in a residential city.

The construction of Shahpur responds to the need to provide a source of local supply for a rapidly growing domestic fertilizer market, following vigorous land reform measures, and also as a major source of supply in Middle East for the growing needs of an export market.

In Iran efforts have been made toward increasing fertilizer consumption and organizing distribution of fertilizer for timely availability at the farm level. Since the creation of the Ministry, the Iranian fertilizer consumption has expanded by over 100,000 tons, reaching the current level of consumption of close to a quarter of a million tons per year.

Regarding the export markets, competition is significant as new fertilizer complexes in the Middle East and producing countries are being created to challenge old established suppliers for a share of the growing world market. Negotiations are under way with these countries in the region.

ABADAN PETROCHEMICAL COMPANY

Abadan Petrochemical Company Limited, was formed as a joint venture in June 1966 between National Petrochemical Company and the B.F. Goodrich Company of the United States, with the National Petrochemical Company holding 51 per cent of the shares. Abadan Petrochemical Company is currently manufacturing raw materials for the plastics and detergent industries.

The Abadan Petrochemical Company operates two closely inter-related chemical plants. These plants, starting with primary raw materials locally available salt, produce 45,000 tons per year of PVC resin, 45,000 tons per year of caustic soda, and 10,000 tons per year of dodecyl benzene. Intermediate products and by-products which also have commercial significance include ethylene, ethylene dichloride, vinyl chloride monomer, hydrochloric acid, propylene, and propylene tetramer. The complex was designed for expansion of the PVC manufacturing capacity up to 90,000 tons.

Abadan Petrochemical Company's manufacturing facilities and commercial activities are oriented toward the domestic Iranian market. Exports will only be incidental as the primary interest of the Company is in serving the local requirement.

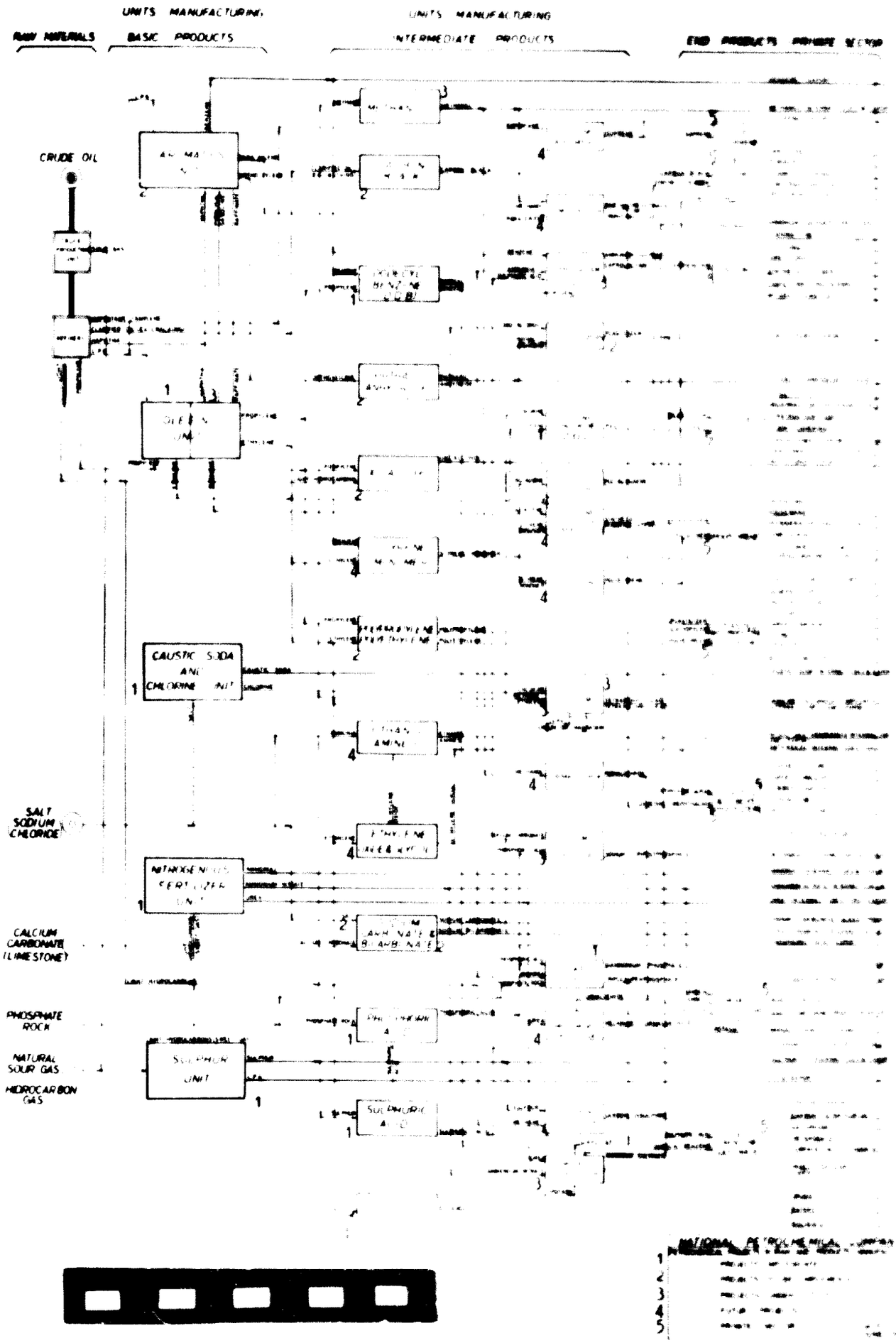
are not considered as over optimistic when viewed in the light of not only the availability of feedstock at low prices but also the expertise already gained in establishing a petrochemical industrial base, the vast experience gained in the well established oil industry, existence of skilled and intermediate manpower readily available to new petrochemical complexes, availability of manpower, (not to mention significant and broad concessions available under special laws applicable to the petrochemical industry, and laws for the attraction and protection of foreign capital).

