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INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT PERFORMANCE AUDIT REPORT

on

MALAWI: TEDZANI STAGE I HYDROELECTRIC PROJECT (Cr. 178-MAI)

February 28, 1975

Operations Evaluation Department

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PROJECT COMPLETION REPORT

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Currency Equivalents (Malawi Pounds and Kwachas):

1968-1970: M£ 1.00 = US\$ 2.40
1971-1973: MK 1.00 = US\$ 1.22 (average)
At the time of the initial change from Pounds to
Kwachas, 1 M£ = 2 MK.

Fiscal Year: January 1 - December 31.

PROJECT PERFORMANCE AUDIT MEMORANDUM

MALAWI: TEDZANI STAGE I HYDROELECTRIC PROJECT (Cr. 178-MAI)

This memorandum represents a performance audit of the achievements and shortfalls of the Tedzani Stage I Hydroelectric Project and Associated Development in Malawi (IDA Credit 178-MAI). It is based primarily on the attached Project Completion Report (PCR) as prepared by the Bank's Eastern Africa Regional Office and on other documents available in the Bank. The accuracy and comprehensiveness of the former have been checked by cross-reference to the relevant material in the Bank files and by subsequent discussions and correspondence with the borrower, members of the Bank staff and others who have been involved with the project. This material includes the original and related Appraisal Reports, the Project and Development Credit Agreements, Supervision and Progress Reports, the statements of the external auditors, and all related correspondence between the Bank and the Borrower.

Introduction

The project itself consisted of two parts. The first entailed a US\$ 5.25 million credit supplied by IDA for the construction of a 16 MW hydroelectric station at Tedzani Falls on the Shire River, the purchase of a 3 MW diesel unit at Lilongwe to handle the power shortage originally projected prior to the commissioning of Tedzani, and the financing of the foreign exchange costs related to the training program of the borrowing entity (the Electricity Supply Commission of Malawi, hereafter referred to as ESCOM). The second part of the project was financed by a loan of US\$ 3 million from the African Development Bank (ADB) to be relent to ESCOM for the latter's general development program (extensions and improvements to mains and substations), as well as for the construction of about 200 miles of 66 KV transmission lines.

The Tedzani scheme was first seriously entertained in 1966 when it became apparent that the recently completed 24 MW Nkula Falls station 4.5 miles upstream would be insufficient to meet the demand forecasted for 1971/72, particularly in the rapidly growing southern region of Malawi. IDA was approached for funding and a feasibility report was submitted in November 1967. A formal request for assistance was made by the Government of Malawi on February 1, 1968. However, there were questions within the Bank as to whether the Tedzani Project would be the least cost alternative. Hence, it was not until the Bank received the supplementary information it requested of the consultants that the way was cleared for an appraisal mission. The outcome of the mission sent in May-June 1968 was a recommendation for a US\$ 7 million IDA credit to fund the foreign exchange costs of the Tedzani Project (US\$ 4.1 million) and of ESCOM's three-year (1969-71) development program (US\$2.9 million). The project was postponed once again, however, due to the Bank's concern over the Malawi Government's economic policies.

Negotiations were renewed after the Government of Malawi inquired in April 1969 about the possibility of IDA participation in a proposed ADB consortium for the project. An economic mission sent in July 1969 reported sufficient improvement of the financial situation to justify renewed lending to Malawi. This was followed by a favorable appraisal mission in August. The credit agreement was signed February 11, 1970, and became effective April 20. Final disbursements occurred in May 1973, about a year before the originally established closing date for the credit.

Project Implementation

Considering the problems encountered in the construction of the Civil Works and the delays in the delivery of certain materials and contracted equipment, the project proceeded relatively smoothly. Besides the delays encountered due to poor rock conditions and strikes at some of the manufacturers' plants, there was also a delay implicit in the acceptance of lower bids with longer construction periods. These delays were originally deemed acceptable since it was felt the Lilongwe diesel could take up the projected shortfall at Nkula. The original plans called for the commissioning of the first 8 MW unit at Tedzani in December 1972, to be followed by the second one the next month. The project was eventually delayed by approximately four months, the station beginning commercial operation in May 1973. This would not have presented any difficulties of note if the 3 MW Lilongwe diesel and interconnecting transmission system, which were scheduled for commissioning by early 1972 to avoid a power shortage, had been completed on time. As it was, erection of the diesel took nearly a year and was not completed until September 1972. This was due mainly to the poor performance of the manufacturer's erection staff (Ruston Paxman Diesels Ltd of the U.K.). This factor, combined with the late delivery and poor quality of the switchgear for the Lilongwe station (supplied by the Indian Consortium for Power Projects PPT Ltd.), engendered supply problems for ESCOM. Power had to be rationed for a short time when demand exceeded the forecasts which had originally prompted the inclusion of the Lilongwe scheme (as shown below).

Electricity Sales: Southern Province and Lilongwe
(in millions of kwh)

	<u>Appraisal Estimate</u> <u>(November 1969)</u>		<u>Actual and Revised Figures</u> <u>(June 1973)</u>	
	<u>kwh</u>	<u>% Annual Increase</u>	<u>kwh</u>	<u>% Annual Increase</u>
1967	77	-	77	-
1968	93	21	93	21
1969	106	14	106	14
1970	117	10	122	15
1971	130	11	132	8
1972	143	10	158	20
1973	156	10	179 ^{a/}	13
1974	176	11	202 ^{a/}	13

a/ Estimates.

Furthermore, the fact that 1972 demand was 10.5% greater than previously envisioned necessitated the postponement of the major overhauls planned for the existing Lilongwe thermal units.

