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ASSISTANCE TO TANZANIA PETROLEUM DEVELOPMENT CORPORATION

SI/URT/87/801

UNITED REPUBLIC OF TANZANIA

Final 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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United Nations Industrial Development Organization
Vienna

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Dar es Salaam
December, 1987

Mourad Y. Yostos
Technical Adviser
SI/URT/87/801

1. OBJECTIVES AND LOGIC OF PROJECT

1.1. The National Economy

Since the Government of Tanzania launched the three year "Programme of Economic Recovery (PER)" from 1986/87-1988/89, indications of economic recovery are becoming promising. The country's overall productivity in the economy (1986/87) excluding that of asmall-holder farmers, increased by 8.5%, a significant increase as compared to a meagre 0.2% increase in 1985/86.

The per capita Gross Domestic Product (GDP) productivity grew by 0.4% compared to a decrease of 0.7% in the previous year. However, according to a report issued by the National Productivity Council (NPC), such growth was outpaced by the country's population growth estimated at the rate of 3.2% a year, thus a net decrease of per capita GDP by 2.9%.

Sectors which recorded increased productivity were estate agriculture, energy, water supply, construction industry and public administration. On the other hand, dismal performance was registered in the manufacturing, mining, transport, trade and financial services sectors.

Estate agriculture productivity increased by 2.3%, a slight increase of 0.2% compared to the previous year. The sector, shows a general average increase at the rate of 3.4% a year since 1980. The trend is attributed to government policy according to PER, whereby more resources were being shifted from other sectors into agriculture and provision of incentive goods.

A robust productivity growth in the energy and water supply sectors is attributed to the on-going capital intensive investments in the sectors, especially the extension of the national grid in the electricity supply system. Productivity in the energy and water supply sectors is estimated to have grown by 9.8% last year, compared to 4.8% in 1985/86. However, the problem of recurrent power interruption continued to depress productivity in other sectors especi-

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ally manufacturing - a situation which would improve significantly by 1988 when connections are made to Kidatu hydroelectric power grid.

The productivity rate in the manufacturing sector decelerated from 13.1% in 1985/86 to about 2.5% last year, the lowest level since 1980. In the mining sector, productivity still showed deterioration despite reduced employment in the sector. Average productivity decelerated from 10.3% in 1985/86 to 5% in 1986/87. Frequent breakdown of the ageing machinery is a main reason. The mining sector, with its very high potential in contribution towards the GDP, remains largely untapped.

Following the agreement with the International Monetary Fund (IMF) in July 1986, there had been some benefits resulting from the Fund's provision of foreign exchange, including the purchase of railway engines, wagons and spare parts; the timely delivery of fertilizers and other farm inputs to peasants and eased crop haulage and reviving some of the local industries.

The Petroleum Industry in Tanzania, now embarking on several development projects, would make quite significant contribution to the objectives of the PER. Establishing export oriented industries such as the Ammonia/Urea Fertilizer Complex (KILAMCO) and the Bitumen Plant - both expected to be implemented soon - would greatly contribute in the increase of foreign exchange revenues. The Lube Oil Blending Plant - which went on-stream in early 1987 - has made significant saving in forex spent on lubes imports as well as ensured availability of products. Given the proven and available sources of hydropower and natural gas, the country could comfortably develop a non-import based power supply system to meet its requirements well into the next century, if given the necessary financial resources. Substitution of natural gas in displacing oil in certain sectors - industry and transport - could also reduce oil consumption.

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 UNDP/UNIDO project to support this sector (DP/URT/74/028, Assistance to TPDC). The technical capability of TPDC has been significantly enhanced by this assistance which ended in December,1984. However, in view of the complex projects being planned to expand the petroleum industry and to utilize natural gas for chemicals production, and of the relatively high investment involved in these projects, TPDC considered it necessary to strengthen its staff with a petrol tehcnical adviser provided by UNIDO. UNIDO, in June 1986, recruited for a short-term of 6 months the same Adviser (under US/URT/85/220) who previously served TPDC under Project (DP/URT/74/028). In July,1987, the same Technical Adviser was assigned again for another 6 months to assist TPDC in its important development objectives, and to ensure the successful implementation of its projects.

