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**Report No.** 9171

PROJECT COMPLETION REPORT

ZAMBIA

MAAMBA COAL ENGINEERING PROJECT
(CREDIT 1333-ZA)

NOVEMBER 30, 1990

Energy Division
Asia Technical Department
Asia regional Office

## ABBREVIATIONS AND ACRONYMS

| | | |
|---|---|---|
| AfDB | - | African Development Bank |
| AfDF | - | African Development Fund |
| BMCL | - | British Mining Consultants |
| BUA | - | Bank Unit of Accounting |
| FR | - | Feasibility Report |
| GRZ | - | Government of Republic of Zambia |
| IDA | - | International Development Association |
| MCL | - | Maamba Collieries Ltd. |
| MIS | - | Management Information System |
| mtoe | - | Million Tonne Oil Equivalent |
| PCR | - | Project Completion Report |
| tpy | - | Tonnes per Year |
| UDI | - | Unilateral Declaration of Independence |
| ZCCM | - | Zambia Consolidated Copper Mines Ltd. |
| ZIMCO | - | Zambia Industrial and Mining Corporation, Ltd. |
| ZK | - | Zambian Kwacha |

THE WORLD BANK
Washington, D.C. 20433
U.S.A.

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**Office of Director-General
Operations Evaluation**

November 30, 1990

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Zambia
Maamba Coal Engineering Project (Credit 1333-ZA)

Attached, for information, is a copy of a report entitled "Project Completion Report on Zambia - Maamba Coal Engineering Project (Credit 1333-ZA)" prepared by the Africa Regional Office with Part II of the report contributed by the Borrower. No audit of this project has been made by the Operations Evaluation Department at this time.

Attachment

# PROJECT COMPLETION REPORT

## ZAMBIA

## MAAMBA COAL ENGINEERING PROJECT (CREDIT 1333-ZA)

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# PROJECT COMPLETION REPORT

## ZAMBIA

## MAAMBA COAL ENGINEERING PROJECT (CREDIT 1333-ZA)

### Preface

This is the Project Completion Report (PCR) for the Maamba Coal Engineering Project of Zambia, for which Credit 1333-ZA in the amount of SDR 4.0 million (equivalent to US$4.3 million) was approved on March 15, 1983. All disbursements to Zambia were suspended in May, 1987. This project was also affected except for disbursements for prior commitments which continued up to January, 1988. The credit was closed on September 30, 1987, two years behind schedule. It was almost fully disbursed except SDR 0.18 equivalent.

The PCR has been prepared by the Energy Division staff of Asia Technical Department (Preface, Evaluation Summary, Parts I and III), and the Borrower (Part II).

Preparation of the PCR is based, *inter alia*, on the President's Report (no separate Staff Appraisal Report was prepared) the Development Credit Agreement, Project Agreement, supervision reports, correspondence between the IDA and the Borrower; and internal Bank memoranda.

PROJECT COMPLETION REPORT

ZAMBIA

MAAMBA COAL ENGINEERING PROJECT (CREDIT 1333-ZA)

Evaluation Summary

Objective

1. The objective of the project was to foster the substitution of indigenous coal for expensive oil products and to provide low-cost energy to meet the growing demand from the industry. The project was to review the existing operation and performance of MCL, analyze the various constraints and prepare a Feasibility Report for the rehabilitation of the mine complex. During the interim period, critical plant and equipment were to be kept in running order with adequate supply of spare parts and components and by providing training to essential staff (para. 3.1).

2. A poor management structure and weak technical capabilities were identified as among the main causes for low level of performance. Any rehabilitation effort was to include strengthening of the technical management capability. ZCCM agreed to enter into a contract with MCL to take over its technical management, including mining, engineering, material management, training, etc.. Suitable senior level technical managers were to be seconded from the ZCCM operation. ZCCM's training center was to undertake training of technicians (paras. 4.2 and 4.3).

Implementation Experience

3. The Feasibility Report (FR) was prepared in time by the BMCL, a project implementation team at ZIMCO provided overall supervision and guidance. Though the chief executive of ZCCM was also the Chairman of MCL, he faced many problems during implementation which could not be anticipated earlier. As ZCCM itself was then undergoing a major reduction of its expatriate professionals, it was unable to second its best available staff to Maamba. Similarly, though the ZCCM had a strong in-house material management and training system, it was unable to tailor any program suited to MCL's needs. Efforts to recruit expert professionals from outside also did not meet with success, engineers of proven caliber were unwilling to accept short time assignments in a remote part of Africa (paras. 5.1 and 5.2).

Results

4. The FR indicated that the coal demand in Zambia and in the neighboring countries will be about 700,000 tpy. In addition to arrear overburden removal, future mining operations would have to deal with much higher overburden to coal ratio. The coal preparation plant and the aerial ropeway required major rehabilitation. Technical assistance was required to

assist MCL to reorganize, direct and improve the level of operational efficiency in mining, coal preparation, field maintenance and material management. The rehabilitation program needed an investment of US$40 million spread over a period of 5 years (paras. 6.1 and 6.2).

5. When the FR study was in progress, the African Development Bank (AfDB) became interested in the project and approved a loan and a credit totalling US$24.4 million to implement the FR during the initial three year period. Since 1984, the IDA and AfDB projects were running together complementing each other. The AfDB project is now extended up to August, 1991. The planned reorganization of the mine complex has now progressed to the stage that a production rate of 700,000 tpy is achievable. But consequent to lower economic activities in the country, the overall demand is now placed at 550,000 tpy only. However, since Zambia Railways is unable to provide adequate transport capacity,the actual production perforce is restricted to a much lower level of 400-450,000 tpy (paras. 6.3 -6.5).

6. Despite the large investment in the rehabilitation measures only a modest increase in production could be achieved. Being unable to adjust its coal prices in step with the high rate of inflation, MCL experienced only a modest improvement in its finances. However, there has been continuous progress in the development of skills and engineering capability. Zambian nationals are now managing the company at all levels with minimum assistance from outside (paras. 6.6 and 6.7).