The delays noted above were minor problems in comparison with the cost overruns. One can identify three broad stages in the escalation of costs related to this project.

Original Estimates and Final Cost of Project
(US\$ thousands)

	<u>First Appraisal</u> <u>Sept. 1968</u>	<u>Second Appraisal</u> <u>Jan. 1970</u>	<u>Revised Estimates</u> <u>July 1970</u>	<u>Final Cost</u> <u>June 1974</u>
Power Station Civil Works	2,345	3,541	4,509	5,765
Electrical and Mechanical Works	2,615 ^{a/}	2,590	2,730	2,893
Engineering and Other Services	514	878	960	1,083
Contingencies	636	480	431	57
Training	120	96	96	97
Lilongwe Diesel	-	444	392	461
Total (IDA portion)	6,230	8,029	9,117	10,356
Total Project Cost	10,259	12,372	n.a.	14,779

a/ Excluding the 66 KV line to Chikwawa and the 33 KV lines to Balaka and Salima which were subsequently omitted from this project.

First, there were increases in the consultants' estimates between the first appraisal report and the second; the estimated cost of the total project rose 21%, due primarily to a 51% jump in the estimated costs of the Civil Works, partly resulting from application to Tedzani of the experience then coming in from the new Nkula plant with regard to the serious silt problem. The second set of increases occurred in 1970 with the opening of the tendered bids. Again much of the increase occurred in the main civil engineering works, with bids 27% higher than the second set of estimates. Analysis of the bids later indicated that a larger sum than expected had been allotted for establishment costs, especially for the insurance to cover work performed outside of Europe.^{1/} Inflation does not seem to have been a major factor in these cost increases.

The third major group of increases involved overruns during construction (see the attached PCR, section 20). For the most part, these increases (amounting to about US\$ 900,000) occurred in the Civil Works contract due to unfavorable rock conditions, not in the main tunnels but in the headrace conduit and desiltation chamber. The remaining increases were primarily accounted for by the effects of the devaluation of the US dollar in 1971 (roughly US\$ 250,000) and the adjustment of supply requirements which were underestimated in the original Bill of Quantities (by approximately US\$ 100,000)^{2/}.

Because of IDA's inability to grant the additional credits to cover the higher than expected initial costs and the subsequent overruns, funds amounting to US\$ 2.4 million were supplied by the Commonwealth Development Corporation (approximately US\$ 1.5 million), the Industrial Development Bank of Malawi (US\$ 0.5 million) and ESCOM's internally-generated cash flow.^{3/} Of note is the fact that although the total overrun for the whole project represented only a 19% increase over the January 1970 estimates, the bulk of it occurred in the main Civil Works (see the attached PCR, Section 20). Net non-civil works costs rose only US\$ 0.1 million, or 2.3% above the original estimates.

Other than the problems encountered with costs and timing mentioned above, there were no substantial difficulties encountered in project implementation. Moreover the Tedzani station has a higher capacity than envisaged in the original appraisal report, 10 MW units eventually being chosen in place of 8 MW ones, with related adjustment of the civil works, such that either

^{1/} This was not an isolated phenomenon, similar cost increases having occurred in Civil Works contracts for IBRD power projects in Zambia and Tanzania.

^{2/} This includes importing some steel and cement at higher prices than originally planned due to shortages, and the threat of shortage, at traditional sources of supply.

^{3/} See the attached PCR, Sec. 15, for the terms of these supplemental loans.

unit (but not both together) can be run at full rated capacity under Stage I. ESCOM performed well and all loan covenants have been fully complied with, including the completion and implementation of a water resource-use study of the Lake Malawi and upper Shire River area (Section 4.05 of the Development Credit Agreement).^{1/} The other important substantive covenants, covering the development of an ESCOM training program and the entity's attainment of a certain level of financial performance, have also been satisfactorily met.

Financial Performance

The entity's financial performance has generally been better than expected. Over the period 1969-72, gross revenues were 3% higher than forecasted. However, a sharp rise in extraordinary operating costs in 1972 raised expenses and lowered net operating income. One-half of this rise was caused by an increase over the estimated fuel budget which was, in turn, necessitated by the delays in completing the Lilongwe transmission lines and the subsequent need to import more fuel to meet the demand with thermal power. At any rate, due to the higher than projected demand for electricity, the average return on net fixed assets in operation still improved, rising from 13.8% in 1971 to 14.2% in 1972. As expected, it fell to 10.3% in 1973, but remained above the 9% floor set by the Project Agreement for 1974, (Section 2.07 (c)).^{2/} Debt service coverage also exceeded expectations, rising from 1.65 in 1971 to 1.86 in 1973 (against a 1.7 appraisal estimate).^{3/} Combined with an encouraging, albeit slow, improvement in the debt/equity ratio, ^{4/} one must conclude that ESCOM's financial performance has been more than satisfactory.

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- ^{1/} Agreement was reached in 1973 during the negotiations for Credit 426-MAI -- Tedzani Stage II (US\$ 7.5 million for the additional two generators and a barrage to increase Tedzani's output by 24 MW) -- authorizing ESCOM to divert a minimum of 4,400 cusecs of Shire River water for 50 years beginning in 1977. Water for other uses (e.g., irrigation) has been allocated as required.
- ^{2/} This condition was raised to 10% during the negotiations for the Second Power Project in order to insure internal cash generation sufficient to provide 25% of the funds for ESCOM's capital development program. Recent projections for FY 74 found a 10.4% return expected.
- ^{3/} The Project Agreement (Sec. 2.10) stipulated a floor of 1.5 on the allowable debt service ratio unless further debt was specifically approved by IDA.

