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ASSISTANCE TO

TANZANIA PETROLEUM DEVELOPMENT CORPORATION

US/URT/85/720

UNITED REPUBLIC OF TANZANIA

Technical Report\*

Prepared for the Government of The United Republic of Tanzania  
by the United Nations Industrial Development Organization  
acting as executing agency for the United Nations Development Programme

Based on the work of Mourad Y. Yostos  
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### ACKNOWLEDGEMENT

My second assignment - Assistance to TPDC - though a short one - was a remarkable event in my services. The assistance given by TPDC and the Ministry for Energy and Minerals was the main stimulant.

Grateful thanks are due to Mr. S. Barongo, Managing Director of TPDC, for his continuous support and concern throughout the span of this assignment - which will always be remembered.

Thanks and appreciation are due to Mr. L.G.T. Mwale, DM-TPDC, to Mr. T. Masili, MIP and the staff of the Marketing & Investment Department for the sincere cooperation given.

Many thanks are due to Prof. N. J. Mwandasya, Commissioner for Energy and Petroleum, Ministry of Energy and Minerals, for his continuous assistance and kind concern.

Finally, I am grateful to the Minister for Energy and Minerals, Hon. Al Haji MUSAHA, M.P., for the valuable assistance and concern extended by his Excellency to me, and which were constant source of inspiration.

7.2.1987.

Harold T. Yost  
UNIDO Technical Advisor

## 1. OBJECTIVES AND LOGIC OF PROJECT

### 1.1: The National Economy:

The trend in the economy during the year 1985/86 was one of better expectations. Rain and climate conditions in general were favourable to growth, and due to concerted efforts of the farmers higher outputs were registered in food crops production. Indications of economic recovery which started in 1984 with an increase of GDP of 3%, continued although at a lower level of 2.3% in 1985. Scarcity of foreign exchange continued to affect production in the industrial sector, and resulted in a deterioration of various services such as education, health, water, transport and energy. The year 1985 was the sixth consecutive year within which the industrial sector continued to register declines in output. In 1985, industrial production declined by 6.4% compared to a decline of 1.3% in 1984. The actual contribution of the industrial sector to GDP declined from 10% in 1981 to 8.2% in 1985, with most industries operating at below 30% of their installed capacities. GDP growth in 1985 at constant 1976 prices, increased by 2.3% compared to an increase of 3.2% realised in 1984. The increase in GDP of 2.3% came mainly from the services sector especially public administration. This 2.3% increase in GDP in 1985 was smaller than the average annual population increase of 3.3% reflecting the continuously deteriorating living conditions for the majority of Tanzanians, yearly. The average real income per capita declined by 11.0% in 1985 compared on 1980.

Overall, Tanzania is currently in a hard economic situation. A greater proportion of imports had to be covered by external loans and grants. The Government's decision to allow private individuals to use their foreign exchange to import a variety of goods helped to ease the situation.

Analysis of the performance of the economy identified the principal factors driving the economy, namely, the availability of foreign exchange and the agricultural sector as the primary foreign exchange earner.

The Government has prepared a three year "Programme of Economic Recovery" from 1986/87 - 1988/89, aiming at increasing GDP at an average rate of 4.5% between 1986 and 1991. The major objectives of the recovery programme are:

- to increase the agricultural output and the export of crops.

- to increase foreign exchange earnings from exports.
- to rehabilitate the important physical infrastructures of the country such as transport and communication, energy and water supplies in support of the directly productive activities.
- to increase capacity utilization of the existing industries. The target being to increase the level of capacity utilization from between 20 and 30% to a level of 60 to 70% by the end of the recovery programme.

In the next few years to the end of this decade, the major industry in Tanzania capable of making the most significant contribution to above objectives, is the Petroleum Industry. The Petroleum Industry is now embarking on several projects including establishing export-oriented industries such as the envisaged Ammonia/Urea Fertilizer complex (KILANCO), a Lube Oil Blending Plant (which was recently commissioned), a Bitumen Plant and a Natural Gas Gathering System for potential users. The contribution of these industries in the increase of foreign exchange revenues will be tremendous. The fertilizer plant alone, is expected to increase the industrial GDP by US \$ 100 MM annually; the local production of lubes and bitumen represent a good saving in forex spent on their imports annually as well as earnings from their possible exports.

Substitution of natural gas in displacing oil in certain sectors would also reduce oil consumption with the consequent decrease in the outflow of foreign exchange.

Agriculture and industrial sectors would also benefit from inputs of such industries in the form of fertilizer, better haulage of crops as result of road improvement, sufficient energy resources for the industry and improved operations.

#### 1.2: Project Background

The Government of Tanzania places high importance on strengthening the existing petroleum refining industry and promoting the development of down-stream chemical industries based on natural gas, substantial reserves of which have been discovered during the period of implementation of a UNIDO Project (DP/URT/74/028 Assistance to TIDC) to support this sector. The technical capability of TIDC has been significantly enhanced by this assistance. However, in view of the complex

projects being planned to expand the petroleum refining industry and to utilize the natural gas for chemicals production, and of the relatively high investment involved in these projects, the Tanzania Government considered it necessary to strengthen TPDC staff with an Adviser provided by UNIDO. UNIDO, in June 1986, recruited a Technical Advisor - who has previously served TPDC from Nov. 1981 to December, 1984 under Project (DP/URT/74/028) - for a six month short-term assignment. Recruitment was financed from the Egyptian Fund for Technical Cooperation for Africa.

1.3: Objectives:

Development Objectives:

To promote the development of petroleum refining and related industries. Three major petroleum downstream plants have been decided by the Government to be established:

- Lube Oil Blending Plant
- Bitumen Manufacturing Plant
- Ammonia/Urea Complex from natural gas
- Strategic petroleum depots to improve distribution pattern

Immediate objectives:

To strengthen the technical capability of TPDC personnel by providing TPDC with a technical adviser on petroleum processing.

The very short period ( 6 months) for project could not be logically adequate for a real contribution in the ongoing activities of the big development objectives. Nevertheless, Adviser gave continuous important inputs in the progress phase of each objective.

UNIDO Technical Adviser, arrived in DSM on 14 June, 1986 and started his duties attached to Tanzania Petroleum Development Corporation, Directorate of Marketing and Investments, collaborating with Director, Manager for Investment Projects, Head of Kilamco Unit, and staff of engineers and economist.

Job description is shown under Appendix -II

**2: ACTIVITIES CARRIED OUT AND OUTPUTS**

The activities in which Project was involved according to project document and the main outputs during Project duration of six months, were:-

**Activities:**

**I - Assist TPDC in the review of engineering packages from:**

- Bitumen Plant
- Ammonia/Urea Plant
- Songo Songo Gas Gathering and Pipeline System.

**II - Monitor the progress and quality control procedures and plant performance during start-up operation, for:**

- Production of Lubricants
- Production of Bitumen
- Production of Ammonia/Urea

**III - Assist TPDC in designing a system for collection, processing and analysis of product marketing and distribution data.**

(This last activity was found to be undertaken at present by a Marketing Exprt provided by statoil of Norway. It is assumed that the activity was actually meant to:

- Assist TPDC in improving the distribution and supplies of petroleum products in the country, identifying petroleum demands and establishing the optimal distribution pattern, facilities needed and systems designs).

**Outputs:**

**I - Review engineering packages for:**

- Bitumen plant (feasibility study and updated basic engineering for a turn - key project)
- Songo Songo Gas Gathering and Pipeline System (basic engineering, specifications, draft agreement, bid documents)

**II: - Monitor the progress and quality control procedures and plant performance during start-up operations of:**

- Lube oil blending plant, DSM.