1.3. Objectives and duties

To promote the development of petroleum refining and related industries. The Government of Tanzania through the Tanzania Petroleum Development Corporation (TPDC) has decided to establish the following major downstream plancs which will greatly contribute towards the country's development aims:

-Bitumen Manufacturing Plant, 30,000 TPY, at Tiper Refinery Dar es Salaam.

-Gas Gathering System and Pipeline for transport of natural gas from Songo Songo Island to mainland and to a fertilizer project at Kilwa Masoko.

-Ammonia/Urea Complex, a world-scale plant using natural gas as feedstock, to be established at Kilwa Masoko.

-Seven Strategic Petroleum Terminals and Depots to improve petroleum products distribution pattern.

Consequently, further technical assistance for TPDC was requested from UNIDO in order to complement the proposed investment and insure the successful implementation of these projects, expected to start soon. UNIDO Technical Adviser arrived to duty station on 11 July, 1987, and started his duties attached to TPDC-Directorate of Marketing and Investments. Job Description is shown under Appendix-I. It is to be noted that the Lube Oil Blending Plant mentioned in Job description, has already been established and put on-stream in January, 1987, an important project which was one of the duties of this Technical Adviser serving previously under Projects (DP/URT/74/028 and US/URT/85/220). The other duty mentioned also under job description "assist TPDC in designing a system for collection, processing and analysis of product marketing and distribution data" was found undertaken by a Marketing Expert provided to TPDC by STATOIL of Norway and sponsored by NORAD. It was assumed, therefore, that the task could be substituted with another on the implementation of strategic depots which would likely improve the distribution and supplies of petroleum products in the country.

Duties would accordingly be as follows:

-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 Bitumen, Ammonia and Urea and the plant performance during start up operations.

-Assist TPDC in the design, procurement and implementation of strategic petroleum depots to improve the

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distribution and supplies of petroleum products in the country.

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2. ACTIVITIES AND OUTPUT

According to project document, the Project was involved in the following activities, the outputs of which are identified:

2. Activities and Outputs:
SCHEDULED:

2.1. Bitumen Plant Project:

As was mentioned by Adviser in his final report in January 1987 (under Project US/URT/85/220), the Italian Government agreed in 1983 to provide funds for updating a previous feasibility study on setting up a bitumen plant 30,000. MT/Y capacity, at DSM Tiper Refinery. Consultants Snamprogetti SPA were commissioned to submit a Techno-Commercial proposal for engineering services required for this plant. The updating study report was prepared in 1985, confirming the viability of establishing a bitumen plant 30,000 TPY. In end 1986, an addendum to the contract agreement was signed between TPDC and Snamprogetti including modifications to the investment cost for inflation and devaluation of the Dollar as well as the inclusion of additional facilities, thus bringing up total investment required to US $27.66 million instead of the previous figure of $16.2 million in 1985.

Since the date of that addendum, the Ministry of Energy and Minerals has been in continuous contacts with the Italian Government to finalize the required financing which became complicated due to the increase in the total investment costs by US$11.46 million.

In September, 1987, the Management Committee for Technical Cooperation of the Italian Ministry of Foreign Affairs, decided to raise the Italian contribution for this project to US $27.66 million, and the Tanzanian Government was advised formaly.

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Output:

Following the approval of the Italian Government to raise its contribution to cover the required investment costs for the bitumen plant project, it is anticipated that implementation would start beginning 1988.

Snamprogetti has started in November 1987 preparing the detailed engineering. Technical Adviser revised Snamprogetti preliminary engineering package to prepare for their detailed engineering which could not be despatched to TPDC before the end of Project. Contacts on technical matters were going on with Snamprogetti, connected with the detailed engineering under preparation.

2.2. Songo-Songo Gas Gathering System and Pipeline:

The development of the pipeline project which will feed natural gas to the ammonia/Urea plant from Songo Songo, has been proceeding in parallel with the development of KILAMCO. In 1985, the Italian government provided a grant of US $4million for pipeline route surveys and basic engineering design, and in 1986 it made a firm commitment to finance the pipeline system's construction. The bid documents for construction have now been prepared and the pipeline cost estimate was figured as US$60.million.