4/ Debt/Equity Ratio

1970	1971	1972	1973	1974	1975
				---Forecast---	
84/16	83/17	81/19	79/21	78/22	77/23

Economic Justification

The overall objective of this project has been to increase the generating capacity of Malawi's power utility. Without such action, projections indicated a widening gap between energy demanded and firm capacity for the early 1970s. Although one of the poorest countries in the world (US\$ 90 average GNP/capita in 1973), Malawi's economy has been growing at a steady pace of about 6% per annum since the country achieved independence in 1964. This has been reflected in the sale of power, which has been growing at an average rate of over 19% per annum between 1964 and 1972.^{1/} Hence, although there has been a slowdown in recent years,^{2/} it was evident by the mid-1960s that ESCOM's existing generating capacity of 36 MW (in southern region and Lilongwe) would soon be overloaded. Industry, especially, was growing at a rapid rate of over 15% yearly, and this sector accounts for more than 60% of ESCOM's kwh sales.

Although it was estimated that the incremental rate of return for the project would decrease from about 11% to 9.7% as a result of the increase in capital costs, the project has subsequently proven more remunerative, in part because of the higher than originally planned capability of the station. Allowing for the 15% tariff increase the entity has requested for 1975, the internal financial rate of return on the completed project has now been estimated by the Bank's Eastern Africa Regional Office to be 11.5%. There is no question but that the increased capacity was necessary. And given the recent trend in fuel prices it is certain that the Tedzani Stage I Project, even at an actual cost of US\$ 440 per kw (on an 18 MW basis) compared with originally appraised cost of US\$ 360 per kw (for a 16 MW station), both figures excluding transmission and engineering, was the least cost alternative. Furthermore, the 66 KV transmission line scheme financed under the ADB loan has proven invaluable for meeting the new capital's growing demand for power and enhancing the flexibility of the interconnected system, although it is worth recording that Malawi Government officials now think it might have been better to install it on locally produced wooden poles rather than the imported steel towers actually used.

The Bank's Performance

The Bank's contributions to this project were of mixed value. On the one hand, the Bank provided a major impetus for the positive institution-building aspects related to the project. Included in the original loan were funds for the overseas training of ESCOM personnel (US\$ 48,000). Although this was later funded by other sources after shifts in the allocations occasioned by the rise in costs, the Bank's efforts in this direction were successful. The training program encouraged by the Bank (Project Agreement

^{1/} This figure is for the southern region and Lilongwe, which together account for over 90% of the kwh sold.

^{2/} The years immediately following independence witnessed a rapid influx of foreign capital which eventually led to increased power usage. Between 1969 and 1972, sales growth averaged 14% annually.

Section 2.11) was submitted as required and was well thought out. Another major contribution on the Bank's part has been the initiation of the Shire River water-use study to determine the most economic allocation of water to its various applications. This is a very significant endeavour in view of the fact that water is an important constraint in both the agricultural and industrial sectors.

On the other hand, it now appears with hindsight that the original one-year postponement by the Bank on macroeconomic grounds may have been unwarranted, as well as being costly. The Bank seems to have taken a somewhat short-sighted viewpoint in objecting to Malawi's plans to move its capital from Zomba to Lilongwe, a measure aimed at promoting the closer unification of the country and stemming the internal migration of inhabitants from the neglected North and central regions to the already overcrowded Southern province.^{1/} The Blantyre/Nacala Railway link, also questioned by the Bank, is an important alternative to the only other outlet to the sea, the Beira line, which sometimes becomes unserviceable due to floods. The Bank later reassessed its original position and it, too, found this railway link to be a worthwhile, albeit long-term, investment. As regards the concern expressed by the Bank about Malawi's financial situation, it is noteworthy that when the credit was eventually granted, there had actually been an increase in the total debt contracted by the Government. Furthermore, IDA had provided Malawi a total of US\$ 21.2 million for three projects only several months earlier, in February 1968;^{2/} and the Tedzani credit was the next logical extension in Malawi's development program.

As a direct result of this delay, Malawi had to spend US\$ 461,000 to erect the 3 MW Lilongwe diesel (US\$ 96,000 in local costs without the aid of a "soft" loan). Although this diesel will serve some useful purpose as a standby in case of transmission line failure, this additional investment would not have been necessary had the Bank not delayed more than a year in financing the Tedzani project. In addition higher costs for the extra fuel imported to meet demand before the project was completed may also be attributed in part to this delay.

As regards the very large cost overrun, it is easy to say in retrospect that the Bank should have included larger contingencies (only 6% contingencies were included in the appraisal estimate for the IDA-assisted part of the project, whereas 37% would have been required, to meet costs as they actually eventuated), but it is not clear that much could have been

^{1/} According to the 1966 census, the population density was 65 persons per square km in the South, compared to 19 persons per square km in the North.

^{2/} IDA Credits 112-114 were signed February 5, 1968, for the Lilongwe and Shire Valley Agricultural Development Schemes and the construction of a highway.

done to avoid the problem. ESCOM's civil engineering consultants (the same firm now as for Tedzani and for its predecessor, Nkula Falls) were highly experienced in the region and they still consider that it would not clearly have been in their client's interest to undertake further geological investigations before going out to tender; instead they redesigned and adjusted the project in light of accumulating knowledge, first of the serious silt problems and then, when construction started, of the unexpectedly poor quality of rock in some parts of the project area, and it was a significant achievement by ESCOM, the main contractor and themselves to keep the project so close to schedule under these difficult circumstances. The Bank was apparently always doubtful about the cost-effectiveness of the consultants' Desiltation Chamber solution to the silt problem, it expressed its concern to ESCOM, and the device has proven fairly expensive (nearly US\$ 400,000 equivalent) and not very effective, but the Bank was never in a position to suggest any positive alternative solution to what was generally recognized to be a particularly difficult problem.