**III - Assist TPDC in evaluation of a Petroleum Products Distribution study (sponsored by the World Bank), in the establishment of distribution facilities and their systems designs proposals.**

- Additional outputs related to this activity:



- Assist TPDC in a Domestic Gas Utilization Study (Sponsored by the World Bank) aimed at displacing oil in certain possible areas.
- Monitor the progress and quality of execution of storage tank facility for crude oil supplies at Tiper Refinery, DSM.

**SCHEDULED ACTIVITIES:**

During the short duration of the Project (14 June 1986 to 13th December, 1986), the following activities were performed:

**I - Assist in the review of Engineering Package**

**2.1: Bitumen Plant Project**

As mentioned earlier, the Italian Government agreed in 1983, to provide funds for updating a previous feasibility study, and Snamprogetti SPA were commissioned to submit a Techno - Commercial Proposal for engineering services required for this project. The updating study report was prepared in April 1985 and confirmed the viability of establishing a 30,000 TPY Bitumen Plant at Tiper's Refinery in Dar es Salaam.

Investment cost - prepared very accurately - would amount to US \$ 17.2 million for the plant capital cost, plus US \$ 2.54 million to cover costs of training of personnel, working capital and interest during construction.

The Italian Government expressed also willingness to give a soft loan for the construction of this plant and to enable qualifying for the loan, TPDC finalized on behalf of the Tanzania Government the following procedures:

- a. Letter of intent was sent in May, 1985, to Snamprogetti expressing the Government decision to finalize a construction agreement with Snamprogetti, subject to the confirmation of the Italian loan.
- b. TPDC negotiated and finalized a contract for the turn-key construction of the plant with Snamprogetti in July, 1985.
- c. Signed in end November 1986 an addendum to the contract Agreement concerning modifications to the investment cost which was now considered U.S.D. 22,920 MM due to inflation and the devaluation of the dollar.

It is expected around the end of 1986 that the Italian Government issues the respective soft loan, with implementation taking place early 1987, as confirmed by the delegation from Snamprogetti in end November, 1986.

Output:

- (i) Review of Snamprogetti engineering package, TPDC and Tiper Refinery views including the increase in size of the vacuum distillation column to enable processing the entire n.d. stream in the refinery; providing instrumentation of the pneumatic type - well acquainted of by Refinery operators - rather than the suggested electronic type; cooling of pumps and machinery by fresh water instead of sea water to avoid maintenance problems; the use of other packaging material (paper, or plastic) for bitumen packaging to reduce high cost of drums; modifications to Tiper Jetty and provision of bitumen marine transport facilities.  
  
A tentative plan for project implementation is attached, envisaging execution time to take 24 months from date of contract agreement.
  
- (ii) Advisor reviewed also the Agreement between TPDC and Snamprogetti for the design, engineering, procurement and construction of the bitumen plant - which would come into force on the issue of loan by the Italian Government.  
  
The review showed the need to modify many of its provisions to be more practical and reasonable - taking the advantage of a possible re-negotiation stipulated in the Agreement.  
  
A report with comments and recommendations was submitted to TPDC on 22nd July 1986.
  
- (iii) Advisor participated in the discussions with Snamprogetti delegates in end November 1986, ended with the issue of an addendum for the modifications to investment costs

1. PROJECT TITLE: [REDACTED]

2. PROJECT NUMBER: [REDACTED]

3. EFFECTIVE DATE: [REDACTED]

4. PROCESS UNIT: [REDACTED]

5. ENGINEERING & CONSTRUCTION [REDACTED]

6. MATERIALS & EQUIPMENT [REDACTED]

7. SITE ACTIVITIES [REDACTED]

8. PRECOMMISSIONING & COMMISSIONING [REDACTED]

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for inflation and devaluation of dollar as well the inclusion of additional facilities to the plant worth U.S. \$ 4.74 MM.

2.2: Songo Songo Gas Gathering and Pipeline System Project:

Following the Italian Government decision in 1984 to finance the implementation of this system, a direct grant of US \$ 3.75 million was given to enable start phase -I covering the basic engineering package. An agreement was concluded with Snamprogetti SpA who started its activities in September 1985 including: the carrying of offshore seabed and subsoil surveys to enable select the optimum pipeline route - basic engineering for the offshore (Songo-Songo/Kilwa Kivinje) and onshore (Kilwa Kivinje/Kilwa Masoko future fertilizer site) facilities - preparation of tender documents for the turn-key supply of facilities, detailed engineering, procurement of equipment and material, installation, hook-up, commissioning and startup - preparation of a project cost estimate and implementation schedule.

An Interim Report was submitted by Snamprogetti to TPDC in end June 1986 reflecting the activities performed up to March 1986. The final report in 14 volumes was submitted mid September 1986 except for the cost estimate and implementation schedule pending TPDC review - followed by a plant Typology/Optimization Report in which Snamprogetti suggested a reduced system capacity in view of a high cost estimate envisaged for the main concept.

A tentative plan for implementation is attached. It is envisaged that the Italian Government would issue in 1987 the loan funds for phase - II implementation should Kilamco takes off following a World Bank's favourable assessment to be issued in early 1987.

In this respect, the Italian Ministry of Foreign Affairs nominated a consultant - S.I.M. (Societa Italiana Monitoraggio)- to assess the status of development of basic engineering package and to verify the consistency of the gas gathering plant. Delegates of Snamprogetti and S.I.M. arrived to DSM in November 1986 to discuss the suggested plant typology report and reach an understanding with TPDC on the final configuration