In 1987, during an assessment of the KILAMCO Project, the world Bank proposed that with the actual proven reserves at Songo Songo of 0.762 trillion cu.ft (Tcf) consideration should be made to:

*dedication kilamco's needs on a 20 years life basis (as opposed to 25 years)

*allowance of the remaining reserve to be made available for the power and domestic sector.

Accordingly, the basis of the Gas Gathering and Pipeline

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System had to be revised.

Further, M.W. Kellogg Co. - KILAMCO turnkey contractor and assigned half of Agrico's (former joint venture partner) shares, in the venture - made in mid 1987 a technical evaluation of Snamprogetti's bid documents and suggested an alternate skid mounted approach for the gas treatment plant in an effort to reduce the overall costs.

Once Kilamco's financing is in place, the Italian government will be in a position to provide the committed funds.

Output:

Adviser revised the technical evaluation report of M.W. Kellog Co. on Snamprogetti's bid documents which were previously checked by Adviser and reported to TPDC in October, 1986.

2.3. Ammonia/Urea Complex (KILAMCO):

In the process of negotiations with potential lenders for this important project in 1986 and 1987, the various parties expressed the opinion to reduce the estimated capital costs and TPDC equity shareholding to make the project more attractive financially and economically. Other issues included the sharing of risks and rewards among the different lenders and shareholders and set conditions for their participation. Export credit agencies, in mid 1986, resolved also that they would make firm commitments to finance project if the following conditions are met:

1. Kilamco receives the blessings, of the World Bank and IMF.

2. Project's capital cost reduced significantly from the then US $478.million.

3. Project exempted in advance from future Paris Club rescheduling of Tanzania's debts.

4. Tanzania demonstrates ability to meet its equity.

At the end of December, 1986, Agrico (joint venture partner) withdrew because of facing financial difficulties, and its shares were assumed by M.W. Kellogg Company (turn-key Contractor of the project) and another American company (Transammonia) accepted to join Kilamco as shareholder (replacing Agrico) and as distributor of products.

The World Bank made an assessment of Kilamco project according to an official request from the Tanzania government to review the project. The World Bank assessment report - final version - was presented to the government in end May 1987, following which a large group representing export credit agencies and development finance institutions met in London in July, 1987, to discuss the latest status of the project and to indicate their respective positions.

Output:

None, due to above prevailing circumstances.

2.4. Strategic Petroleum Depots:

In 1986, the Tanzania Government decided to establish strategic petroleum terminals/depots at Makambako, Mwanza Bukoba, Isaka, Musoma, Dar es Salaam and Tanga, to overcome the current product supply problems and to improve product distribution.

Ingra/Montmontaza Company of Yugoslavia showed keen interest in the implementation of project and presented in end 1986 a financial/engineering proposal in which Adviser participated profoundly. After various meetings, a protocol of minutes of meeting and preliminary agreement

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was concluded between Ingra and TPDC in end 1986, and Ingra started preparing detailed engineering.

In August, 1987, Ingra advised the ministry of Energy and Minerals that upon the request of the Yugoslav financial institutions, the project would be financed under certain conditions, including mainly- except contract guarantees for the credited part of the contract - to provide counter deliveries of some goods (cotton, tea, coffee, cocoa beans and sisal). The Minister replied that it will not be possible to make such countertrade arrangment as a means of repaying the loan as this was against government present policy. Ingra's proposal was in fact a departure from the earlier agreement, and TPDC is now looking for other interested companies for financing and implementation.

Output:

Following the apparent withdrawal of Ingra from their committment with TPDC, Adviser presented in October 1987 a memorandum to TPDC Managing Director suggesting for TPDC to start approaching others interested in financing and implementation including Toyo Minka Kaisha Ltd., who has been previously in contact with TPDC on the implementation of some depots. The memorandum also recommended to speed up the acquiring of sites in Tanga, Isaka, Musoma, Bukoba and Dar es Salaam.

2.5. Petroleum Products Distribution Study:

Loûis Berger S.A.R.L. - a French consultant commissioned in 1986, by the World Bank (and study financed by the International Development Association, IDA) to carry out a study examining the current domestic demand for petroleum products, develop statistics and conduct examination of distribution facilities and give recommendations - presented Draft Final Report to TPDC in July 1987 for review and comments, in 317 pages.