Sustainability

7. The declining trend of production during the previous five years has been arrested and a capacity build-up has taken place. Customers are receiving consistent sizes and quality of coal. Coal costs are high by international standards. If the company is unable to market at least 550,000 tones of coal per year and adjust the coal price to overcome the high inflation rate, it well be unable to meet its debt repayment obligation and remain viable (paras. 7.1-7.3).

Lessons Learned

8. Though small, it has been one of the successful projects. The Bank performed satisfactorily all through the project cycle from identification to implementation. The Bank has learned that such small companies operating in isolated areas are not able to maintain a high level of management skill and engineering efficiency. Since they cannot attract very competent professionals for employment, there should be greater emphasis on technical assistance and training (paras. 8.1-8.3).

# PROJECT COMPLETION REPORT

## ZAMBIA

## MAAMBA COAL ENGINEERING PROJECT (CREDIT 1333-ZA)

## PART I: PROJECT REVIEW FROM BANK'S PERSPECTIVE

### 1. Project Identity

| | | |
|---|---|---|
| Project Name | - | Coal Engineering Project |
| Credit No. | - | 1333-ZA |
| RVP Unit | - | Africa |
| Country | - | Zambia (AF6IE) |
| Sector | - | Energy |
| Sub-sector | - | Coal |

### 2. Project Background (1983)

2.1 Zambia is well-endowed with energy resources, most of which are still only partly explored. The main energy resources are hydropower and coal, but there are also large amounts of uranium, as well as renewable resources such as wood, bagasse, molasses, wind, solar and geothermal. There are as yet no firm indications of exploitable hydrocarbons.

2.2 The hydroelectric generating capacity is equivalent to 2.2 million tonnes of oil equivalent (mtoe). It meets the domestic demand fully, and part of the demand for Zaire and Zimbabwe. There is sufficient potential (estimated at 4,000 megawatt) for further development of hydroelectric power to meet the country's requirements for decades ahead. Zambia has also ample coal resources, though most of it is still unexplored.

2.3 Commercial energy consumption in 1981 was estimated at 2.5 mtoe, of which 1.4 and 0.3 mtoe were met by hydropower and coal respectively, and the balance by imported oil and coke. Hydropower is the main source of industrial energy, constituting 55.4 percent of the total consumption, followed by oil products (30.6 percent), coal (11.2 percent) and coke (2.8 percent). Over 80 percent of domestic consumption of hydropower, 60 percent of coal and 34 percent of oil products are by the mining sector alone. The mining sector provides over 20 percent of foreign exchange earnings and 30 percent of gross value added.

2.4 The main consumers of coal in Zambia are the mining, chemical fertilizer and cement industries, which together account for 85 percent of the demand. Coal is used primarily as a heat source and not for power generation. It can replace much of the imported petroleum products used in the copper smelters and other industries, and thus make a valuable contribution in the saving of foreign exchange. Despite conservation efforts, the consumption of

oil products in the mining and mineral industries has been rising, and the share of coal declining. This is primarily due to decline in the volume and quality of coal production.

2.5 The structure of Zambia's energy sector evolved largely in response to the effects of the Unilateral Declaration of Independence in 1965 in neighboring Zimbabwe, then Southern Rhodesia. Prior to that, nearly all of Zambia's commercial energy supplies came from or were imported through Zimbabwe. As a result of events following the UDI, the Government of Republic of Zambia (GRZ) found itself unable to rely on previous arrangements to meet commercial energy requirements and had to set up its own institutions to develop the domestic energy base.

2.6 In early 1966, Zambia Electric Supply Corporation was established for the development of hydroelectric energy. Other institutions established were the Maamba Collieries Ltd. (MCL), for the mining of domestic coal, and the Tazama Pipelines Ltd., for the transport of crude petroleum from Dar-es-Salaam to the Indeni Petroleum Refinery Ltd. in Ndola. The authority for the development of the country's energy resources was shared amongst these institutions on the one hand, and three separate Ministries of the Government. Partly as a result of this sharing of authority, the development of individual domestic energy resource was not guided by an integrated strategy for the sector, resulting in less than optimum use of some resources and greater than optimum use of others.

2.7 As a first step, the Government established the National Energy Council in April, 1981 with the responsibility for coordinating the plans of various agencies. The Council was also to act as the counterpart agency for the Bank's energy assessment work. At the request of the Government, a Bank mission visited Zambia in early 1982 to assess the country's energy resources and assist the Government in preparing a strategy for the development of the energy sector within the framework of the country's long term development goals.

2.8 MCL is a wholly owned subsidiary of Zambia Industrial and Mining Corporation, Ltd. (ZIMCO), which owns partly or wholly more than 100 companies including Zambia Consolidated Copper Mines, Ltd. (ZCCM), one of the largest copper producers in the world. ZCCM operates large open pit and underground mines in the Copperbelt and has staff experienced in mining and associated activities. MCL operates the only coal mine in Zambia at Maamba, 10 kilometers north of Lake Kariba and 76 kilometers southeast of Choma, a road and rail junction in the south eastern part of Zambia. The mine was designed in 1966 to produce 1.5 million tonnes of run-of-mine coal and 1.2 million tonnes of beneficiated coal with 15 to 16 percent ash content. The clean coal is transported by a 11.5 kilometer long aerial ropeway, over hilly terrain to the nearest railroad. The production of saleable coal rose from 100,000 tonnes in 1966 to about 820,000 tonnes in 1972, but declined thereafter when the ZCCM smelters were required by the Government to switch from coal to surplus heavy fuel oil when the Indeni Refinery was commissioned in 1972. The demand of saleable coal remained stagnant at about 50 percent of the mine design capacity.

2.9 About US$20 million were spent over the years 1972-81 to improve MCL's performance, and there were plans to invest another US$30 million during the next five-year period. Past efforts focussed on improving performances of

individual sections of the operation and lacked an overall perspective. There were no concerted actions to resolve the operation's basic weaknesses. Since coal is an essential input to several of the country's major industries, efficient operation of the mine was of national importance.