2-2. Project Execution Plan

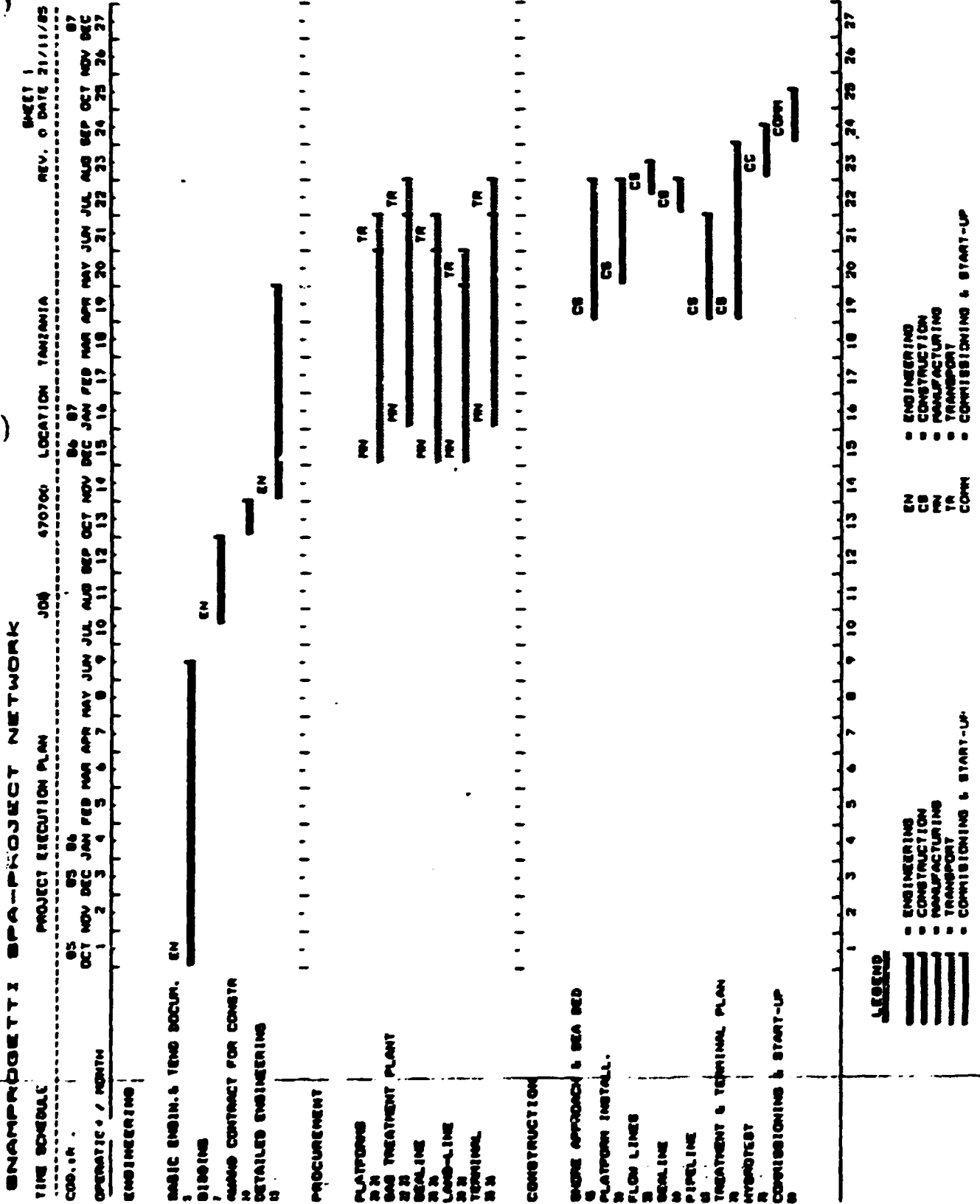


FIG. IV.11.6

of the system to work out the total estimated investment costs and time schedule for implementation.

Output:

- (i) Review of Snamprogetti Interim Report, Conceptual Design and Optimization Study. A summary was prepared, together with conclusions to assist TPDC in the final review of the basic engineering - submitted later - and to enable making a decision.  
  
Technical Adviser submitted the full report with recommendation on 13 August, 1986.
- (ii) Evaluation Report of the basic engineering, bid documents and Snamprogetti final report was presented by Adviser to TPDC in Oct. 1986.  
  
Comments and recommendations covered also the proposed contract agreement with the successful bidder.
- (iii) Adviser studied and commented on Snamprogetti Plant Typology Optimization Report of Oct. 1986, based on system capacity of 65 MMSCFD of treated gas instead of 100 MMSCFD originally selected and on which the basic engineering was based. The change was proposed to avoid a no-financing situation from the Italian Government because of a high cost of investment (\$ 65 million) now estimated versus an earlier estimate of \$ 35-40 million given to that Government.  
  
A compromise was presented by Adviser in order to essentially maintain a transport capacity of 100 MMSCFD of treated gas to the mainland while reducing the treatment plant to 65 MMSCFD at this stage.
- (iv) In November, 1986, delegates from Snamprogetti and the Italian Government arrived in DSM to discuss the final plant typology. Adviser's proposal was presented and agreement was reached on the final configuration of the system based on that proposal.

2.3. Ammonia/Urea Complex:

Complete financing of this project could not be reached in 1985/86. The most significant concern for financiers in terms

of the economic viability of the project related to the fall in price of urea. Project viability is dependent on a substantial increase in urea price, currently very low at about \$ 90 per ton.

Other concerns at this stage are the no firm final estimates of the capital costs of project, and whether plant would compete effectively in the Asian markets - given the present high reliance investment costs. Reliance is now estimating the financial requirements as \$ 498 million (\$394 million project assets, \$ 18 million preoperating costs and \$ 96 million interest during construction). The International Finance Corp. tentatively estimates requirements at about \$ 425 million (\$ 334 million project assets, \$ 18 million preoperating costs and \$ 73 million as interest).

The World Bank - to assist Tanzania in monitoring situation to the Paris Club of Investors - is now carrying out an analysis to evaluate the chances of financial and economic success of the project. A complete comprehensive assessment of the project including its priority in Tanzania's overall investment programme would be presented to the Government early in 1987.

## II - Monitor Progress and Quality Control Procedures:

### 2.4.

#### Production of Lubricants:

The setting up of a lube oil blending plant in Dar es Salaam, was intended to reduce the foreign cost of importing lubricants. At present prices, the saving in foreign exchange would amount to 24%, yielding some US \$ 4.8 million per year based on the foreign exchange allocated to Industry in 1985 of 20 million Dollars. The plant will cater for 70 to 80% of the total lubricants (motor and industrial) in the country, the remaining (specialty products) will continue to be imported.

The project was financed by a soft loan from the Italian Government and is owned by Agip(T). TPDC has 50% shares in AGIP(T). Plant would blend lubricant products for the five marketing oil companies in Tanzania (Agip, BP, Caltex, Esso and Total, with production shared according to their market shares of 30%, 35.6%, 12.9%, 7.0% and 7.9 respectively. Each company will import the additive requirements for its

lubricants and its oil stocks.

Empty packages will be supplied by local manufacturers with the raw material imported by Agip and production allocated to the oil companies according to their market share of lubricants.

Plant occupies an area of 9.7 acres at Maracini, DSM, and designed for an annual production of 30,000MT of finished packaged products, based on operating 8 hours shift per day, 5 days per week, 230 productive days per year.

Plant was commissioned and startup performed in Nov. 1986. Commercial production is expected January 1987.

Total investment costs US \$ 11. million.

Outputs:

(i) Progress was monitored by UNIDO Technical Adviser in a comprehensive report submitted to TPDC in September 1986. A write up was prepared based on inspection of plant, to cover the design criteria, product data, product receipt, description of facilities process and the flow of empty and filled packages. This was necessary to acquaint TPDC with the facilities provided and plant operations since no drawings or any information were provided by Agip(T).

Report covered Adviser comments on the design concept of the plant and facilities provided.

(ii) Quality control procedures were also recommended in the report.

(iii) Based on the information collected on drum package cost and the high cost of imported raw material per drum, Adviser recommended the establishing of a Drum Reconditioning Unit at the lube blending plant to clean and reuse the empty drums disposed of by consumers and which could be collected by the marketing oil companies. The objective would be to save high amounts of foreign exchange(US \$ 2 million) to be spent annually for the import of drum material.



Technical Adviser prepared a paper on this proposal covering technical and economical study, sizing of equipment and design concept for ready implementation when appropriate. Paper was presented to TRC end September, 1966.

- (111) Plant was commissioned in December 1966 and officially inaugurated by the President of the Republic of Tanzania on 7 January, 1967.

2.5.

Production of Nitrogen

Nitrogen could not be produced during the very short life time of project. Construction of plant has not started yet.

Output:

NIL

2.6.

Production of Ammonia/Urea:

Construction of Complex has not started yet.

Output:

NIL

III - Assist in Improving Product Supplies and Distribution

2.7.

Strategic Petroleum Depots

Inadequate upcountry petroleum storage capacity is seriously affecting production in the Agricultural and Industrial sectors on which Tanzania's economy depends to earn its much needed foreign exchange.

Out of the total oil storage facilities of some 153,000 cu. mts in the Country, 110,000 cu. mts. installed in DSM representing about 72% of the total capacity country-wide. The remaining 28% are small depots scattered in 14 different locations upcountry and could not cover the demand.

Product supplies are by rail and road tankers and both are not adequate. Coupled with the present poor roads, the system of supplies is inefficient.

The Government has, therefore, decided to establish strategic petroleum depots at Makumbulu, Mwanza, Butobo, Isaka, Mwanza, Dar es Salaam and Tanga to overcome the current supply problem and improve product distribution.