Output:

Technical Adviser reviewed Louis Berger Draft Final Report and submitted to TPDC on 1st September, 1987, a full report with comments and recommendations.

2.6 Domestic Gas Utilization Study:

In November 1986, GDC Inc. of USA was entrusted a domestic gas utilization study under a technical assistance credit granted to Tanzania by the International Development Association (IDA) of the World Bank Group. The study included a gas market survey and conversion study for major fuel oil consumers in Dar es Salaam to establish potential industrial gas market and the relevant investment required for the conversion of the industrial plants into gas usage. Also, a compressed natural gas (CNG) pilot project to be launched as a forerunner of a gas pipeline supply from Songo Songo.

The scope of work of consultant was to encompass three phases:

-phase 1: Data consolidation and strategy of gas supply.
-phase 2: Gas markets identification, utilization and supply - under 3 tasks:
  * Task 1: market identification and evaluation.
  * Task 2: conversion of industrial facilities to natural gas.
  * Task 3: evaluation of compressed natural gas (CNG) schemes.
-phase 3: Development of implementation plan and strategy.

In end February 1987, GDC prepared its Interim Report presenting its findings, conclusions and recommendations for phase 1 and tasks 1,2 and 3 of phase 2. According to the Agreement with TPDC, GDC would only carry out phase 3 if TPDC finds the findings and conclusions of phases 1 and 2 satisfactory.

Output:

Adviser reviewed GDC Interim Report presenting findings, conclusions and recommendations for phases 1 and 2. In November, 1987, TPDC conveyed its comments on the interim report to the World Bank and to the Consultant, stating that report had to be upgraded. Consequently phase 3 of the study could not be assigned for the time being.

UNSCHEDULED:

2.7 Crude Oil Processsing Agreement

The present Crude Oil Processing Agreement between TPDC and Tiper Refinery in DSM, is a "cost-plus" payment agreement with unfavourable terms that lack proper control on actual expenditures by the Refinery. Annual expenditures have been continuously increasing resulting in the rise of operating costs.

Adviser was, therefore, asked to review subject Agreement and report findings and recommendations to TPDC.

Output:

Adviser made a thorough review of the Crude Oil Processing Agreement and presented his report to TPDC in end July, 1987, with comments and recommended ammendments, identifying the various obligations and responsibilities of each party.

2.8 Sales/Purchase Agreement:

Sales agreements - renewable every 5 years - were previously entered between TPDC and the five oil marketing companies: BP, Agip, Caltex, Total and ESSO, for the marketing of petroleum products processed from crude oil in DSM refinery and imported refined products.

The Sales Agreements concluded since over than 10 years need to be revised and updated and Adviser was asked by TPDC to participate in such revision.

Output:

Adviser participated in the review of Sales Agreement and in the discussions with the oil companies in August and November, 1987 to reach an agreed upon version.

2.9 Kilwa Kivinje/DSM Gas Pipeline Feasibility Study:

Consequent to the failure of GDC, Inc., to present a successful Domestic Gas Utilization Study on phases 1 and 2 (Activity 3.6), it was recently decided by TPDC to embark on a feasibility study, in place of phase 3 of the Domestic Gas Utilization Study, with the work to be given to the Cambrian Group of companies (M/S Hardy BBT Ltd., Canada) provided that they carry out the study for both steel and aluminium pipes for the gas pipeline to supply DSM. The study will be financed by CIDA (Canadian Int. Development Agency). With this arrangements, Tanzania can benefit by getting some financing from the Canadian Government.

Output:

Adviser particpated in the discussions with delegates from M/S Hardy BBT Ltd. on the study requirements and the arrangements needed for such an agreement.

3. ACHIEVEMENTS OF IMMEDIATE OBJECTIVES

In persuance of the duties specified under Project document, the following have been achieved by UNIDO TECHNICAL ADVISER:

I - Scheduled:

3.1. Bitumen Plant:

Following the approval of the Italian Government to provide the necessary funds for the project, Snamprogetti are now preparing the detailed engineering for implementation.