The PCR makes the important point that the Bank's reporting requirements could have been better adapted to ESCOM's normal administration and reporting procedures, and that this has been done with the second project (Tedzani Stage II) for which an IDA Credit was approved in September 1973. While this would probably not have eliminated the need for ESCOM to hire a Project Accountant specially for the IDA project (it has not now), it does raise a question whether, with less reporting load to Washington, the Project Accountant might not have been able to do more to compensate for the one weakness which ESCOM has specifically criticized in its consultants - failure to undertake revised cost measurements and cost forecasts as early and as often as would have been necessary to keep the company sufficiently well informed about its forthcoming resource needs.

Conclusions

Despite a slight delay in the completion date, the project was effectively executed, although at considerably higher cost than originally expected, due mainly to underestimates of the civil works items which appear mainly to have been hard to avoid. The project's major objectives were met, the hydroelectric scheme was clearly economic, and the internal financial rate of return to the project will probably be higher than originally projected. Although the Bank's delay between the first and second appraisal missions was of questionable merit and quite costly to Malawi, its subsequent efforts, both during and after credit negotiations were quite appropriate (there were five supervision missions at timely intervals) and involved significant institution-building as regards the entity's training program and the Shire River water-use study.

PROJECT COMPLETION REPORT

MALAWI

CREDIT NO. 178-MAI

Tedzani Stage I Hydroelectric Project and Associated Development

1. Borrower - Government of Malawi
2. Beneficiary - Electricity Supply Commission of Malawi (ESCOM)
3. Amount of Credit - US\$5,250,000
4. Date Credit Signed - February 11, 1970
5. Effective Date - April 20, 1970
6. Closing Date - June 30, 1974
7. Period of Grace - 10 years
8. Term of Credit - 50 years
9. Interest Rate - None
10. Service Charge - 3/4 of 1%
11. Fiscal Year - Ends December 31
12. Exchange Rate - MK 1 = US\$1.22
13. Appraisal Report No. and Date - PU-24a - January 9, 1970
14. Amortization - 1/2 of 1% paid semi-annually commencing May 15, 1980 and ending November 15, 1989 and 1-1/2% paid semi-annually thereafter to November 15, 2019.
15. Parallel Financing - African Development Bank (ADB) loan of US\$3 million to Borrower for onlending to the Beneficiary and subsequent loans of MK 1.2 million from the Commonwealth Development Corporation (CDC) and MK 0.4 million from the Industrial Development Bank of Malawi (INDEBANK). Terms are:
 - ADB - 7% interest and 3/4 of 1% commitment charge, 5 year grace period and repayments extending over 15 years after grace period.
 - CDC - 8-1/2% interest - repayment in 15 equal annual installments of capital from March 31, 1976 with interest on reducing balance.
 - INDEBANK - 8-1/2% interest repayable in 8 annual installments of capital from December 31, 1974 and interest half yearly, June and December, with first payment December 31, 1973.

16. Project Description (Original)

The Project comprises the major part of ESCOM's development program for the three-year period 1970 through 1972. The principal features of the program and the project are:

- (a) construction of Tedzani Stage I hydroelectric development (16 MW) with related substations;
- (b) addition of a 3 MW diesel unit at Lilongwe which was required by the end of 1971 to avoid a power shortage in 1972 prior to commissioning Tedzani Stage I hydroelectric development;
- (c) system control center at Blantyre;
- (d) training of ESCOM personnel;
- (e) construction of 66 kV lines, 4.5 miles from Tedzani to Nkula Falls, 28 miles from Tedzani to Blantyre and 165 miles from Nkula Falls to Lilongwe;
- (f) extensions and improvements to mains and substations; and
- (g) other items such as service line materials, meters, special transport equipment, office machines, etc., which are required for general development and have to be imported.

The IDA Credit was to cover the foreign exchange cost of the first four items, and the ADB Loan that of the last three.

17. Project Description (Actual)

The project was carried out broadly in accordance with the original project description.

18. Objective and Justification of the Project

Additional generating capacity was needed to meet the rapidly developing load in the Southern Region and ESCOM's consultants demonstrated that the Tedzani Stage I hydroelectric development with an initial capacity of 16 MW was the least cost method of meeting this requirement. The Lilongwe transmission line was required to meet the growing demand for power in the Central Region and the 3 MW diesel generating unit was needed to meet this demand until Tedzani Stage I and the transmission line could be commissioned. These objectives have been achieved.

19. Construction Schedule and Problems Encountered

The main civil works contractor was W & C French (Overseas) of the United Kingdom. Notwithstanding faults in rock formation which were encountered during construction, requiring continuous review and adaptation of designs by the civil consultant, and fear of a cement shortage, which resulted

during one period in the need to buy 1,000 tons from the United Kingdom, the main contractor performed well and the hydroelectric power station went into commercial operation in May 1973, only three months behind the original scheduled completion date.