In 1966, Technical Adviser - who was serving TRC during that time - prepared a techno-feasibility study for construction of

depots at Nakanbako, Iwaza and Tanga to improve/supply and distribution of petroleum productions for southern, Lake and Northern regions. The study was considered adequate and representative and taken as basis for the depot projects implementation. The Government in 1986 considered inclusion under Depot Projects the setting up of other depots to Bukoba, Isaka, Rutuba and DSM.

Ingra/Ministry of Yugoslavia showed keen interest in the project implementation since 1986 and pledged to secure the Yugoslav Government for financing.

In July, 1986, Ingra delegates had talks with TPDC on the schedule of implementation and preliminary financial arrangements.

In September, 1986, Minister for Energy and Minerals - during his official visit to Yugoslavia - was presented a preliminary proposal for implementation. In end November, 1986, representatives from Ingra came to DSM and presented to TPDC basic engineering & financial proposal for Nakanbako.

#### Output

- (i) Adviser participated with TPDC in the meetings held in July 1985 with Ingra delegates. In the meeting depots capacities were defined and schedule of implementation in 4 phases was setup.
- (ii) Following the presentation to Minister for Energy and Minerals of Ingra's preliminary proposal on Depot Projects, UNIDO Technical Adviser was asked to scrutinize and comment on proposal. Adviser presented his report to TPDC and Minister in early October 1986, covering the phases of depots implementation, revised capacities, impact of the newly added depots on the pattern of supply, TPDC construction obligations required by Ingra, cost estimates, time schedules and constraints that should be solved for smooth and timely implementation.
- (iii) Adviser revised basic engineering for Nakanbako Depot and made several modifications including another plot plan proposed for a better layout of facilities and less investment costs.

**2.8. Petroleum Products Distribution Study:**

The World Bank has been realizing the problems faced by Tanzania in petroleum products distribution, as discussed under point (2.7) above and commissioned a French consultant "Louis Berger S.A.R.L." to carry out a "Petroleum Products Distribution Study". The objective is to examine the current domestic demand for petroleum products and develop statistics which establish the petroleum demands on a geographical, seasonal and end user basis. An examination of the facilities for distribution, terminals, transportation methods and equipment, depots and retail and consumer delivery will be conducted.

The total estimated cost of the study - which will be financed by the International Development Association (IDA) of the World Bank Group - is F.P. 1,100,000.-

**Output:**

- (i) UNIDO Advisor reviewed the draft contract presented to TPDC by the French consultant "Louis Berger S.A.R.L." and submitted to TPDC a report covering comments and recommendations in end July 1986.
- (ii) In September, 1986, representatives from Louis Berger arrived in DSH for discussions with TPDC on draft contract. Advisor participated in the discussions of draft contract and agreement reached on various amendments.
- (iii) Contract was signed in November 1986 for implementation, follow up of which would not be possible for the short term of Project.

**UNSCHEDULED ACTIVITIES:**

Additional unscheduled activities - which could also be grouped under main Activity III - were carried out by UNIDO Technical Advisor, as follows:

**2.9. Domestic Gas Utilization Study:**

The availability of natural gas from the Songu - Songu field presents an opportunity for Tanzania to replace a significant percentage of petroleum imports with a domestic fuel. The

substitution of natural gas is displacing oil in certain possible areas could, therefore, reduce oil consumption with the consequent decrease in the outflow of foreign exchange.

Four main areas of substitution by natural gas require consideration:

- to replace P.O. usage in industrial boiler and furnace applications.
- as the fuel for thermal generation of electricity.
- to replace kerosene for cooking.
- the technical potential exists to use compressed natural gas (CNG) directly in transport applications, as fuel.

The primary and principal market for natural gas will be in DSM region where most of the industrial end - users are located.

Therefore, it was foreseen important to initiate a comprehensive gas utilization study.

The International Development Association (IDA) - of the World Bank Group - granted a technical assistance credit to Tanzania of US \$ 8.0 million to be used for a package of projects in the petroleum sector. The projects include a gas market survey and conversion study for major fuel oil consumers in DSM to establish potential industrial gas market and the required investment for converting industrial plants into gas usage. A compressed natural gas (CNG) pilot project will be launched as a forerunner of a gas pipeline supply from Songu Songu.

GDC, Inc., USA, were the successful bidder in a bid solicitation issued by TPDC. Their scope of work encompasses two phases: one involves the evaluation of markets for gas, conversion of industrial loads to gas, a feasibility study of CNG as transport fuel and the preliminary engineering and cost estimates of the gas pipeline and delivery systems.

The other phase comprises the preparation of a detailed strategy for the optimal utilization of natural gas in Tanzania.

A draft contract agreement was submitted by GDC to TPDC for review.

Output:

- (1) Advisor participated in the review of draft agreement and in meetings and discussions with representatives of GDC in September, 1986, to finalize draft contract.

Contract agreement was put in final shape with the necessary amendments. The first phase would take 4 months from the date of contract signing while the second phase would take 3 months.

TIKDO (Tanzania Industrial Research Development Organisation) were hired by consultant as sub-contractors to carry out the gathering of data at industrial plants on equipment which will be considered for conversion to natural gas. TIKDO would also make field scouting surveys for the pipeline alternative routes.

(ii) Contract agreement was signed in November 1986 and TIKDO started gathering data at industrial plants.

2.10. Crude Oil Tank - Tiper Refinery:

Minister for Energy and Minerals directed UNIDO Adviser to inspect and monitor the progress in the construction of a new crude oil storage tank 45,000 cu.mt. nominal capacity at Tiper Refinery, DSM. Tank is 60 mts. diameter x 16 mts overall height, floating roof type, constructed by Snamprogetti of Italy at a total cost US \$ 1.647 million. Loan agreement for investment cost was made between the Government of Tanzania and Italian credit institutions represented by some Italian banks.

Output:

Thorough inspection was made by Adviser in July, 1986, and a report was submitted to TPDC, Refinery and Minister monitoring progress of work, observations, comments and recommendations. Storage tank is expected to be put in operation by November 1986.

Reports and Papers

List of reports and papers prepared by UNIDO Technical Advisor during the tenure of the Project, is given in Appendix I.

3. ACHIEVEMENTS OF IMMEDIATE OBJECTIVES

In pursuance of the duties specified under Project document, the following have been achieved:

I. Review of Engineering Packages:

3.1. Bitumen Plant

(i) Following information relayed by Snamprogetti on the additional costs involved to carry out the modifications suggested under point (2.1 - Output(i) decision was taken to cancel the suggested modification to Tiger jetty and suffice with the original bitumen transport facility-the barges, as contained in the engineering package. It was found advisable now to delete suggested increase of the column capacity; to have a fresh water closed circuit cooling system and water demineralization plant. The use of plastic (polyamide) bags for bitumen packing instead of drums would also be considered when a complete study is presented by Snamprogetti but stressed on its importance rather than depending on drums for packaging.

(ii) Report of Adviser commenting on the Agreement for the design, engineering, procurement and construction of the bitumen plant, tackled many articles on works and services to be performed by contractor and by owner (TPDC), the obligations and rights of each side, programme of work, guarantees, test runs, provisional and final acceptance, liquidated damages and contractor's maximum aggregate liability.

Recommendations were given - with justifications - on the suggested changes for each of these points and provisions to bring it more practical and reasonable - Recommendations were accepted by TPDC.

Since Agreement has not come into force because of the non-conclusion of financing loan, negotiations could be undertaken at stage of implementation to amend such clauses.

Constraints:

No further constraints are expected, since all outstanding problems have been resolved and an

addendum was signed last November concerning the updating of total investment costs to cover the increase for inflation since signing the Agreement in 1985 and to cover the devaluation of the Dollar.