No constraints are now hindering the implementation, and construction of plant is expected to start early 1988. Schedule for project, shows execution, commissioning and startup would take two years.

Constraints: None.

3.2. Songo-Songo Gas Gathering and Pipeline System:

The World Bank's report setting out their review of the Kilamco project, requested Tanzania consideration of gas utilization not only for Kilamco but also for purposes of power generation and possible use by industrial and commercial sectors in Dar es Salaam.

Based on this, it was decided to rationalize the Gas Gathering and Pipeline System that would be required to deliver gas from Songo Songo to the mainland, and it was resolved that the revised basis of the system should be:

1. The overall gathering and delivery system should be sized for 100 MMSCFD. This would include:
   a) The flowlines from wells SS-3,4,5,7 and 9 would be sized and installed to accomodate the increased capacity from 65 to 100 MMSCFD. This means to increase diameter of flowlines to 10" or 12".

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The size of wellhead separators will also have to be increased.

b) The gas treatment plant would be sized and installed to accomodate the increased capacity from 65 to 100 MMSCFD.

c) the submarine gas pipeline would remain as presently designed, with a capacity of 100 MMSCFD.

d) At the chosen landfall on the mainland at Kilwa Kivinje, the pipeline delivering gas to Kilamco at Kilwa Masoko would remain as presently designed with a capacity of 65 MMSCFD.

e) A flanged connection would be provided at the landfall at Kilwa Kivinje for the future connection of the proposed DAR es Salaam pipeline for an anticipated gas supply requirement of 35 MMSCFD.

The foregoing changes in the system configuration, will have an impact on the complete design package and the cost increase could be an increase of about US$ 3.0 million.

A further development came from M.W. Kellogg Company - Kilamco turnkey contractor and partner - on examining of project document. They suggested that the scope of the treatment plant can be reduced significantly by using a skid-mounted approach which would change the plant operation to an un-attended operation. On this basis, many facilities would be eliminated such as a 600m^2 building, guard house, fire station, air compressor system, waste water treatment system, potable water system, water well and bulk TEG storage - reducing Snamprogetti design by 75%. The overall cost savings would in this case be quite substantial.

Snamprogetti were requested by TPDC to review Kellogg's approach and provide TPDC with their comments and cost estimate.

Constraints:

The financing of this project by the Italian Government, and consequently its implementation, is dependent on the take-off of Kilamco project.

3.3. Ammonia/Urea Complex:

The final assessment of the World Bank to this important project was quite positive. It said the project has the potential for a high financial rate of return to the Government on its investments, a reasonable return to outside investors and ample coverage of external debt.

Several meetings were convened in London, following the issue of the World Bank assessment, and attended by a large group of credit agencies and development finance institutions. The meetings had the purposes to discuss the latest status of Kilamco project after the release of the World Bank Assessment Report, and to have the lending agencies and institutions to indicate their respective positions. The general conclusion of the meetings was to ask the Tanzania Government to provide its equity share and the need to obtain adequate reassurances to prevent inclusion of Kilamco debt in any possible future rescheduling of Tanzania debt. In the meetings, UK was prepared to make available a credit of US$130 million, Yugoslavia to make available US$37.5 million (which may be increased to US$100 million if their supplies package could be increased) and Belgium confirmed the availability of US$ 75 million. Other countries would indicate their possible committments before the end of the year.

Constraints:

The Government of Tanzania is currently arranging for the provision of the equity share in foreign exchange of US$ 10. million per year during the three year construction period. The local cost component is estimated at equivalent to US$ 20 million, and TPDC has been setting aside

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some resources for this purpose.

The reassurances of Paris Club to prevent inclusion of Kilamco debt in any possible future rescheduling of Tanzania debt would pose no problem as most of Club Delegates expressed acceptance.

It is envisaged, therefore, that TPDC would be able to provide shortly its equity share and that more lender confirmations would be secured and project could then take off in early 1986.

3.4. Strategic Petroleum Depots:

It was not possible to make a countertrade arrangement with the Yugoslav financial institutions - as was suggested by Ingra Company for the construction of the seven strategic depots and the substitute was then to look for other partners to finance and implement the project.