The contractors for the Turbines (Voest of Austria), Alternators (Elia Union of Austria) and the Transmission Line (BICC of United Kingdom) also performed well but many problems were encountered on some of the smaller contracts. The more important of these are described below:

(a) Lilongwe Diesel (Ruston Paxman of England)

Teething troubles experienced with this unit were more numerous than average and resulted in a great deal of outage time during the first few months after commissioning. Excessive vibration which resulted in the disintegration of the alternator fan was due to bad erection, and cracks in the injection nozzles which resulted in numerous outages were due to faulty design.

(b) 11 kV Switchgear, Transformer Control Kiosks and Reactor (ICPP of India)

Equipment was badly finished and not in accordance with the specifications. Later modifications, due to bad design, were necessary.

(c) Control Center Equipment (Serck Controls of England)

The system was non-operative at the time of the Completion Inspection, and the manufacturer was at that time examining the design to determine where modifications were necessary.

(d) Building for Diesel Unit (M Construction of Malawi)

The completed building was to a very poor standard.

The contract for the Switchgear (Hawker Siddeley of South Africa) was placed through a Japanese Agency and this gave rise to communication problems and delays in delivery which were in some measure responsible for the delay in commissioning the Project. At the time of the Completion Inspection (September 1973) the following work was still outstanding:

- (a) minor finishing works at the Power Station and the supply of spares;
- (b) desiltation chamber scour valve not fitted, due to its late arrival. This must now await the first shut down of Tedzani before installation can be effected;

- (c) minor modifications to intake gates and screens - retention payments were being withheld until completed;
- (d) replacement of faulty equipment - transformer contract - retention payments being withheld;
- (e) replacement of faulty equipment - Switchgear Contract - retention payments being withheld;
- (f) replacement of minor defective parts for Diesel Unit; and
- (g) System Control non-operative - final payments withheld pending rectification by manufacturer's erector.

20. Cost of Project

Details of the original allocation of proceeds and the allocation of expenditures as finally disbursed are shown in Annex 1 and the original estimate of costs compared with the final breakdown of costs are shown in Annex 2.

There have been serious cost overruns on the Main Civil Contract and the contingency allowance of between 6% and 7% was inadequate. An initial increase of about MK 1.0 million was due to bids containing a much larger sum for establishment costs than allowed by the consultants who had based their estimates on actual costs for the Nkula hydro project completed some two years earlier. Costs later escalated still further (by some MK 0.6 million), principally due to unexpectedly bad rock conditions along the route of the headrace conduit and in the area of the desiltation chamber and the need to excavate deeper to suit the hydro-turbines selected.

The cost of engineering and supervision is about 25% above the original estimate due principally to the difficult geology encountered.

The final cost of the main civil works (US\$ 5.8 million) was some 65% higher than the original estimate (US\$ 3.5 million) and the overall cost of the Project (US\$ 14.8 million) was some 19% higher than the original estimate of costs (US\$ 12.4 million).

21. Consultants

The project was jointly designed by Messrs. Watermeyer, Legge, Piesold and Uhlmann (Civil Consultants) and Kennedy and Donkin (Mechanical/Electrical Consultants) both of the United Kingdom. The performance of both has been generally satisfactory and their site supervision good, except that ESCOM has felt that the civil consultants could have progressed cost measurements more effectively and reported earlier and more frequently so as to give more warning of the increases in costs. It is also doubtful whether the Desiltation Chamber, which cost some US\$ 360,000 equivalent, was the least cost method to deal with the silt problem. With hindsight, in view of the geological problems encountered and consequent substantial cost overruns, it may be said that more geological survey work should have been done at the feasibility stage, but it is not clear that this could have been foreseen at that time; Watermeyer, Legge, Piesold and Uhlmann had long experience in

the area and the Nkula Falls project designed by them had been successfully completed shortly before. They adapted designs and construction methods expeditiously during execution of the Tedzani Project in such a way as to keep it close to schedule despite the unexpected difficulties.

22. Organization and Management

ESCOM is, generally speaking, well managed and its operations are in accordance with sound public utility practice. All senior management and most professional staff are expatriates with wide experience in public utilities and ESCOM is quite capable of operating the project efficiently. However, there has been a fairly rapid turnover in senior expatriate staff during the last two or three years and ESCOM is having more difficulty than before in finding suitable replacement staff. At the time of the Completion Inspection, there were vacancies for Progress, System Control and Communications Engineers. Additionally, the Training Manager and two local Accountants had recently left. The problem is that, in spite of recent increases in salary scales, these are still not competitive with salaries offered by other employers for local qualified staff and are not sufficiently attractive to retain the expatriate personnel. A continuation of this trend can, in due course, adversely affect the efficiency of ESCOM, although hopefully, it should not unduly affect the operation of the project.

There is no quick and easy solution to the above problem. The level of salary scales is determined by Government policy and ESCOM can only hope to be successful in recruiting suitable expatriate staff until its training program begins to pay off, and qualified local staff can be promoted to posts presently occupied by expatriates.

ESCOM has a good training program and hopes to achieve this aim by 1980. This may be a little optimistic where specialist senior staff are concerned. There is little the Bank can do at present in this matter and indeed, since the situation is not desperate, there is little the Bank need do, apart from drawing the attention of ESCOM and the Government to our concern in this matter.

23. Financing

Annex 3 shows the appraisal forecast of the financing plan from FY 1970 to FY 1973 along with actual financing from FY 1970 to FY 1973. The table below is a summary of the Annex.