## 3. Project Objectives and Description

3.1 Project Objectives. The objective of the project was to foster the substitution of indigenous coal for expensive oil products and to provide low-cost energy to meet the growing demand from the industrial and other consumers. As a first step towards achieving the objective, the project was to review the existing operation and performance of MCL, analyze its various technological, marketing, economic, financial and managerial constraints, and prepare a feasibility report for the rehabilitation of the mine complex. During the review period, the essential plant and equipment were to be provided with critical spare parts and components needed to keep the mine running. Also, training that could not await completion of the feasibility study would be provided to operation, maintenance and other key technical personnel.

3.2 Project Description. The project had three basic components as follows:

(a) A feasibility study for the assessment of coal demand for the next two decades; updating of geological information and determining additional exploration needs; review of the functioning of the mining operation, beneficiation plant and ropeway transport system; survey of all plant and equipment and preparation of a maintenance manual for repair and overhaul; review of MCL's staffing pattern, identification of its long-term training needs and formulation of a training program; review of the stock of spare parts, components and consumable stores, and the drawing up of a plan for inventory management; review of MCL's financial and accounting practices and management structure, and recommendations for improving the same for effective management and coordination; and preparation of a feasibility report for rehabilitation of the mine complex to meet projected demand; assessment of investment needs; projection of operating costs and recommendation on a realistic pricing policy, to make MCL economically and financial viable.

(b) Procurement of critical spare parts and components needed to keep the mine complex operating during the study period and of quality control equipment for the coal preparation plant.

(c) Training of key technical persons, estimated at about 8 man-months, for the implementation of repair and maintenance program during the review period.

## 4. Project Design and Organization

4.1 Project Design. The problems facing MCL and the need for its rehabilitation were discussed with the Government and the major coal consuming industries. The project concept was understood and welcome by all concerned. The terms of reference for the feasibility study were discussed with ZIMCO and agreed with the Government at the negotiations.

4.2 Under the existing arrangements, MCL had a non-technical Managing Director posted at Maamba as the chief executive officer. Of the six high level technical positions, two were vacant while the other incumbents did not possess the requisite professional expertise. None had experience of commercial enterprise. More importantly, there was no senior technical person to coordinate the activities of the mine complex. As the poor management structure and weak technical capabilities were identified as among the main causes for the low level of performance, any rehabilitation effort was to include strengthening of the technical management team.

4.3 Project Organizations. ZCCM agreed to enter into a contract with MCL to take over its technical management, including mining, engineering, material management, etc. MCL was to have a technical General Manager for the overall coordination and two other specialists for mine planning and design and maintenance of equipment. One or two specialists, including the General Manager, were to be seconded from ZCCM's own operational staff, while the others specialized in coal mining were to be recruited abroad. ZCCM's training school in the Copperbelt was to undertake the training of technicians. ZIMCO was to setup a project implementation unit to oversee the implementation of the project.

4.4 The timing of the project was very appropriate because the copper and fertilizer industries were also undergoing rehabilitation program which called for continued supply of coal of requisite volume and quality at a price lower than the imported fuel. The project was well prepared, and it attracted all round support.

## 5. Project Implementation

5.1 Project Start-up. The credit became effective on January 31, 1984. The FR was prepared in time (October, 1984) by the British Mining Consultants Ltd. (BMCL) on the lines indicated in para. 3.2. The project implementation unit in ZIMCO provided overall supervision and guidance. Though the Chairman of Board of Directors and the chief executive of ZCCM was also the chairman of MCL, he faced many problems which could not be foreseen earlier. As ZCCM itself was then undergoing a major reduction of its expatriate managerial and engineering staff, it was unwilling or often unable to second its best available staff to the MCL. ZCCM made several efforts to second senior engineering staff but the results were not satisfactory. Similarly, though the ZCCM had a strong in-house material management and training system, it was unable to tailor any program suited to the MCL's needs. Given the assurances received from ZIMCO/ZCCM it was not possible to foresee these problems.

5.2 Implementation & Procurement. When the efforts to recruit the senior management/engineering personnel from ZCCM failed, the jobs were advertised and several expatriate engineers were interviewed. It became evident that engineers of proven caliber were unwilling to accept short term assignment in a small company operating in a remote part of Africa. It took about 20 months before the required staff could be recruited or contracted from BMCL. Until these staff were in position, procurement actions for spare parts and the training program could not be started. Additional funds had to be allocated to augment the technical assistance program (Part III, Table 6). This was later financed by an African Development Fund (ADF) credit of BUA 1.6 million (US$1.65 million).

5.3 Project Costs and Disbursement. The project was originally designed to be completed in 20 months, from February 1983. The loan became effective only in January 1984 and for various reasons explained above, it had to be extended by 24 months, up to September 1987. The last bill was paid in January 1988 (Part III, Tables 2 and 3). The estimated cost of the project was US$6.1 million which was to be shared between IDA, US$4.3 million (SDR 4.0 million) and MCL, US$1.8 million. The actual expenditure spread over 49 months amounted to US$9.8 million with the IDA share remaining at US$4.3 million (SDR 3.8 million) but the MCL contribution going up to US$5.5 million, 3.0 million in foreign cost and 2.5 million equivalent in local cost (Part III, Table 6). Due to suspension of withdrawal rights of Zambia in May, 1987, SDR 0.18 million equivalent remaining undisbursed on March 31, 1988 had to be cancelled.

## 6. Project Results

6.1 Physical Results. The FR indicated that the coal demand in Zambia and in the neighboring countries was about 700,000 tonnes per year. It also showed that future mining operation has to be carried out under a much higher stripping ratio of coal to overburden (average 1 tonne coal to 6.3 $m^3$ OB) compared to half of that ratio as originally planned. Moreover, due to poor equipment availability and stripping design in the past there was a substantial shortfall in planned stripping. In order to achieve any higher level of production, MCL required additional mining equipment, refurbishing and modification of the coal preparation plant, and rehabilitation of the aerial ropeway, workshop and other engineering infrastructure. It also required a preventive maintenance system with proper material management support. The company also needed an effective organization structure and a management information system (MIS). The estimated investment to complete the rehabilitation work was US$40 million spread over a period of 5 years (Part III, Table A).