As was suggested by Adviser, TPDC made contacts with Toyo Minka Kaisha Ltd., who are now studying the subject.

Constraints:

Implementation depends on locating interested partners who are able to finance and construct the startegic terminals/ depots. Sites for depots at Tanga, Bukoba, Isaka, Musoma and Dar es Salaam remain to be procured.

3.5. Petroleum Products Distribution Study:

The report of Technical Adviser on Consultant Louis Berger's Draft Final Report on this study, provided comments on the executive summary as well as on each chapter. Main parameters of Consultant's estimates of growth rates for petroleum products were based on issues of overall growth in GDP, balance of trade and foreign exchange earnings and investment rates. Consequently growth in white product potential was low. Adviser pointed out in his report that given the central role of agriculture in the Country's Economic Recovery Programme, the Government target under ERP of one million MT of crude oil equivalent, the envisaged establishing of bitumen plant in two years time and which will have an impact on the country's infrastructure, and the expected diversion of trade to land locked neghbouring countries via Dar es Salaam port, would likely boost the growth rates b beyond consultant's projections.

Construction costs estimated by Consultant for the strategic depots were roughly calculated and not representative. Technical terms were not properly worded; some recommendations given on the responsibilities of dealers and agents were not justifiable; some suggestions for streamlining Tiper Refinery to oil companies depots were not practical, etc.

Based on these comments and others, TPDC replied to Consultant and the World Bank to enable consultant put his report in final shape.

3.6. Domestic Gas Utilization Study:

The summary of findings and conclusions of GDC Interim Report on this study were as follows:

*On gas supply: the proved natural gas reserves in the Songo Songo field remaining after the Kilamco volumes are reserved would be adequate to provide an average of 20-25 MMSCFD for the Dar es Salaam market. The prospects for producing the gas classified as probable reserves are good and the total reserve estimates may be increased after some production experience is gained.

*Potential markets existing are: industrial, power, refinery fuel, and transportation.

*On conversion of industrial facilities to natural gas: a survey of the 16 largest industrial fuel consuming industries indicated that it is technically feasible to convert all of the fuel burning equipment to natural gas. At an estimated delivered gas price of US$2.00 per Mcf and an O&M cost differential between oil and gas operation of 5% of the new equipment cost, conversion would be economical and the resulting computed simple paybacks for each industry would be less than 3 to 4 year.

*Natural gas could be used to fuel new thermal power station, thus delaying the construction of new hydroelectric generation.

*It is technically feasible to convert the equipment at Tiper refinery which is burning F.O.

*The transport market for natural gas is based on using compressed natural gas (CNG) as a vehicular fuel. Initially DSM buses (UDA) could be converted, followed by retrofitting of trucks and lighter vehicles.

*Planning for a CNG"stand-alone" project (utilizing a marine transportation system to deliver CNG to DSM) would require a very extensive marine delivery infrastructure and becomes economic.

*Planning for a "pre-pipeline" project should be deferred until the Gas Utilization Study is completed (phase 3) and the economic feasibility of using CNG in the transportation sector is confirmed.

Commenting on the report, it did not contain detailed analysis and backup information for the conclusions reached. Adequacy of gas reserves and delivereability to meet peak and average demands was not well established. CNG study also lacks detailed economic/financial analysis. To give a clear indication on the project viability a preliminary pipeline cost estimate and economic analysis would have been helpful to confirm the theoretical assumptions under phase 2 of the study.

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Consequently, findings and conclusions under phase 2 of the study could not justify commissioning GDC to perform phase 3, and consultant was asked to upgrade his Interim Report.

II - Unscheduled:

3.7. Crude Oil Processing Agreement:

Adviser made a review of the present Crude Oil Processing Agreement between TPDC and Tiper Refinery in Dar es Salaam. Actual expenditures by Tiper against the budgeted were also reviewed. Big variances were noticed between the expenditures and the budgeted, which signified that a "Cost Plus" payment agreement was not in favour of the User (TPDC).

Adviser submitted to TPDC in July, 1987, a report with his views and comments, together with provisions and ammendments that need to be affected to the present agreement, and recommending a substitute with a "Cost per Barrel (or MT)" agreement.