The Snamprogetti delegation in end November, 1986, assured of the finalization of financing by the Italian Government by the end of 1986, or beginning 1987.

**3.2. Songo Songo Gas Gathering and Pipeline System**

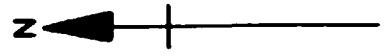
(1) System basic engineering was carried out by Snamprogetti based on TPDC decision to design the facilities for a gas transport capacity of 100 MMSCFD to supply KILANCO (fertilizer plant) and other future potential users. At the present point of time those other potential users were in DSM where an ongoing project sponsored by the World Bank (IDA) - Domestic Gas Utilization Study - is looking into the possibility to replace a significant percentage of petroleum products with a domestic fuel "Natural Gas" (point 2.9). A gas pipeline may, therefore, connect with the Songo Songo pipeline terminal end on mainland and transport gas in excess of KILANCO to DSM.

Snamprogetti estimating that system investment costs related to capacity 100 MMSCFD at US \$ 65 million, now favours a lower transport capacity of 65 MMSCFD to just supply KILANCO. The purpose - as stated in their plant Typology Optimization, Technical and Economical Report - was to bring budget cost estimate closer to an earlier preliminary figure of US \$ 40 million to ensure a positive response from the Italian Government in approving the required funds.

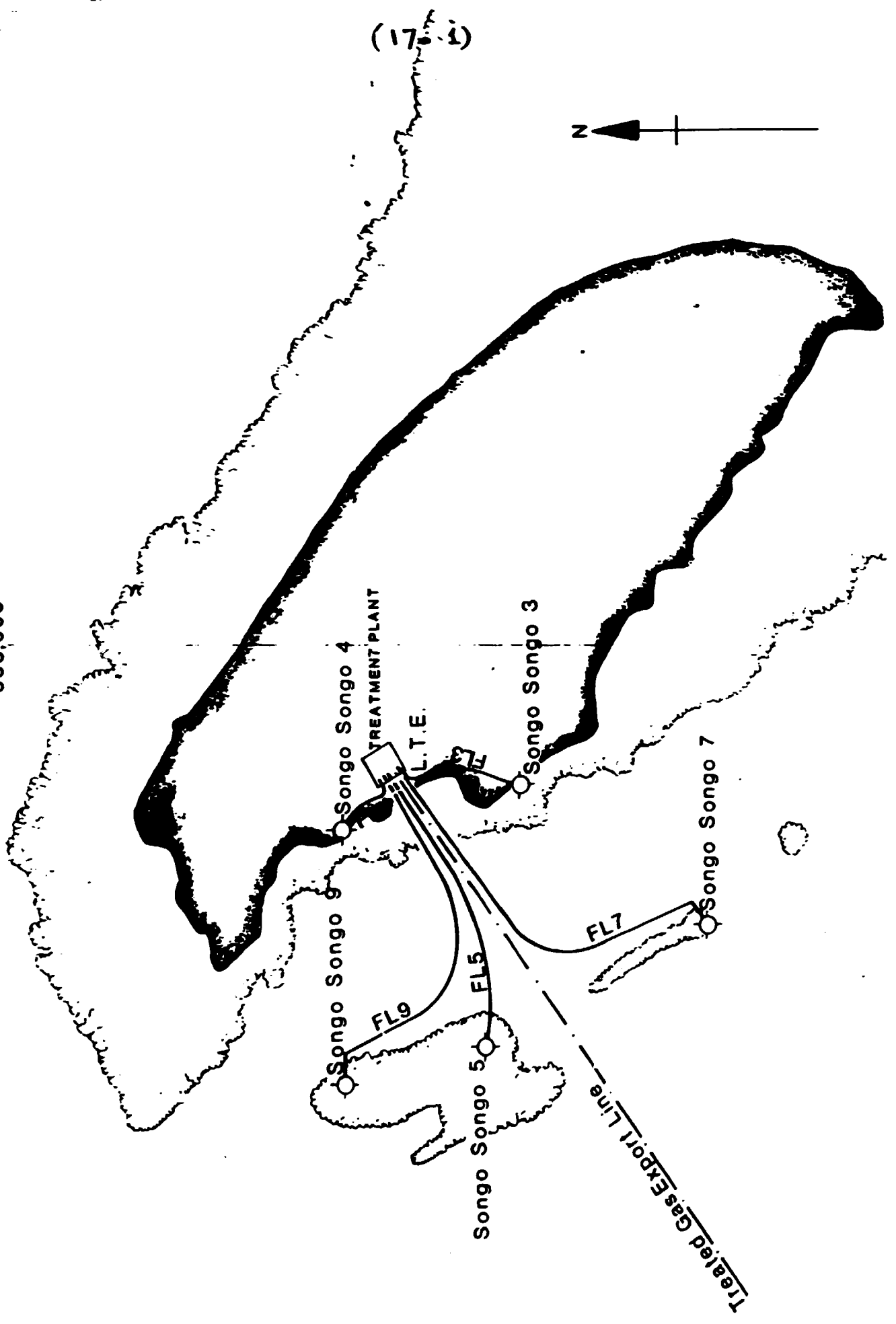
Under such situation, UNIDO Technical Advisor proposed a compromise plant typology that satisfied TPDC objectives of the gas transfer and at the same time has a reasonable investment cost. Proposal constituted the following main design criteria:

- Gas transmission submarine pipeline capable to transport 100 MMSCFD to mainland from Songo Songo field, for future users

(17-1)



555,000





- Gas treatment plant to be installed for KILANCO (65 MSCFD) requirements but designed for future expansion to treat up to 100 MSCFD of gas.
- Onshore pipeline for KILANCO as sized by Snamprogetti (12") for a capacity of 65 MSCFD.)
- Maintain essential technical construction details for proper operation of the system.

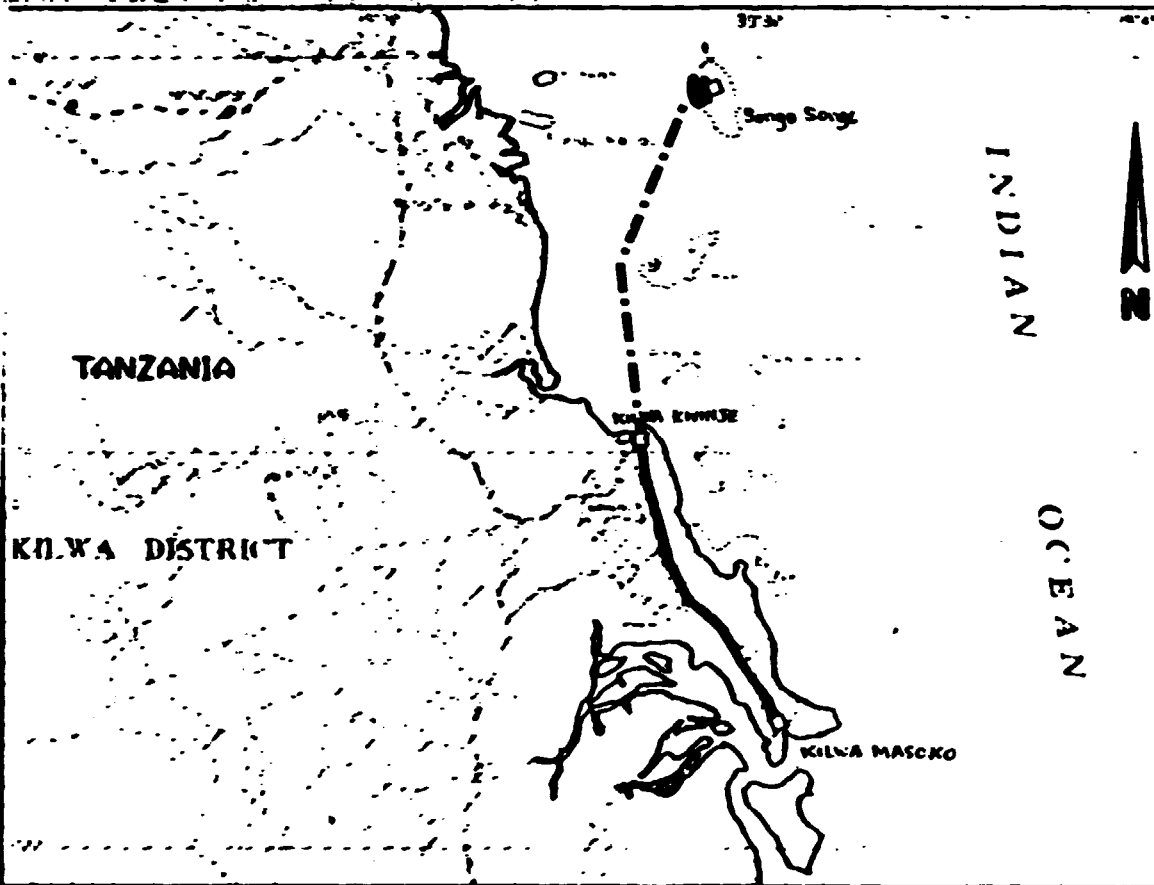
Proposal was submitted to TPDC and Ministry of Energy and Minerals on 25 October 1986, then discussed in a general meeting and accepted.