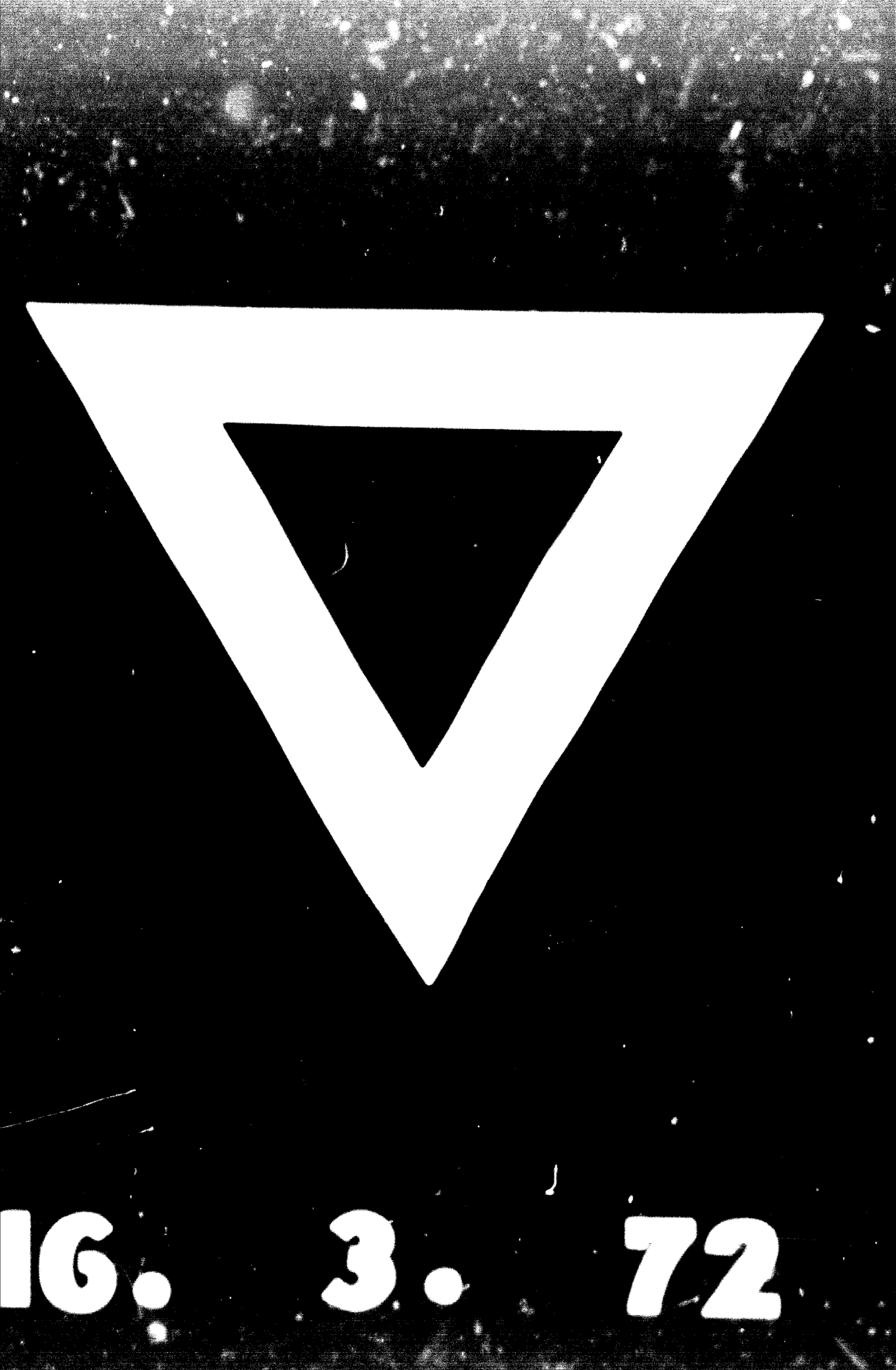
Nor are these hopes considered over optimistic when viewed in the light of the major leap forward in recent years in the economic growth and the Gross National Product of Iran under a framework of economic and financial stability.

In all respects Iran is prepared to co-operate fully with foreign investors having the technical and financial qualifications to the mutual benefit of both parties.

NATIONAL PETROCHEMICAL COMPANY

PETROCHEMICAL PROJECTS IN IRAN AND PRODUCTS MANUFACTURED





IG. 3. 72