6.2 A technical assistance scheme was recommended to assist MCL to reorganize, direct and improve the level of operational efficiency and production in several areas including mine planning, design and operation, coal preparation, field maintenance and material management. Selected management personnel, supervisors and specialist artisans were to be trained through specially designed courses to broaden their knowledge, skill and experience. The report also pointed out that the success of the MCL rehabilitation program would depend upon the Zambia Railways' ability to transport the increased volume of production.

6.3 When the feasibility study by BMCL was in progress during January to September 1984, AfDB became interested in the project. Based on the BMCL data it carried out a parallel economic exercise to assess the project viability and fund requirements. AfDB representatives also participated in the review of the BMCL feasibility study report in October, 1984. This was followed by further meetings between the Bank and AfDB in Abidjan and Paris. AfDB agreed to finance the first three years of the rehabilitation project amounting to US$22.71 million as loan (BUA 22.71 million) and US$1.65 million as credit. The agreements were signed in December 1984 and they became effective in August 1985. The loan closing date has been extended from August, 1988 to August, 1991.

6.4 Impact of Project. MCL suffered a major decline in production and related operations between 1980 and 1985. The main reason for this decline was an acute shortage of foreign exchange required for repair and maintenance of earth moving equipment and the beneficiation plant. The rehabilitation work commenced with the availability of the IDA and AfDB funds. The planned reorganizations of the mine, coal preparation plant, aerial ropeway and related support operations have now progressed to the stage that a production rate of 700,000 tonnes of saleable coal per year is achievable. The manpower increased from 1,424 in 1983 to about 1,606 in 1990 due to increased mining activities.

6.5 One of the major influences on the rate of production is the demand for coal. Consequent to lower economic activities in the country, and major customers having already revised their coal demand to a lower level, the overall demand is now estimated at 550,000 to 600,000 tonnes per year including 50,000 tonnes for exports. The other important factor is the inability of the Zambia Railways to provide adequate number of rail cars and locomotives for the transport of coal in excess of 400,000 to 450,000 tonnes per year. Many small customers are resorting to more costly road transport or switching to alternative fuel.

6.6 There has been continuous progress in the development of skills and engineering capability. Some equipment and spare parts are now made locally which were previously imported from overseas. The main workshops are being reorganized to support a much greater program of equipment overhaul. The equipment rationalization policy has achieved more effective maintenance, and a reduction in the amount of inventory for spare parts and components.

6.7 Financial Performance. Despite the large investment in the rehabilitation measures, only a modest increase in sales could be achieved (Part III, Table 5). But better operational efficiency is reflected in the improved financial position of MCL during the last three years. It recorded a modest profit of about US$0.3 million in FY86, US$3.97 million in FY87 and US$0.32 million in FY 88. However, with the declining sales volume the profitability is likely to suffer.

## 7. Project Sustainability

7.1 The declining trend of production during the previous five years has been arrested, and a capacity build up has taken place. The customers are consistently receiving properly sized better qualities of coal. With better rail transport, the production could have gone up another 10-15 percent with consequent financial benefits to the MCL.

7.2 The project implementation coincided with a period when Zambia experienced very severe economic problems and counterpart investment funds became very scarce. However, MCL managed to finance some of its own foreign exchange needs for replacement capital, spare parts and foreign training (Part III, Tables 6A and B). But this trend is not likely to continue if the company is unable to market at least 550,000 tonnes of coal per year and if it is not allowed to adjust the sale price to overcome the high inflation rate in Zambia. In fact, MCL suffered a loss of US$0.1 million in 1988-89 for a sale of 430,000 tons of coal.

7.3 The lower sales revenue is seriously affecting the cash flow position and the company's ability to service loan repayments. With the problems of the Zambia Railways as yet unresolved it is difficult to be optimistic on future coal production and the financial health of the company. At the current volume of production (about 425,000 tpy), MCL will require 20-25 percent price increase if it were to remain viable and meet all its debt service obligations. But it will also raise the domestic coal price beyond the border price (about US$40/t) of imported coal from Zimbabwe.

## 8. Bank Performance

8.1 Though small, the Coal Engineering Project has been one of the successful projects in Zambia. The Bank performed satisfactorily all through the project cycle from identification to implementation, and in assisting in seeking the AfDB loan to finance the rehabilitation of MCL. Only 5 missions could be fielded in 5 years (Part III, Table 9B), which somewhat affected the procurement of critical spare parts for early renovation of run-down earth moving equipment and the training program. After the suspension of disbursement the Bank continued to monitor the progress through the quarterly project implementation reports received upto the middle of 1988.

8.2 As the project progressed it became evident that the existing mining operation must form a part of a long-term mining plan for systematic exploitation of the open-pit reserves at an optimum cost. It was also noted that the current management and personnel were not equipped to deal with these problems. These shortcomings were overcome by an active collaboration between the lenders and borrowers supported by a number of competent consultants. This called for enhanced fund allocation for the technical assistance and training of managers and engineers.

8.3 The Bank has learned that such small companies operating in isolated areas are not able to maintain a high level of management skill and engineering efficiency. Since they are unable to compete and attract very experience professionals for direct employment, there should be greater emphasis on technical assistance and training. Technical assistance available from any individual foreign expert can not be effective unless such service is backed up by a competent organization abroad. Dependence on expatriate staff should be minimized by timely training of suitable local staff.

## 9. Borrowers' Performance

9.1 The success of the project is mainly due to the full commitment and cooperation of the ZIMCO and MCL management at all stages from the project preparation to implementation. The management always acted with all sincerity and diligence on the advice rendered by the Bank and its consultants.

9.2 After going through extensive management training at home and abroad and three years of expatriate technical assistance, most of the Zambian managers are now able to effectively manage their respective business. They are also actively teaching the skills they acquired to their subordinates. Although technical assistance is continuing on a limited basis at some senior levels, the day to day management is now being successfully carried out by the Zambian nationals.

## 10. Project Relationship

10.1 The Bank maintained a close relationship with the GRZ and other entities associated with the production, transportation and consumption of coal. The Bank also developed a special relationship with the ZIMCO through the Project Unit created to oversee the project implementation. The close collaboration between the Bank and ZIMCO/MCL officials also contributed to the success of the project.