- (ii) Early in November 1986, delegations from Snamprogetti and Italian Govt. (Ministry of Foreign Affairs) convened with TPDC to discuss their Plant Typology. Adviser's compromise plant typology was also presented and an agreement reached on the configuration of the system to be adopted. On such agreed upon basis, Snamprogetti would finalize the cost estimate, prepare time schedule for implementation and put the bid documents into final shape before end Dec. 1986.

- (iii) Comments and recommendations were submitted by Adviser to TPDC concerning other draft documentations prepared by Snamprogetti under the basic engineering package, including "Instruction to Bidders", and "Contract Agreement (with successful bidder)"

Recommendations included adding to the gas quality guarantee the necessity to be free from dust, gum, oil and imperities - Test runs performed on ... capacity of gas treatment plant and not partially on the capacity required by KILANCO - More justifiable liquidated damages in case of non-fulfillment of the process guarantees versus an unfair issue - More justifiable compensation in event of completion time delays - more reasonable payment conditions with progress payments relevant to work progress - and a reasonable performance bank guarantee in favour of Owner (TPDC).

(18-1)



KEY MAP

Scale 1:500.000

Fig. IV.11.14


28-4-82 ISSUED FOR CONCEPTUAL AND OPTIMIZATION STUDY

*Mox...*

REV.	DATE	DESCRIPTION	BY	CHKD	APP'D	NO. OF	TOTAL APP'D
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**Snamprogetti**

**SONGO - SONGO PROJECT  
GAS GATHERING AND TRANSMISSION**

**GAS GATHERING NETWORK**

**T. P. D. C.**  
TANZANIA PETROLEUM  
DEVELOPMENT CORPORATION

PROJECT No.	DRAWING No.	REV.
30		

REPLACES	JOB No. 470700	SHEET No. 1:25000	SYSTEM No.	
REPLACED BY	DWG No. GB-4E-70501			

Recommendations were agreed upon by TIDC and relayed to Snamprogetti during the visit of their delegation in November 1986 to amend according.

Constraints:

The financing of this project by the Italian Government and, thereafter its implementation is dependent on the conclusion of the final financing arrangement of MILANCO project.

3.3. Ammonia/Urea Plant

This project at present is at stand still pending the decision of the Paris Club for financing. The decision is expected early 1987 after the conclusion by the World Bank of the analysis of financial and economical aspects with a view to issue a complete comprehensive assessment of the project.

II - Monitor Progress and Quality Control Procedures:

3.4. Production of Lubricants:

(i) The report on the description of new Lube Blending Plant and the progress of constructions submitted to TIDC in September 1986 covered design criteria, description of facilities and the flow of empty and filled packages.

On the design concept, report indicated that AGIP(?) avoided the use of facilities usually recognized in modern blending plants such as mechanical separation in the transfer of base oils on receipt and efficient heating system - which when adopted would lead to higher operating efficiency and product quality preservation. Transfer of base oils from port was done by a multiproduct pipeline which could result in product contamination. Mechanical separation system could have been better since the distance between the delivering (ship) and receiving (tanks) stations is only 800 mts.

Hot water system was also introduced as the heater type for product heating, which is a low efficient system because the total heat content (BTU per lb) of hot water is very low in comparison to that of steam.

Technical Advisor - during his previous service in Tanzania - has in 1982 cautioned against these operating systems. Many other drawbacks were also indicated in the report.

Report dealt also with the operations likely to take place after the commissioning of plant - the filling operations and empty packages.

Recommendations were given on the appropriate specifications of containers (drums, food type cans, jerrycans), types of closures and reshipper cases.

Quality control procedures were also discussed and the report gave particular recommendations including the importance of Repeatability of physical and chemical tests in the plant laboratory to ensure accuracy. Duplicate results by the same technician using the same instrument was advisable. Results would be considered suspect if their difference were found greater than the international reorganized standards. A table was provided for such limits against tests of kinematic Viscosity, Apparent Viscosity, Pour Point, Flash Point, sulphated Ash and Total Visc Number.

- (ii) The setting up of the lube plant for Tanzania, was intended to reduce the foreign cost of imported lubricants. At present prices, the saving in foreign exchange amounts to 26%, yielding some US \$ 4.8 million per year based on the foreign exchange allocated to Industry in 1985 of 20 million dollars. However, another good amount of foreign exchange would be spent annually on the importation of raw material for the manufacturing of empty containers. One area within the container setup for the lube plant drew the attention of UNIDO Advisor for its considerable share in the foreign exchange expenditure - the "drum". At present (1986), the cost of imported raw material to manufacture one 200 - litre drum was US \$ 15. A used drum is worth T.sh.2000 (\$45. at 1986 price. Considering the need to manufacture initially 81,400 drums annually, to be increased to 122,000 drums when lube plant attains its full design capacity (30,000 MT/Y), then Tanzania would be spending some US \$ 2 million per

year on raw material for empty drums.

Advisor proposed accordingly to setup a Drum Reconditioning Unit at the Lube blending plant to clean and reuse the empty drums recollectd from consumers, thus saving a substantial foreign exchange of US \$ 2.0 million per year and avoid the possible shutdown of blending facilities in the case of interruption of imported raw material for drum manufacturing.

A paper was presented to TRDC on this proposal providing the design concept, machinery required and estimated investment cost for ready implementation when appropriate. It was envisaged that implementation could start in 1990 whereby enough empty drums would be available for collection by the marketing oil companies. The total estimated cost for the unit of US \$1.35 million was envisaged to be paid back in less than a year (8 months) which is very attractive. The proposed drum reconditioning facility - as indicated - would represent an indigenous source of supply of empty drums; would reduce package cost, yielding more revenues; and would tend to boost the blending capacity of the plant and eliminates the risk of shutdowns.

3.5.

Production of Bitumen

Constraints:

Implementation awaits the release of funds by the Italian Government which is expected in early 1987. The Italian Government has shown interest in this project and pledged to finance.

3.6.

Production of Ammonia/Urea:

Constraints:

No progress has been made for the implementation of this project pending the conclusion of financing requirements.