3.8. Sales/Purchase Agreement:

The Sales Agreements concluded since 10 years between TPDC and the 5 marketing oil companies in the country, was due also to be revised, its renewable data (every 5 years) being due. Adviser participated in its review and presented his recommendations and the draft revision conveyed to the marketing oil companies. Joint meetings with oil companies were also convened.

3.9 Kilwa Kivinje/DSM Gas Pipeline FeasibilityStudy:

The Domestic Gas Utilization Study (Activity 3.6) indicated that there is a potential market in DSM to benefit from the substitution of imported oil and oil products by natural gas, thus improving the country's economy in reducing the outflow of foreign exchange.

Phase 3 of the Domestic Gas Utilization Study was concerned with the development of a gas supply system to

Dar es Salaam, subject to the results of tasks under phase 1 and 2 of the study which tasks were not successfully conducted.

TPDC had, therefore, to embark on a feasibility study for subject gas pipeline system from Kilwa Kivinje to DSM and agreed to commission Hardy BBT Ltd, Canada, to carry out the new study. Adviser was, therefore, asked to prepare a Terms of Reference for this feasibility study and which was prepared in end November, 1987, and delivered to Consultant for review and endoresement with the agreement to be signed later in around February, 1988, together with the securing of CIDA finance. Feasibility study is estimated to take some 6 months.

****

Progress Report

A three months progress report on TPDC various development projects during the period 11 July - 11 October, 1987, was prepared and submitted to UNIDO.

4. FINDINGS AND RECOMMENDATIONS

4.1. Findings:

4.1.1 Significant changes has been made to the original concept of KILAMCO fertilizer project to make it more attractive to lenders. The estimated capital cost has been revised downward to US$ 425 million instead of the previous revision of US $478 million. In the shareholding structure, TPDC's eqity share in the venture was reduced to 51% with 8% non-voting until the project debt is repayed.

Conditions fixed by the British Belgian, French and Yugoslav export credit agencies being necessary for them to make firm commitments to finance project (Kilamco to receive the blessings of the World Bank and IMF on project - reduction in capital cost - project exempted in advance from future Paris Club rescheduling of Tamzania debts) were met except for the condition of TPDC to meet its equity payment obligations which issue is now persued by the Government. TPDC's foreign exchange equity requirements will be about US$ 10 million per year during the three-year construction period.

4.1.2 Extensive revision of the 1981 Joint-Venture Agreement for the KILAMCO Project will be required in order to reconsile the different interests and philosophies of the financial participants, once the project takes off and before its physical implementation.

4.1.3 There exists sufficient gas at Songo Songo for both the fertilizer and power consumption until well past the year 2000, and that the additional costs of securing both Kilamco and domestic users over the lifetime of the project are reasonable. This reportedly has been confirmed by ECL.

4.1.4 Following the World Bank assessment report on KILAMCO and its proposal to TPDC on the dedication of the Songo Songo proven gas reserves, it becomes necessary

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now to review and redesign the gas collection and treatment facilities at Songo Songo to serve both KILAMCO and domestic users in Dar es Salaam. Preliminary indications from ECL show that the existing wells are adequate to start the project provided they are reworked and the tubing replaced with a larger gauge.

4.1.5 The report of ECL in May 1987, on Songo-Songo gas field and the possible alternative pipe route to the mainland, shows that the 14" offshore (submarine) pipeline Songo-Songo/Kilwa Kivinje as selected by Snamprogetti is the most optinum pipeline design to suppy gas to both KILAMCO and Dar es Salaam.

4.1.6 The proven natural gas reserves in Songo-Songo field remaining after reserving the needs for KILAMCO, would be adequate to provide an average of 20-25 MMSCFD for the Dar es Salaam market.

4.1.7 The prospects for producing the gas classified as probable reserves in Songo-Songo field, are good. Total reserve estimates may increase after gaining more production experience.

4.1.8 The scope of the gas treatment plant at Songo Songo can be reduced significantly by using a skid-mounted approach rather than the conventional. This would change the plant operation to an un-attended operation, reducing design by 75% and consequently substantial savings in the overall cost.