## 11. Consulting Services

11.1 The FR clearly identified the need for technical assistance in various disciplines to support the MCL management in the implementation of the rehabilitation program. Following the Bank/AfDB procedure BMCL was selected for the job. It was mainly financed by the AfDB credit and to a lesser extent by the IDA credit. The technical assistance covered almost all aspects of project operation and management including coal production, beneficiation and transport, repair and maintenance engineering, procurement and material management and training of personnel. It also provided for two full time positions of General Manager and Engineering Manager. With the exception of these two posts, Zambian managers were placed in leading positions and backed up and assisted by experienced expatriates. This required a high degree of counterpart teamwork and training to ensure maximum benefit.

11.2 The duration of the first phase of technical assistance for each discipline varied from three months to three years depending upon the rehabilitation work involved. The consultants also identified practical training needs of managers and supervisors and exposed them to similar operations overseas. A special academic course was designed to train the prospective general manager. These played a major role in the success of the rehabilitation project and in developing management effectiveness of many of the Zambian senior personnel.

## 12. Project Documentation and Data

12.1 The legal documents were well drawn up and there was never any room for ambiguity. The President's Report (no separate appraisal report) provided a useful framework for the IDA and borrowers during the project implementation. The project management maintained and furnished all data in this report without any assistance from the Bank. All data are now maintained at the project in a computerized MIS which can be easily accessed.

PROJECT COMPLETION REPORT

ZAMBIA

MAAMBA COAL ENGINEERING PROJECT (CREDIT 1333-ZA)

PART II. PROJECT REVIEW FROM BORROWER'S PERSPECTIVE

## 1. Introduction

1.1 Maamba Collieries Limited received through GRZ/ZIMCO a World Bank/IDA loan (Cr. No. 1333-ZA) amounting to SDR 4.0 million (equivalent to US$4.3 million) in 1983 for:

(a) a pre-investment feasibility study;

(b) procurement of critical spare parts and components to keep the mining complex operating during the study period;

(c) training of key technical/managerial personnel to prepare them for other project implementation through mostly experiential training at the mine and abroad in all disciplines of the mining complex. A small amount of foreign exchange was employed to train selected personnel in specialized courses of the mining operations including financial, maintenance and repair aspects in Europe. Selected personnel through these courses were prepared to run the most critical areas of technical/engineering and general management.

1.2 The feasibility study was carried out by the British Mining Consultants and was completed in October 1984 for the World Bank. After the Bank identified and appraised the project report the subsequent loan agreement with GRZ/ZIMCO was reached in 1983.

1.3 The feasibility study team identified the need for the rehabilitation of the Mine and associated plants and workshops, modificatin of the beneficiation plant, and training needs for managers, engineers and technicians. Whilst all the aspects of the rehabilitation were being identified, there was urgent need that a further load funding was required for additional capital equipment and replacement was required for additional capital equipment and replacement of existing equipment. The African Development Bank (AfDB) became interested and was contacted with the resulting loan funding to Maamba Collieries Limited (MCL) through the GRZ/ZIMCO of BUA 22.71 million being granted and a further African Development Fund (AfDF) in the amount of BUA 1.6 million was provided for technical assistance which fulfilled yet another identified need in the MCL's rehabilitation process. It is through this loan funding which acted as a bridge between the envisaged US$40 million assistance by the World Bank that the objectives of the feasibility study could be fully met. Further, it is against this interim assistance that the two projects can hardly be separated in this review for instance spare part listing on World Bank was prepared by a combined team of BMCL and MCL.

1.4 Recommendations in line with identified need were prepared for action. BMCL again were identified to carry the consultancy service project following the AfDB loan facility as a technical assistance team to carry out the recommendations as contained in the World Bank Feasibility Report.

1.5 Among other World Bank/IDA Loan conditions worth noting are the following:

(a) A ZCCM/MCL technical management agreement;

(b) A GRZ/ZIMCO/MCL counterpart contribution towards the total project cost.

## 2. Project Implementation and Result

2.1 ZCCM/MCL Technical Management Agreement: There was some delay in making up of the ZCCM technical team. Two Technical General Managers were engaged in succession. Due to remoteness of Maamba there was reluctancy on the part of the first General Manager to stay in Maamba. His replacement lacked the complementary mining and financial experience to be of great benefit to the complex mining operation that has been under capitalized for a long time. As a result of this, British Mining Consultants were contacted in 1985 to second from among its technical staff at Maamba a Technical General Manager with a subsequent choice of Mr. C Freeman. Mr. C. Freeman was the head of the technical assistance team at the time and former head of World Bank sponsored feasibility study on Maamba's operation. It is under his charge that the success of the rehabilitation project is being recorded.

The recruitment of the maintenance and repair engineer under the designation of Chief Mechanical Engineer played a vital role in improving the maintenance and repair of mining equipment and upgrading of workshop practices.

In the field of Mine Planning and Design the specialist recruited from abroad did not measure up to expectations. ZCCM found it difficult to provide requisite personnel on Maamba site to fully produce the desired benefits. Experience staff were difficult to find even for itself at that time.

2.2 GRZ/ZIMCO Counterpart Contributions: The contribution towards the total project cost was met as reflected in the World Bank's Part III report on project financing.

2.3 Spare Parts Provision: Maamba received the benefit intended in the spare part acquisition although delays were experienced in the procurement of these spares.

## 3. Feasibility Study Report/Recommendation

3.1 This is the most valuable document to serve as a check for the future. The plight of Maamba was fully addressed in the report as follows:

(a) Deepening and dwindling thickness of coal seams;

(b) Extent of coal reserves and ore reserve estimation;

(c) Increasing overburden to coal tonnage ratio to 4:1 from 1:1 (BCM: one tonne of coal);

(d) Under capitalization of the mine, a result of lack/inadequate investment caused low capacity of the mining equipment and operating plants which enables the production of poor quality coal;

(e) The control of the pricing structure;

(f) The expanding coal market;

(g) Weak technical and managerial capability of available personnel and recruitment procedures;

(h) Maintenance and repair standards;

(i) Procurement and materials management; and

(j) Other infrastructure improvements.