(1)	(2)	(3)
Actual 1970-73	Appraisal Forecast 1970-1973	Column 1 - Column 2

(Millions of U.S. dollars)

Sources of Funds

Internal Cash Generation	10.1	10.5	- 0.4
Less Debt Service	<u>5.8</u>	<u>6.4</u>	<u>- 0.6</u>
Net internal cash generation	<u>4.3</u>	<u>4.1</u>	<u>+ 0.2</u>
<u>Long-term Borrowings (including interest added to principal)</u>			
<u>Tedzani - Stage I</u>			
IDA	5.9	5.7	+ 0.2
ADB	2.8	3.2	- 0.4
CDC and INDEBANK	2.2	-	+ 2.2
Other	<u>-</u>	<u>1.5</u>	<u>- 1.5</u>
	10.9	10.4	+ 0.5
Capital Contribution	<u>0.5</u>	<u>0.2</u>	<u>+ 0.3</u>
Total Source of Funds	<u>15.7</u>	<u>14.7</u>	<u>+ 1.0</u>

Applications of Funds

Construction Expenditures

Tedzani Stage I	14.1	12.5	+ 1.6
Others	<u>2.7</u>	<u>2.0</u>	<u>+ 0.7</u>
	16.8	14.5	+ 2.3
Increase in Working Capital	<u>- 1.1</u>	<u>0.2</u>	<u>- 1.3</u>
Total Application of Funds	<u>15.7</u>	<u>14.7</u>	<u>+ 1.0</u>

The financing table indicates that the excess of actual over appraisal cost estimates is being met by loans from the Commonwealth Development Corporation and INDEBANK. ESCOM has from time to time made temporary use of short-term bank rather than long-term borrowing to finance part of its actual expenditure program.

24. Summary Financial Results

The financial projections prepared at the time of appraisal covered FY 1969 to FY 1974. Income Statements and Balance Sheets showing actual and appraisal estimates of operating results from FY 1969 to FY 1973 are shown in Annexes 4 and 5.

Generally speaking, as shown by the following table, the operating results from FY 1969 to FY 1972 have been close to the operating results forecast at appraisal.

	<u>% variation from appraisal forecast</u>				
	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
Revenues	- 0.9	+ 1.3	+ 1.1	+ 9.9	+ 21.2
Expenses (Including depreciation)	+ 1.8	+ 3.0	+ 8.1	+ 35.0	+ 25.5
Net Operating Income	- 4.7	- 0.7	- 6.4	- 12.3	- 4.3

The substantial increase in expenditures during 1972 was mainly due to additional maintenance expenditures during that year which should not recur annually. The Project Agreement includes a rate of return requirement of 9% effective FY 1974, when the project facilities will be operational for a full year. Under the recent Project Agreement for the Second Power Project, the rate of return requirement has been increased to 10%. It is expected that ESCOM will meet this requirement. The rate of return on net fixed assets in operation increased from 10% in 1969 to 14.2% in 1972.

25. Covenants

Section 4.05 (a) of the Development Credit Agreement required the Government to make a study of the resources of water from Lake Malawi and Upper Shire for irrigation, power and other uses and Section 4.05 (b) requires that, promptly upon the completion of the study, the Government will make a decision about the allocation of water for power and communicate its decision to the Association and ESCOM. The study was completed by UNDP and the report circulated by mid-1973, but the Government has yet to take the required action under Section 4.05 (b) of the Development Credit Agreement.

Other particular covenants of substance, in an amended form where required, have been carried over into the Credit Agreement for the Second Power Project.

26. Auditors

ESCOM's accounting records are well maintained and financial reports are prepared promptly. Its accounts are audited annually by the international accounting firm of Deloitte and Company.

27. Useful Lessons Arising from the Project

This has been a problem project from the outset. It was first appraised in May 1968 but construction was postponed pending a clearer picture of the general economic and financial position of Malawi. It was re-appraised in August 1969 by which time the cost estimates for civil works had been increased by the consultants by 50% from US\$ 2.345 million to US\$ 3.541 million. Costs of civil works again increased after the loan was appraised due partly to increased costs of the desiltation chamber, which was included in the project against the Bank's advice to ESCOM and bad rock conditions which, in view of the consultant's presumed intimate knowledge of the area, were quite unforeseen.

With the benefit of hindsight it is, of course, always easy to criticize. It is probably true that a detailed analysis of the feasibility report and design specification might have resulted in savings in the cost of civil works. This, however, is a time consuming task and Bank staff has neither the time, facilities nor, frequently, the expertise, to perform this function. It is not always practicable to obtain a second opinion on all these aspects as this would mean doubling up on engineering costs, and in this case, in view of the consultant's detailed working knowledge of the area and the Nkula project, there was no apparent reason to ask for a second opinion on the geological survey or the cost estimates. However, where doubt exists, e.g. with specifications and cost estimates, a second opinion should always be obtained.

Another important lesson arising from the project is the extent to which a relatively large project can overburden the resources of a small utility such as ESCOM. Principal areas involved were:

- (a) Administration of the Project - A Project Liaison Engineer and Project Accountant were appointed to administer the Project. These were necessary to relieve ESCOM's permanent staff of this additional burden; and
- (b) Reporting Requirements - The Bank's reporting requirements involved additional work for ESCOM as these conflicted with the Utility's procedure for administering the Project.

Reporting requirements for the Second Power Project are being amended to ensure consistency with ESCOM's procedures and to avoid duplication of work.