III - Improving Product Supplies and Distribution  
3.7. Strategic Petroleum Deposits:

(1) Schedule of implementation that was discussed and agreed upon during the meeting in TRDC with Ingre

delegates was as follows:

phase 1 - Makabako (14000 cu.mt.)

phase 2 - Mwanza 10,000 cu.mt. and Bukoba (5000 cu.mt.)

phase 3 - Isaka (10,000 cu.mt.) and Musoma (5000 cu.mt.)

phase 4 - DSM (25,000 cu.mt.) and Tanga (30,000 cu.mt.)

- (ii) In their proposal given to Minister of Energy and Minerals, agreed upon sequence of implementation was confirmed as well as preliminary cost estimates for each phase and the percentage of T.sh. involved in each case. It was also indicated that TPDC would carry out technical obligations including transport of equipment DSM/depot site - roads and infrastructure water, sewerage and electricity connections - civil works except for equipment foundations and exemption from all taxes and customs duties.

Adviser presented on 13.10.1986 a complete report on this proposal including the costs involved for TPDC obligations which were identified by Adviser in details. The report also pointed out to the need to revise the forecast throughput for each of the additional depots (Isaka, Bukoba, Musoma and DSM). Adviser indicated that Isaka would affect previous figures for Mwanza since supply Shinyanga Region now made from Mwanza - Likewise if supplier to Mara and Kagera Regions are resumed from Kenya to feed Musoma and Bukoba depots then Mwanza would again be affected.

Adviser revised throughput of Makabako and information relayed to Ingra in Yugoslavia to enable proceed with their initial plans for this depot being given priority as phase I.

- (iii) The basic engineering drawings prepared by Ingra for Makabako Depot and presented to TPDC in end November, 1986, were revised and discussed, with Ingra representatives. Many modifications were introduced by Adviser including the need to apply API standard No. 650 for atmospheric tanks instead of API 620 for low pressure tanks used in the design of storage tanks. Floating roof for gasoline tanks were also identified instead of fixed roofs. Shape of roof and bottom for the storage tanks were also changed. Fuel oil tank was also eliminated based on Advisers report

of 13.10.1986 and the relevant boiler was also cancelled. Adviser's report by Ingra representatives a proposal for a better plot plan of the depot featuring improved location of facilities for better operation and reduced costs. Adviser's recommendations were accepted and endorsed under a protocol of minutes of meeting and agreement concluded between Ingra and TPDC.

### 3.8. Petroleum Products Distribution Study

Comments and recommendations of Adviser were considered in the review of draft contract agreement with consultant's representative in end September, 1986. Based on the statistics developed and trend lines, a detailed five year forecast and less detailed projections over a ten - year horizon of demands would be prepared by Consultant. The examination of facilities for distribution in the country is expected to establish the optimal distribution pattern to meet the forecast demand patterns. It is also expected to quantify and prioritise investment requirements for the facilities needed to achieve an optimized distribution system.

### 3.9.

#### Domestic Gas Utilization Study:

Draft agreement with consultant was reviewed in detail in meeting with consultants' representatives held at TPDC and in which Adviser participated fully.

The objective of subject agreement/study is to develop a complete plan and programme on the technical, economic and financial aspects of domestic utilization which will result in maximizing the benefits to the Country's economy by substitution of imported oil and oil products.

The primary and principal market for natural gas in DSM have been identified in six areas:

1. Doojimboto area.... Fertilisers and fibre processing plants.
2. Umujo Industrial area... Textile mills, Industrial Jonds
3. Vaso Hill region..... Cement factory
4. Pugu road Industrial area-retail processing factories, glass plants and other large energy users.
5. Central City region..... Brewery and commercial (customers (hotels, restaurants).
6. Zambezi-Italian Petroleum)-Tloper refinery, DSM  
Refinery Refinery

It was also agreed that data gathering on energy consumption, data on equipment at industrial plants to be considered for conversion to natural gas - be entrusted to Tanzania Industrial Research and Development Organization (TIRDO) as sub-contractor to Consultants GDC, Inc, TIRDO would also make field scouting-surveys for the gas pipeline from Kilwa Kivinja (fed from Songu Songu field) to Dar es Salaam and in the soil investigations along the proposed route. In parallel with, and using information from gas market survey and conversion study, Consultants will carry out a feasibility study on CNG production and transportation.

Supply system costing shall be undertaken subject to the results of the market and conversion evaluation and the CNG supply scheme.

Upon completion of the first phase, TPDC and IDJ will review the findings and agree on arrangements for implementation of phase 2, which is Gas Development strategy.

This will include the preparation of an implementation plan reflecting the overall gas development strategy and consolidation of the findings in phase 1 - a project schedule which shall set out the construction schedule, financing requirements - and a manpower development plan.

### 3.10. Refinery Crude Oil Tank

Inspection shown some cracks in tank foundation. Report of Adviser to the Government officials and the Refinery indicated recommendation for repairs and other suggestions related to calibration and testing before putting into operation.

Repairs were carried out successfully and the storage tank was commissioned and put into operation in November 1986.



#### **4. FINDINGS AND RECOMMENDATIONS**

##### **4.1. Findings:**

- 4.1.1. Establishing the Ammonia/Urea fertilizer project (KILANCO) should be pursued till finalization of the remaining financial constraints. Revenues expected from this Complex are expected to increase the industrial GDP by US \$ 100MM annually from its startup. Further, the transfer of Songo Songo natural gas to the mainland would not materialize unless a fertilizer is setup. Consequently, the delay in take off of this project has an impact on future natural gas utilization.**
- 4.1.2. Setting up a Bitumen plant would help transform refinery excess residue into more refined products. Further, bitumen is most needed for the infrastructure of the country. Implementation of project must therefore, be pursued.**
- 4.1.3. A saving in foreign exchange up to 24% in the cost of imported finished lubricants would be realized upon the operation of the new Lube Oil Blending Plant. Taking into account the Forex allocated to Industry in 1985 of US \$ 20 million, a saving of US \$ 4.8 million is expected, which represents more than 50% of the outlay for the investment of plant.**
- 4.1.4. The expected fertilizer plant (KILANCO) requires the dedication of 70% of the proven reserves to its use, thus substantially effecting the long-term viability of gas supply to other potential users. Studies showed that a constant supply rate for Kilanco and other uses (100 MSCFD) could only be sustained for 15 years. Additional wells have to be drilled.**
- 4.1.5. Present proven gas reserve (726 bcf) are at a remote offshore field (Songo Songo) and unless the present prevailing scheme of pipeline gas transport for the expected fertilizer plant (KILANCO) is profited at this point of time to enable the transport of rest of reserve 216 bcf to the mainland when needed, it may be impossible in future - for technical and financial reasons - to develop another transport pipeline system.**

4.1.6. All geological indications are favourable for the discovery of further gas fields, both onshore and offshore. A number of exploratory wells are being drilled or are planned. While these are in reality exploring for oil, further gas finds would be a favourable consequence.

4.1.7. Natural gas displacing oil in domestic markets can provide significant economic benefits to the Tanzanian national economy. Conversion of DSM industry from use of P.O. to natural gas yields a present - worth saving (at 12% discount rate) of \$ 21.5 million. Clearly there is a strong incentive to convert DSM industry from P.O. to natural gas.

4.1.8. Compressed natural gas (CNG) could play a major role in substituting for high value gasoline and diesel fuel uses in the transportation sector in Tanzania.

4.1.9. The design concept of the new tube oil blending plant in DSM avoided the use of facilities usually recognized in modern blending plants. Imported base oil would be transferred from jetty by pipeline using the product - to - product pumping system rather than the more efficient mechanical separation. Heating system is done using hot water instead of steam for higher efficiency. These findings among others - were previously cautioned against its introduction, in 1982 during previous service of Adviser in Tanzania.