3.2 The extent of coal reserves and ore reserves estimation were determined using modern methods of coal reserve calculation. Up-rating of the mining equipment was achieved by purchase of new equipment through the AfDB Loan and modification to the small coal washing machine was achieved in the Coal Preparation Plant which was made to replace the old jig bath which produced poor quality coal as a result of inherent inadequate separation parameters. Coal separation through the new dense media cyclone is well defined and has improved the quality of fine product very greatly. Further refurbishment of the Coal Preparation Plant from raw coal handling to coarse coal dense media separating baths and Aerial Ropeway have been improved to an extent that coal production can now be placed at 700,000 tonnes per annum as long as a constant and consistent availability of foreign exchange will be made available to renew operating plants and equipment every year.

The maintenance and repair crews have been set up that are capable of refurbishing existing equipment in these plants, thereby contributing to improved maintenance and low cost of repair and reduction on the foreign exchange bill. The conservation of foreign exchange through improved workshop practices will continue to be encouraged at Maamba.

3.3 The up-take of coal has always been in the region of 500,000 - 600,000 tonnes of coal per annum but the acute problems of Zambia Railways; lack of locomotive power, train wagons, old railway line and railway sleepers and generally low level of economic activity in the country cause considerable loss of sales volume culminating into the loss of revenue notably in 1988/89 when ZK40 million and expected ZK95 million in 1989/90 financial years have been recorded. The customer has therefore not been fully serviced despite available coal at the rail head in Masuku. Presently only 425,000 tonnes of coal per annum is expected to be transported to the market. This trend is

bound to prevail over Maamba unless Zambia Railways' inability to service the coal transport issue is resolved through some urgent sourcing of funding for it.

3.4 Zambia Railways' failure to fully service customers resulting in lower volume of sales has placed a considerable strain on Maamba's finances leading to:

(a) Maamba's inability to replace capital on schedule; thus driving Maamba into the pre-1985 position;

(b) Maamba's negative cash flow situations;

(c) Loss of coal sales volume especially in the foreign market due to late deliveries;

(d) Maamba's inability to service loan repayments;

(e) Maamba's inability to relieve the coal customer of the high coal price increase as higher sales volume would inhibit the call for higher prices of the commodity; this has placed Maamba coal as an expensive product on the international market and may jeopardise export expansion drives;

(f) Coal based industry being stagnant and lack of the market expansion in the country; and

(g) Lack of experienced local labor as attractive salaries cannot be offered by Maamba.

3.5 Most engineers/technicians and workmen have been either exposed to experiential training locally and abroad with an eventual change of attitude. Proven result show improved work performance. Engineering personnel are capable of refurbishing most components on their own given the requisite materials and some modifications are achieved to avoid high cost from outside expertise. The level of operational performance in operating departments of Mining, Coal Preparation Plant and Ropeway has reached a high confidence level. It is for this reason that counterpart management has been successful to a point where only the Technical General Manager and Procurement Specialist of the technical assistance team have remained on site against a large number of operational/design and engineering staff that composed the complete technical assistance team. The local technical team at Maamba can only fail as a result of lack of foreign exchange, continued loss of sales volume which limits the amount of Kwacha cover on Femac with which to purchase vital spare parts.

3.6 Export earnings have considerably increased along with increased coal export potential as a direct benefit of improved coal production of the coal beneficiating equipment. Export earnings contribute to US$1.5 million per annum as the present moment; this is being utilized to purchase spare parts while Bank of Zambia still allows the total retention of the coal export proceeds.

3.7 Maamba, apart from some specialized rehabilitation program needs US$4 million for spare parts to achieve a smooth operation. In the interim period that Zambia Railway (say four years) could be improved, the need to assist Maamba in the amount of US$10 million will still be required. Any additional coal requirement to cover new nationalized programs i.e., Integrated Iron and Steel Project will need a further capital injection if the capital replacement program will not be supported by increase sales volume or further foreign assistance funding.

Workshops have been reorganized to suit present improved standards obtaining at Maamba with infrastructure improvements being constantly properly cared for.

## 4. Conclusion

4.1 The World Bank/IDA loan opened a new and reassuring chapter in operational, technical and financial aspects of Maamba.

4.2 Maamba still requires capital injection as most of AfDB acquired equipment have reached the end of its useful life and investment in manpower is still of top priority. The recommended US$40 million has not been invested in full and investment on manpower development has been very low indeed despite improved level of performance. Development of the employee in employment with higher retention potential will be enhanced.

4.3 The counterpart system of management provided invaluable experiential training.

4.4 International competitive bidding procedures further widened a broad specturam in modern procurement procedures eliminating bias and cost reduction in relation to very limited or one supplier sourcing system of purchasing.

4.5 National coal demand was low due to low economic activity in the country and lack of funding on the part of some of the coal consumers and the railway transporting company. The national coal demand is placed at 550,000 - 600,000 tonnes per annum.

4.6 The technical management of Maamba has attained a high level of confidence. Apart from financial aspects of the company most areas can be handled with a higher degree of confidence. Improvement in the financial areas will be addressed.

4.7 The retention of only two specialists as at present depicts the success of the project.

4.8 Foreign exchange ought to be available for a continual successful operation of Maamba. The difficulty of obtaining foreign exchange has been compounded by Zambia Railways' inability to carry planned coal sales targets.

4.9 The Bank's guidance has been useful and direct in its presentation of issues leading to eventual improved state of the Mine.

4.10 BMCL have been of great assistance to the success story of Maamba. The technical team displayed the will to work. The attitude expressed in hard work, dedication and commitment to duty has been imparted into Zambians with impressive success.

4.11 ZIMCO and MCL has provided peaceful working environment. The vision of a viable company will indeed be achieved.

4.12 The statistical data as presented in Part III is representative of the situation as provided from identification of the project.

4.13 Permanent labor has changed slightly from 1,342 in 1983 to 1,400 in 1990. Temporary and casual workers are still estimated at 1983 figures of about 82 and 206 respectively.