MALAWIELECTRICITY SUPPLY COMMISSION OF MALAWIPOWER PROJECT - CREDIT NO. 178-MAIOriginal and Final List of Goods and Services

(US Dollars)

<u>Category</u>	<u>Description</u>	<u>Original Allocation</u>	<u>Final Allocation</u>
I	Hydrostation & Civil Works	1,541,000	2,485,655
II	Electrical & Mechanical Works	1,882,000	1,871,217
III	Substations	559,000	- 1/
IV	Engineering & Other Services	512,000	578,153
V	Three MW Diesel	377,000	314,975
VI	Training	48,000	- 1/
VII	Unallocated	331,000	-
	Total	<u>5,250,000</u>	<u>5,250,000</u>

October 1973

1/ Substation equipment and training were generally financed from the loans from ADB and CDC and by ESCOM.

Note:

An exchange adjustment of US\$249,034 is also payable by the borrower.

MALAWI

ELECTRICITY SUPPLY COMMISSION OF MALAWI

POWER PROJECT - CREDIT NO. 178-MAI

Original Estimate & Final Cost of Project
(US\$ Thousands)

	<u>Foreign Currency</u>		<u>Local Currency</u>		<u>Total</u>	
	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>
A. IDA Financed Elements						
1 Power Station Civil Works	1,325	3,014	1,855	2,751	3,180	5,765
2 Desilting Chamber	216		146		362	
3 Turbines, Generators & Other Equipment	1,752	1,894	34	213	1,786	2,107
4 Substations	559	426	17	88	576	514
5 Control Center	130	206	96	66	226	272
6 Diesel Station	377	365	67	96	444	461
7 Engineering & Supervision	475	556	175	271	650	827
8 Training	48	49	48	48	96	97
9 ESCOM Services	36	13	192	243	228	256
10 Contingencies	331	22	149	35	480	57
Total	<u>5,249</u>	<u>6,545</u>	<u>2,779</u>	<u>3,811</u>	<u>8,028</u>	<u>10,356</u>
B. ADB Financed Elements						
1 Transmission & Distribution	3,000	2,942	1,344	1,481	4,344	4,423
Grand Total	<u>8,249</u>	<u>9,487</u>	<u>4,123</u>	<u>5,292</u>	<u>12,372</u>	<u>14,772</u>

Note: Average conversion rate of US\$1.22 = 1 Kwacha was taken for converting final costs into US Dollars
June, 1974

M A L A W I

ELECTRICITY SUPPLY COMMISSION OF MALAWI

Appraisal Estimate and Actual Funds Statement
(thousands of Kwachas)

<u>Year Ending December 31</u>	<u>1969</u>		<u>1970</u>		<u>1971</u>		<u>1972</u>		<u>1973</u>		<u>1970-73</u>		<u>1970-73</u>	
	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>
<u>SOURCE OF FUNDS</u>														
Internal Cash Generation														
Net Income before Interest	1,008	967	1,228	1,260	1,404	1,327	1,696	1,503	1,708	1,675	6,036	5,765	7,364	7,033
Depreciation	506	490	532	526	554	543	654	618	846	811	2,586	2,498	3,155	3,048
TOTAL INTERNAL CASH GENERATION	1,514	1,457	1,760	1,786	1,958	1,870	2,350	2,121	2,554	2,486	8,622	8,263	10,519	10,081
<u>BORROWINGS (incl. capitalized interest)</u>														
Malawi Government	8	7	8	8							8	8	10	10
Tedzani														
Government - relending of IDA loan			724	250	1,456	1,862	2,310	2,196	202	549	4,692	4,857	5,724	5,926
" " " ADB "			1,104	20	1,158	1,286	364	594	22	427	2,648	2,327	3,230	2,839
Other Loans								619		1,149		1,768		2,157
Second Power and Other Projects									1,198	0	1,198	0	1,461	0
Capital Contributions	104	111	40	164	40	71	40	75	40	90	160	400	195	488
TOTAL	1,626	1,605	3,636	2,228	4,612	5,089	5,064	5,605	4,016	4,701	17,328	17,623	21,139	21,500
<u>APPLICATION OF FUNDS</u>														
Construction Expenditures (excluding capitalized interest)			2,470	1,334	3,508	4,486	3,710	3,950	520	1,813	10,208	11,583	12,454	14,131
Tedzani I														
Other Expenditures	762	785		92				706	1,678	1,447	1,678	2,245	2,047	2,739
TOTAL CONSTRUCTION EXPENDITURE	762	785	2,470	1426	3,508	4,486	3,710	4,656	2,198	3,260	11,886	13,828	14,501	16,870
<u>Debt Service</u>														
Interest	642	642	702	636	814	725	962	784	1,094	890	3,572	3,035	4,358	3,703
Amortization	216	216	400	402	410	410	430	429	448	450	1,688	1,691	2,059	2,063
	858	858	1,102	1,038	1,224	1,135	1,392	1,213	1,542	1,340	5,260	4,726	6,417	5,766
Net Increase in Working Capital (other than cash)	110	(82)	8	(506)	24		16	(214)	40	72	88	(648)	107	(791)
Total Application of Funds	1,730	1,561	3,580	1,958	4,756	5,621	5,118	5,655	3,780	4,672	17,234	17,906	21,025	21,845
Increase (Decrease) in Cash	(104)	44	56	270	(144)	(532)	(54)	(50)	236	29	94	(283)	114	(345)
Cash at Beginning	298	312	194	356	250	626	106	94	52	44	194	356	237	434
Cash at End	194	356	250	626	106	94	52	44	288	73	288	73	351	89
Debt Service Coverage	1.8	1.7	1.6	1.7	1.6	1.65	1.7	1.75	1.7	1.86	1.6	1.7	1.6	1.7

JUNE, 1974

MALAWI

Electricity Supply Commission of Malawi

Appraisal Estimates and Actual Income Statements
(Thousands of Kwachas)

