

Introductory Paper on the Assab Petroleum Refinery

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This paper is intended to present the background to the decisions that led to the construction of the refinery and to discuss the problems that were met from the conception of the project up to the starting of operation. It is hoped that articles on the technical and economic aspects of the refinery will appear in later editions of this magazine.

INTRODUCTION

The importance of petroleum products being available within easy reach and the necessity for any country to ensure a steady and continuous flow cannot be overstressed. Suffice it to say that any country's economic development will be halted if this steady supply is interrupted, and its level of consumption is a gauge of the level of development.

The fact that Ethiopia has decided on the construction of a refinery to meet her present and future requirements of petroleum products can not be considered as a novel idea or a break from her traditional petroleum supply.

The construction of moderate size refineries as near as practicable to the consumption areas has been the practice of many countries for the last ten years. This tendency is increasing at a fast rate as new ideas on design and construction of small refineries are developed enabling refineries of capacities as low as 200,000 tons per annum to be economically feasible.

The continent of Africa has been quick to make use of this opportunity as could be evidenced by the fact that there will be over 20 refineries along its coast before the turn of this decade. Although most of these refineries are being constructed and managed by the big oil companies, more and more governments are participating not only for the economic benefit but also to make sure that they have enough control to avoid any interruption of supply due to political or other causes.

In this respect Ethiopia did not follow the normal practice of inviting the big oil companies to construct and manage, but preferred the fully Government owned refinery. This independence was further strengthened by the use of the USSR Credit and know-how. At first sight the move taken by the Government may be considered as drastic when considering the fact that the big oil companies have been the sources of supply for this country. However, as could be seen

further in this paper, the Government has found room for all to participate in the venture.

CAPACITY AND PROCESS TYPE

Analysis of the type and quantity of the products consumed in Ethiopia for the periods between 1950 and 1960 showed an annual increase between 12 to 14% and the general tendency of even larger annual rate was taken into consideration in determining the type and capacity of the refinery. It will be worthwhile to note here that the 1964 and 1965 consumption figures have shown that the annual increase had risen to 16%, and that the total consumption figure for 1966 was approaching the 300,000 tons mark.

Based on the general policy that the refinery to be constructed should be in a position to supply all the internal demands of the country for at least five years after the start of operation, a design capacity of 500,000 tons per year was decided upon.

The most practical and economical type of refinery chosen consisted of the following technological processes:-

- a) Desalting
- b) Atmospheric distillation
- c) Vacuum distillation
- d) Hydrotreating of reforming charge and catalytic reforming for premium gasoline
- e) Desulphurisation for lighting and jet kerosenes
- f) Sulfur plant

This process scheme was found to be able to meet the range of products required in the country with the exception of lubricants and aviation gasoline. The investment required for the additional plants to produce these two exceptions was found to be economically unsound, and was left to a later period when the consumption figures would justify such installations.

Besides the above processes, it was found advisable to include in the refinery scheme facilities such as, drum manufacturing shop, butagaz bottling station, blending facilities and other auxiliaries.

LOCATION

The two major alternatives for the refinery location considered were:-

- i) at or around Addis Ababa where 60% of the total country's requirement is consumed or
- ii) at the ports of entry

The first alternative would have entailed the construction of a crude pipeline of nearly 900 km length, the cost of which would have been more than double the refinery construction cost. Besides the necessity of finding this capital, the crude intake would be so small that tank truck transport, even at its present abnormally high rate, would be much more economical when all factors are taken into consideration. Moreover, the location of a refinery around the capital would have required the return transport of products to the coastal consumption centre in quantities of about 15% of the total production. The refinery's annual production would also have had to be geared to the annual consumption of the country, and any export possibilities would have been curtailed due to the prohibitive production cost that would have been inevitable.

For the second alternative, the two ports of entry, namely Massawa and Assab, were the possible alternatives, the third, Djibouti, not being considered at this stage for obvious reasons. From the two, Assab was chosen for the following two main reasons:

- a) Its vicinity to the consumption centres of the country, as well as to the possible crude supply centres.
- b) better existing transport facilities, and better prospect for improvement of same by rail link or the proposed Tendaho - Awash road connection.

Otherwise both sites were found lacking to the same degree in the following factors which are essential for determining the location of a complex industry like a refinery.

- a) Inadequate electric power and fresh water facilities,
- b) Insufficient skilled manpower necessary for the construction period,
- c) Insufficient housing facilities for the construction personnel,
- d) Unavailability of services like garages, local material, supply lines etc,
- e) Existence of extreme climatic conditions.

CONTRACTUAL OBLIGATIONS:

The major contracts (one for the refinery

complex and the other for the power station) were entered between the representatives of the Imperial Ethiopian and the USSR Governments, the total sum of the contracts amounting to 41.5 million Ethiopian dollars. More than 80% of this sum was made available from the USSR Credit payable over 12 years at 2½% interest.

The contracts entered between the two Governments were for complete construction and with no side conditions. The Ethiopian Government was left completely free on all the major issues as to the choice of management, sources of crude, staffing etc.

Besides the above lump sum, the Ethiopian Government was to bear an expenditure of two million Ethiopian dollars for consultants and administration during the duration of the construction.

CONSTRUCTIONAL SCHEDULE AND PROBLEMS:

The first one year and six months was devoted to geological and hydrogeological surveys, coupled with the detail design and approval. Actual construction on site started in February, 1964 and the first unit testing would be started in December this year with the final handing over date scheduled for the second half of February, 1967.

More than 37 trial wells were dug in search of fresh water, and a water basin was discovered about 13 km from the refinery site, with a supply capacity of 110 litres per second. The quality of the water is excellent, and since the refinery's requirement is 36 litres per second, the investigation has also solved the problem of future users.

The major problems met on the construction are skilled labour shortage, housing facilities for the Soviet staff, shortage of electric power, and the language barrier between the Soviet specialists and the local labour.

More than 400 Soviet specialists had to be brought to site in view of the local labour shortage mentioned above.

OPERATION STAFF

Steps were taken to train as many Ethiopians as possible for the operation staff. Up-to-date, twelve engineers have completed their two years training, as well as 44 technical school graduates for periods ranging from one to one and a half years. More than 50 are already back and are participating in the installations at Assab.

It is hoped that out of the 380 technical staff required for the refinery, only 20 expatriates will be required. For each of these expatriates trained Ethiopian counterparts will be attached, with the aim of completely Ethiopianising the refinery in less than five years.

CRUDE AND DISTRIBUTION

The Refinery will operate on Kuwait and

Basrah crudes, except for the initial testing period when Kirkuk crude is being used. A Five year contract was signed for the purchase of the crude requirement.

Agreement in principle was reached between the Ethiopian Government and the oil companies operating in the country at the moment on the distribution of the products from the refinery.

CONCLUSION

The construction of the refinery in this country

has brought to focus the extreme shortage of technical personnel from the level of the skilled operator to the engineer. The technical schools in Addis Ababa and Asmara, and recently the Bahr Dar Polytechnic are attempting to fill the gap, but the yearly output as well as the standard and diversification is far from the requirement of a developing country like this one.

It is felt that EAEA should make an attempt to assist the Government in planning manpower development for future industries.

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