PROJECT COMPLETION REPORT

ZAMBIA

MAAMBA COAL ENGINEERING PROJECT (CREDIT 1333-ZA)

PART III: STATISTICAL INFORMATION

1. Energy Sector Bank Loans and Credits

| | Loan | Purpose | Year of approval | Status | Comments |
|---|---|---|---|---|---|
| 1. | Kafue Hydroelectric Project (Stage II) | Power generation | 1973 | Completed | Successful |
| 2. | Indeni Refinery Modification Engineering Project | Refinery product mix modification | 1982 | Completed | Successful PCR under preparation |
| 3. | Petroleum Exploration Promotion Project | Oil and gas exploration | 1982 | Completed | Successful PCR under preparation |
| 4. | Oil Pipeline Rehabilitation Engineering Project | Survey of 1700 Km Dar es Salaam Ndola pipeline to assess corrosion damage | 1985 | Completed | Successful PCR under preparation |

2. Project Timetable

| Item | Date planned | Date revised | Date actual |
|---|---|---|---|
| Identification | - | - | 02/82 |
| Preparation | 05/82 | - | 05/82 |
| Appraisal | 06/82 | - | 06/82 |
| Credit negotiations | 01/10/83 | - | 02/01/83 |
| Board approval | 03/15/83 | - | 03/15/83 |
| Credit agreement | 05/23/83 | - | 05/23/83 |
| Credit effectiveness | 08/13/83 | 11/30/83 | 01/31/84 |
| Credit closing | 09/30/85 | 09/30/86 | |
| | | 09/30/87 | 06/30/87 |
| Credit completion | 12/31/85 | 12/31/87 | 03/31/88 |

3. Loan Disbursements
(Million US$)

| Financial Year | 1984 | 1985 | 1986 | 1987 | 1988 |
|---|---|---|---|---|---|
| Appraisal estimate (cum) | 1.6 | 4.3 | - | - | - |
| Actual (cum) | 0.5 | 1.1 | 2.6 | 3.9 | 4.3 |
| Actual as % of estimate | 31.0 | 25.6 | 60.0 | 90.7 | 100.0* |
| Date of final disbursement | | | | | 01/04/88 |

*(a) Original credit amount SDR4.0 m was equivalent to US$4.3 m.
(b) Disbursement suspended in May 1987, except for prior committed fund.
(c) Undisbursed sum SDR0.18 m equivalent cancelled.

4. Project Implementation

| Indicators | Appraisal | Actual |
|---|---|---|
| Disbursement | 1 | 2 |
| Estimated cost | 1 | 1 |
| Anticipated completion | 2 | 2 |
| Compliance with loan conditions | 1 | 1 |
| Project finances | 2 | 1 |
| Management performance | 2 | 1 |
| Procurement progress | 2 | 2 |
| Consultants | 1 | 1 |
| Reporting | 1 | 1 |

Legend: 1 - Problem-free or minor problems
2 - Moderate problems

5. Project Production

| Year | Actual Production | | | Coal capacity |
|---|---|---|---|---|
| | OB $M.M^3$ | Raw coal Mt | Washed coal Mt | Mt |
| 1984-85 | 2.63 | 0.71 | 0.51 | 0.51 |
| 1985-86 | 1.56 | 0.82 | 0.54 | 0.55 |
| 1986-87 | 3.73 | 0.78 | 0.51 | 0.60 |
| 1987-88 | 4.04 | 0.91 | 0.57 | 0.70 |
| 1988-89 | 3.11 | 0.68 | 0.44 | 0.80 |
| 1989-90 (est) | 4.50 | 0.80 | 0.50 | 0.80 |

6. Project Costs and Financing
(Million US$)

A. Project Cost

| | Estimate | | | Actual | | |
|---|---|---|---|---|---|---|
| | FC | LC | Total | FC | LC | Total |
| Feasibility study and technical assistance | 0.8 | 0.2 | 1.0 | 1.5 | 0.4 | 1.9 |
| Critical spare parts | 3.2 | 0.5 | 3.7} | | | |
| Quality control equipment | 0.2 | - | 0.2} | 5.6 | 1.9 | 7.5 |
| Training | * | - | - | 0.2 | 0.2 | 0.4 |
| Base cost estimate | 4.2 | 0.7 | 4.9 | 7.3 | 2.5 | 9.8 |
| Contingencies | 0.9 | 0.3 | 1.2 | - | - | - |
| Total financing required | 5.1 | 1.0 | 6.1 | 7.3 | 2.5 | 9.8 |

*US$50,000

B. Project Financing

| | Appraisal Estimate | | | Actual | | |
|---|---|---|---|---|---|---|
| | FC | LC | Total | FC | LC | Total |
| IDA | 4.0 | 0.3 | 4.3 | 4.3 | * | 4.3 |
| ZIMCO/MCL | 1.0 | 0.8 | 1.8 | 3.0 | 2.5 | 5.5 |
| | 5.0 | 1.1 | 6.1 | 7.3 | 2.5 | 9.8 |

*US$20,000

## 7. Project Results

### A. Direct Benefits

| Indicators | Appraisal estimate | Estimate at closing date | Estimate at full development |
|---|---|---|---|
| 1. Review of technical managerial and economic constraints and preparation of a rehabilitation feasibility report. | The report to cover, geology, mining, washery, infrastructure, etc. at a cost of US$1.25 m (IDA). | The report was completed in time and it covered all appraisal issues at a cost of US$1.06 m to IDA. An additional amount of US$0.48 m was spent for technical assistance including MIS design. | No change |
| 2. Procurement of critical spare parts and quality control equipment. | This was intended to permit MCL to continue its mining and washery operations till a regular loan could be secured for full fledged rehabilitation, cost US$3.00 m (IDA) and US$1.55 m (MCL). | There was some delay in procurement. However, the money was gainfully utilized to keep the equipment in running order till ADB loan became effective. Cost US$2.64 m (IDA) and US$4.80 m (MCL). | No change |
| 3. Training of engineering personnel. | 10 technicians and operators costing US$0.05 m. | 23 managers, supervisors, technicians and operators costing:<br>IDA US$0.12 m<br>MCL US$0.5[illegible] m | No change |