Year ending December 31	1969		1970		1971		1972		1973	
	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual
Electricity Sales - millions of KWH	106.8	105.7	118.2	121.9	131	132	144.2	159	158	178
Average revenue/unit in tambala	2.14	2.14	2.19	2.17	2.20	2.22	2.17	2.18	2.17	2.15
Gross Operating Revenue	2,272	2,270	2,612	2,646	2,906	2,939	3,154	3,468	3,154	3,822
Operating Expenses										
Operation and Maintenance	358	359	378	372	402	451	402	655	462	619
Fuel and Electricity	132	146	164	192	212	245	40	276	26	216
Administration and General	318	325	330	356	354	406	382	448	412	545
Depreciation	506	498	532	526	554	543	654	618	846	811
Total Operating Expenses	1,304	1,328	1,404	1,446	1,522	1,645	1,478	1,997	1,746	2,191
Net Operating Income	988	942	1,208	1,200	1,384	1,296	1,676	1,471	1,688	1,631
Other Income (Net)	20	26	20	60	20	35	20	32	20	44
Net Income before Interest	1,008	968	1,228	1,260	1,404	1,329	1,696	1,503	1,708	1,675
Total Interest Charges	642	642	702	630	814	708	962	725	1,094	1,101
Less: Capitalized Interest	-	-	76	8	214	111	218	108	40	211
Interest charged to Operations	642	642	626	622	600	597	744	617	1,054	890
Net Revenue for Year	366	326	602	638	804	732	952	825	654	785
Average Net Fixed Assets in Operation	9,892	9,578	10,112	9,629	10,166	9,652	11,210	10,584	15,644	16,204
Return on Average Net Fixed Assets in Operation (%)	10	10	11.9	13	13.6	13.8	15.0	14.2	10.8	10.3

JUNE, 1974

MALAWI

Electricity Supply Commission of Malawi

Appraisal Estimate and Actual Balance Sheets
(Thousands of Kwachas)

<u>Year ending December 31</u>	<u>1969</u>		<u>1970</u>		<u>1971</u>		<u>1972</u>		<u>1973</u>	
	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>	<u>Estimated</u>	<u>Actual</u>
<u>ASSETS</u>										
Fixed										
Gross Fixed Assets in Operation	13,504	13,178	14,074	13,564	14,700	13,991	17,368	16,507	25,068	25,659
Less: Accumulated Depreciation	3,412	3,622	3,944	3,862	4,498	4,388	5,152	4,941	5,998	5,726
Net Fixed Assets in Operation	10,092	9,556	10,130	9,702	10,202	9,603	12,216	11,566	19,070	20,843
Work in Progress	-	348	1,976	1,390	5,072	5,561	6,332	7,923	870	1,081
Total Net Fixed Assets	10,092	9,904	12,106	11,092	15,274	15,164	18,548	19,489	19,940	21,924
Current										
Cash and Treasury Bills	194	356	250	626	106	94	52	44	288	73
Other	430	495	448	458	482	684	520	859	570	1,042
Total Current Assets	624	851	698	1,084	588	778	572	903	858	1,116
Total Assets	10,716	10,755	12,804	12,176	15,862	15,942	19,120	20,392	20,798	23,040
<u>LIABILITIES AND EQUITY</u>										
Equity										
Reserves and Surplus	586	608	1,188	1,248	1,992	1,979	2,944	2,864	3,598	3,716
Capital Contributions	244	79	284	434	324	516	364	591	404	669
Total Equity	830	687	1,472	1,682	2,316	2,495	3,308	3,455	4,002	4,385
Long Term Debt										
First IDA Project										
IDA			724	125	2,180	2,111	4,490	4,441		
ADB			1,104	10	2,262	1,307	2,626	1,901		
CDC								619		
Others	9,696	9,694	9,304	9,435	8,894	8,889	8,464			
Total Long Term Debt	9,696	9,694	11,132	9,570	13,336	12,307	15,580	15,420	16,554	17,028
Current Liabilities	190	374	200	924	210	1,140	232	1,517	242	1,627
Total Liabilities & Equity	10,716	10,755	12,804	12,176	15,862	15,942	19,120	20,392	20,798	23,040

JUNE, 1974

MALAWI

SECOND POWER PROJECT

ELECTRICITY SUPPLY COMMISSION OF MALAWI

Actual & Estimated GWh Generated and Sold, Installed & Firm Capacity
System Maximum Demand & Load Factor
(Southern Region & Lilongwe)

<u>Year</u>	<u>Generated</u>	<u>Sold</u>	<u>% Increase</u>	<u>Installed Capacity MW</u>	<u>Firm Capacity MW</u>	<u>Maximum Demand MW</u>	<u>Load Factor</u>	<u>Remarks</u>
<u>Actual</u>								
1967	85	77		36	28	15	65	
1968	103	93	21	36	28	18	65	
1969	116	106	14.2	36	28	20	66	
1970	133	122	15.1	36	28	23.3	65	
1971	145	132	8.1	36	28	25.7	64	
1972	173	158	19.7	39	31	31.6	62	
1973	192	173	12.6	55	46	34.2	64	
<u>Estimated</u>								
1974	222	202	12.8	55	46	40	63	
1975	262	226	11.9	67	54	46	65	
1976	278	250	10.6	71	58	51	62	
1977	303	275	10	91	78	55	63	
1978	332	302	10	91	78	61	62	12 MW of steam and diesel plant to be retired in 1979/80 and replaced with 12 MW gas turbine.
1979	365	332	10	91	78	68	61	
1980	401	365	10	91	78	75	61	

June, 1974