4.1.9 Small but significant, potential markets exist in DSM for natural gas. The base case potential demand in the industrial market sector is 7MMCFD, to increase to 19 MMCFD by year 2000.

4.1.10 It is technically feasible to use natural gas in the transportation sector to fuel city transit buses, light and heavy duty vehicles. The economic feasibility of using CNG in the transportation sector is yet to be confirmed.

4.1.11 Preliminary analysis indicates that a natural gas pipeline to transport gas from Kilwa Kivinje (the landfall of the transmission pipeline from Songo-Songo field) to Dar es Salaam is feasible, but should still be confirmed technically and economically.

4.1.12 Tankage product re-allocation at marketing oil companies is done without referring to TPDC for approval. In many cases re-allocations do not meet with international safety regulations, thus rendering their depots unsafe and hazardous to surrounding areas.

4.2 Recommendations:

4.2.1. The Bitument Plant Project is expected to take off in early 1988. It is important that TPDC appoints a field project team attached to Snamprogetti team on site. Team members would have a unique chance for an "on-the-job" training during the construction work, precommissioning, commissioning and start-up operations.

4.2.2. On starting the implementation of KILAMCO project, a field project team should be appointed to follow up the various phases of implementation. On -site TPDC representative should also be stationed to monitor the work progress.

4.2.3. The skid mounted approach, changing the Songo Songo gas treatment plant operation to an un-attended operation is very much recommended than the conventional design of Snamprogetti. The benefits of this configuration are the substantial reduction in field piping and field installation work and plant area, the pre-testing of process modules, instrumentation and controls at the fabrication centres prior to shipment. The main control panel will shut the plant down in a safe condition in the case of an upset. The overall cost savings is expected to be also

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quite substantial, adding to the benefits of the concept thus making it worth the implementation.

4.2.4 The hydrocarbon exploration programme should be continued, with one of the goals being to find additional gas reserves for the Dar es Salaam market.

4.2.5 The economic and financial analysis of the potential markets for natural gas in Dar es Salaam should be persued for a detailed study to confirm those potential markets which are economically and financially feasible.

4.2.6 With the new lube oil blending plant in operation for almost a year, TPDC and Agip (T) should think of establishing a Drum Reconditioning plant to clean and reuse the empty drums to be collected from consumers. Imported raw material (steel sheets and closures) for new drums is becoming more expensive, with shortages sustained from time to time. Setting up of a drum reconditioning plant would save the country some US $2.0million per annum in foreign exchange. Paper by Adviser on this proposal was submitted to TPDC and MEM in september, 1986.

4.2.7 Procurement of potential sites for the strategic terminals/ depots at Dar es Salaam, Tanga, Bukoba, Isaka and Musoma is still an outstanding issue and have to be finalized in order to reflect on the approached financing and implementing institutions the seriousness of project.

4.2.8 The construction of a railway siding at Kurasini, Dar es Salaam decided upon in 1984 to enable transport of products to the south-west industrial areas (including future Makambako depot) has not yet materialized. TPDC should pursue this important issue for implementation the soonest possible.

4.2.9 The present "Cost Plus" payment "Crude Oil Processing Agreement" - is not to the benefit of TPDC. TPDC should consider negotiating with Tiper Refinery a "Cost per Barrel - or per MT" agreement instead.

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4.2.10 A Tanzanian Petroleum Code to govern the safe storage and handling of petroleum products and liquefied petroleum gas in the country should be established by TPDC. This national code is very much required to enable the control of adequate safety distances and regulations in new and present depots, in industry and in petrol stations.

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MYY/ljn...
Dec. 1987
Dar es Sâlaam

Mourad Y. Yostos
Technical Adviser
SI/URT/87/301

UNITED NATIONS

APPENDIX - I

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO

SI/URT/87/801/11-51/J 13424

JOB DESCRIPTION

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

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Applications and communications regarding this Job Description should be sent to:

Project Personnel Recruitment Section, Industrial Operations Division

UNIDO, VIENNA INTERNATIONAL CENTRE, P.O. Box 300, Vienna, Austria

V.81-33106

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 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/URT/74/028, 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 to utilize the natural gas for chemicals 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.