4.1.10. Inadequate storage in the country is seriously affecting production in the agricultural and industrial sectors on which Tanzania's economy depends to earn her much needed foreign exchange. Out of the total oil storage of 153,000 cu.ft. in the country, 72% (110,000 cu.ft.) is in DSM while the remaining 28% (43,000 cu.ft.) are scattered storage at 14 different locations upcountry. With the present insufficient transport facilities either by rail road or coastal and with the poor condition of roads, more petroleum depots become important to establish at strategic areas.

4.1.11. About 50% of imports of refined products to DSM are reshipped to Tanga depots for the demand of the region (Arusha,

Kilimanjaro, Singida and Tanga). Transport costs DSN/Ranga would amount to several millions of shillings (road transport rate is at present 7 sh./km/1000 lit. Distance DSN/Ranga is 354 km).

If demand is directly shipped from abroad to Tanga, substantial saving retransport cost from DSN) could be realized.

#### 4.2. Recommendations:

##### 4.2.1. Lube Oil Blending Plant

4.2.1.1. It is not advisable to ask the local drum manufacturer - as is being thought of by Agip (T) - to move one of their drum production lines to the lube blending plant area. Imported raw material (steel sheets and closures) for one drum costs US \$ 15. (1986) which is high and may not be availed all the time.

4.2.1.2. Instead, it is highly recommended to establish a Drum Reconditioning Unit at the blending plant to clean and reuse the empty drums disposed of by lube consumers which could be recollected by marketing oil companies. The saving in foreign exchange when setting up this unit amounts to some US \$ 2.0 million per annum, being the import cost of steel sheets and closures for drum manufacturing. Paper on this suggestion was submitted by Adviser to TPDC and Ministry with full description of design concept of the facilities required for implementation when appropriate.

##### 4.2.2. Bitumen Plant Project:

The Agreement between TPDC and Snamprogetti S.P.A. signed on July 17, 1985, for the design, engineering, procurement and construction of 30,000. T/Y Bitumen Plant in DSN Refinery, should be renegotiated for more reasonable and practical terms. A unique chance is available since it is stipulated that possible modifications to the terms and conditions could be agreed upon in case the Agreement does not come into force within 4 months from its signature. As stipulated, Agreement coming into force is dependent

on the conclusion of loan agreement to be financed by the Italian Government - which event did not happen to this date.

**4.2.3. Songo Songo Gas Gathering System and Pipeline**

**4.2.3.1.** Future gas finds are necessary at Songo Songo field in the event that gas would be required for other users than KILANCO. This would compensate for the rapid depletion of reserves that would occur then.

A long term viability of gas supply would require new well drilling in Block C (where present offshore wells are) and in the yet undrilled Blocks B, D and E said to be promising.

**4.2.3.2.** On starting the implementation of this project, TPDC should appoint a Field Project Team attached to TPDC site Representative (who will be consultants M.W. Kellogg) to attend to execution works and gain a unique "on-the-job" training. Team members would thereafter be the most suitable candidates to operate the new company GASCO.

**4.2.4. Strategic Depots Projects:**

**4.2.4.1.** Establishing strategic petroleum depots at Mwanza, Bukoba, Isaka, Musoma, Dar and Tanga to improve supplies to their regions, should be pursuit for implementation. Implementation proposal from Ingra/Montmontaza of Yugoslavia is very attractive and should be fully utilized without delay.

**4.2.4.2.** Tanga proposed strategic depot, should be considered for a marine terminal to receive direct imports of refined petroleum products (gasoline, illuminating kerosene and Gas oil) required for the Regions (Tanga, Arusha, Kilimanjaro and Singida). About 50% of the country's imports of refined products are consumed in Tanga, and are retransported from DSM. Significant transport costs DSM/Tanga could, therefore, be saved annually. Further, should supplies come from near port of Mombasa, Tanga marine terminal becomes more justified.

**4.2.4.3.** Procurement of potential sites at Bukoba, Isaka, Musoma, Dar and Tanga for their strategic depots should be finalized the soonest possible to profit from the attractive offer from Ingra of Yugoslavia, avoid further cost inflation and to provide Ingra with necessary data for the engineering design and for the infrastructure requirements.

APPENDIX - I

REPORTS AND PAPERS BY ADVISER

(copies were despatched to UNIDO in time)

- Crude Oil Storage Tank, Tiper Refinery - Report .....18.7.1986
- Agreement for 30,000. T/Y Bitumen plant-Report.....22.7.1986
- Petroleum Products Distribution Study-draft agreement...28.7.1986
- Songo Songo Gas Gathering Project - contractor  
agreement and bid documents.....13.8.1986
- Songo Songo Gas Gathering System and Pipeline -  
Conceptual design and Interim Report.....13.8.1986
- New Lube Oil Blending Plant, DSM - Report.....12.9.1986
- Drum Reconditioning, Lube Oil Blending Plant-Paper.....12.9.1986
- Depots Projects - Report.....13.10.1986
- Basic Engineering and Plant Typology Optimization  
Report, Songo Songo Project - Report.....25.10.1986
- Depots Project - Capacity and Pattern of Supplies.....9.2.1987

APPENDIX - II

**JOB DESCRIPTION**

US/URR/06/220/ 11-51.1.1.

<b>Post title</b>	<b>Technical Adviser</b>
<b>Duration</b>	<b>6 months</b>
<b>Date required</b>	<b>As soon as possible</b>
<b>Duty station</b>	<b>Dar-es-Salaam (Tanzania), with travel within the country.</b>

**Purpose of project** The government of Tanzania through the Tanzania Petroleum Development Corporation (TPDC) has decided to establish three major petroleum downstream plants: Ammonia/Urea, Bitumen and Lube Oil blending plant. Negotiations are under way and further technical assistance is being requested in order to complement the proposed investment and insure the successful implementation of the intended projects. This assistance will help streamline the industrial exploitation of the substantial gas resources which have a considerable potential for the country's economic development. The utilisation of the natural gas for the production of chemicals will contribute towards the country's development aims.

**Duties** The expert will be assigned to the TPDC and in consultation with all concerned parties he will:

- Assist TPDC in review of engineering packages for Bitumen and Ammonia/Urea plants and the Songo Songo gas gathering and pipeline system,
- monitor the progress and quality control procedures in the production of Lubricants, Bitumen, Ammonia and Urea and the plant performance during start up operation,
- assist TPDC in designing a system for collection, processing and analysis of product marketing and distribution data.

The expert will be expected to prepare a final report on his mission.

**Qualifications:** University degree in mechanical or chemical engineering with a minimum of 20 years of experience in designing and executing projects in the petroleum refining industry.

**Language:** English

**Background Information:** Since 1974 TPDC has been receiving UNDP/UNIDO technical assistance in developing the country's hydrocarbon resources, training of personnel and strengthening TPDC's structure and capability in formulating and implementing its development plans.

The government of Tanzania places high importance on strengthening the existing petroleum refining industry and promoting the development of down-stream chemical industries based on natural gas, substantial reserves of which have been discovered during the period of implementation of a UNDP/UNIDO project to support this sector (DP/UNT/74/020, Assistance to TPDC). The technical capability of TPDC has been significantly enhanced by the previous UNDP/UNIDO assistance. However, in view of the complex projects being planned to expand the petroleum refining industry and utilize the natural gas for chemical's production, and of the relatively high investment involved in these projects, TPDC considers it necessary to strengthen its staff with a petroleum processing adviser provided by UNIDO.