### B. Economic Benefit & C. Financial Impact

Not Applicable

D. Studies

| | Purpose as Defined at Appraisal | Status | Impact of Study |
|---|---|---|---|
| 1. Feasibility Study. | Consultants to assess coal demand to review existing operations, staffing pattern, material management system, etc. and | | Feasibility report received in October 1984. |
| | (a) to prepare a set of recommendations for rehabilitation of the mine complex including mine planning and design, mining plant and equipment, washer, ropeway, infrastructure, etc. | Completed | African Development Bank extended a loan and a credit in December 1984 totalling US$25 m for the implementation of recommendations. Work is in progress. Coal production and coal quality have improved. |
| | (b) to identify training needs for managers, technicians and operators. | Completed | A large number of managers, engineers, supervisors, technicians and operators have been trained abroad, and in Zambia with technical assistance from expatriates. |
| 2. Critical spare parts and components. | Technical specialists of ZCCM to study the physical conditions of mining plant and equipment and to prepare a list of critical spare parts and components for urgent repair and maintenance, and of quality control equipment for improved monitoring of washery operation. | Completed | The list was also reviewed by the BWCL consultants before procurement action. The material was received at site and duly made use of. It helped to improve coal production in terms of both quantity and quality. |

8. Status of Covenants

| Loan Covenants | Deadline for Compliance | Status |
|---|---|---|
| 1. Execution of a Subsidiary Loan Agreement between borrower and ZIMCO and a Loan Agreement between ZIMCO and MCL (Section 6.0(a) of Cr. A). | Condition of Effectiveness | Complied 12/23/83 |
| 2. Execution of a technical management contract between CCM and MCL (Section 4.01 (b) of Pr. A). | " | Complied 10/31/83 |
| 3. Creation of a Project Unit at ZIMCO to oversee the project implementation (Section 2.01(b) of Cr. A). | " | Complied 03/19/83 |
| 4. During the implementation of the project, the Government to permit ZIMCO/MCL access to a minimum of US$1 m in foreign exchange to match IDA's contribution on a one-to-three basis. IDA's share of US$3 m for spare parts, etc. to be disbursed in two tranches of US$2 m and US$1 m each. MCL to contribute its share of US$1 m during the first tranche (Section 1, Para. 4(ii) of Cr. A). | The disbursement of IDA's second tranche was contingent upon GRZ/MCL fulfilling its commitment to the first tranche. | Complied 05/27/86 |
| 5. ZIMCO and MCL are to obtain prior approval of IDA for the proposed training program and list of spare parts, components and quality control equipment (Section 2.04 of Pr. A). | - | Complied |
| 6. With respect to the evaluation and implementation of the recommendations and other conclusions contained in the report:<br>(i) during the carrying out of the Project, ZIMCO and MCL and the Associaiton shall exchange views from time to time on said recommends and conclusions; and<br>(ii) upon completion of Part A of the Project, ZIMCO and MCL shall consult with the Borrower and the Association on the recommendations and conclusions relating thereto and shall exchange views with the Borrower and the Association on a proposed coal rehabilitation project. (Section 2.02(d) of Pr. A). | - | Compiled.<br>By the time the consultant's report became available in December 1984, the African Development Bank agreed to finance the coal rehabilitation project. |
| 7. ZIMCO and MCL shall maintain records adequate to reflect in accordance with consistently maintained appropriate accounting practices their operations and financial conditions, including, without limitation to the foregoing, separate accounts reflecting all expenditures in respect of the project (Section 5.01 of Pr. A). | - | Complied |
| 8. ZIMCO and MCL shall: | - | Complied |
| (a) have their accounts and financial statements (balance sheets, statements of income and expenses and related statements) for each fiscal year audited, in accordance with appropriate auditing principles consistently applied, by independent auditors acceptable to the Assocation; | | |
| (b) furnish to the Association as soon as available, but in any case not later than nine months after the end of each such year: (i) certified copies of its financial statements for such year as so audited; and (ii) the report of such audit by said auditors, of such scope and in such as the Association shall have reasonably requested including, without limitation to the foregoing, separate opinions by said auditors on the separate accounts referred to in Section 5.01 of Project Agreement (Section 5.02 of Pr. A). | Yearly | Complied |

9. Use of Bank Resources

A. Staff Input
(Staff Weeks)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | Total |
|---|---|---|---|---|---|---|---|---|---|
| Preappraisal | 3.0 | - | - | - | - | - | - | - | 3.0 |
| Appraisal | 6.0 | 22.0 | - | - | - | - | - | - | 28.0 |
| Negotiations | - | 4.7 | - | - | - | - | - | - | 4.7 |
| Supervision | - | 0.7 | 8.7 | 8.1 | 10.3 | 4.4 | 1.6 | 0.1 | 33.9 |
| Others | - | 12.1 | 1.0 | 0.2 | 0.9 | 0.1 | - | - | 14.3 |
| Total | 9.0 | 39.5 | 9.7 | 8.3 | 11.2 | 4.5 | 1.6 | 0.1 | 83.9 |

[redacted]



## B. Missions

| | Mission | DD/MM/YY | No. of persons | Man-days in field | Speciali-zation | Perform-mance trend | Types of problem |
|---|---|---|---|---|---|---|---|
| 1. | Through appraisal | 01/24/82 | 1 | 7 | Min | - | - |
| | | 06/14/82 | 3 | 35 | Min<br>Fin<br>Eco | - | - |
| 2. | Appraisal through Board Approval | - | - | - | - | - | - |
| 3. | Board approval through effective-ness | 08/03/83 | 2 | 10 | Min<br>Fin | - | - |
| 4. | Supervision | 04/11/84 | 2 | 6 | Min<br>Fin | 2 | Technical Management and pro-curement |
| | | 10/10/84 | 2 | 4 | Min<br>Fin | 2 | |
| | | 09/25/85 | 1 | 8 | Min | 2 | " |
| | | 05/22/86 | 3 | 12 | Min<br>Fin<br>Eco | 2 | Procurement |
| | | 11/05/86 | 3 | 11 | Min<br>Fin<br>Eco | 1 | |

Legend: 1 - Problem free or minor problems.
2 - Moderate problems.

## C. Costs

Not available