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PROJECT PERFORMANCE AUDIT REPORT

on

ETHIOPIA: FINCHAA HYDROELECTRIC PROJECT

(LOAN 596-ET)

March 23, 1976

Operations Evaluation Department

PROJECT PERFORMANCE AUDIT REPORT

ETHIOPIA: FINCHAA HYDROELECTRIC PROJECT (LOAN 596-ET)

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Ethiopia: Finchaa Hydroelectric Project (Loan 596-ET)

Amounts (in US$ mln.) as of December 31, 1975

	Original	Disbursed	Cancelled	Repaid	Outstanding (Excl. undisb.)
Loan 596-ET	23.100	23.097	0.003	1.160	21.937

Project Data

	Original Plan	Revisions			Actual
Conception in Bank	-				10/68
Board approval	5/69				5/06/69
Loan agreement	5/69				5/09/69
Effectiveness	8/08/69				8/08/69
Physical Completion	12/72				9/73
% of original project actually completed by date shown	85%				100%
Loan Closing	12/31/73	6/30/74	12/31/74	6/30/75	11/75
Total Costs[1/]	US$30.3				US$37.4
Inc. Fin. Rate of Return	15.5%[2/]				13%

Mission Data

		Month Year	No. of Days	No. of Persons	Manweeks	Date of Report
Identification		10/68	-	-	-	-
Appraisal		11/68	15	2	4 2/7	4/10/69
Subtotal			15	2	4 2/7	
Supervision	I	5/69	6	1	6/7	6/26/69
	II	11/69	10	1	1 3/7	12/19/69
	III	7/70	10	1	1 3/7	8/04/70
	IV	5/71	10	2	2 6/7	8/26/71
	V	11/71	3	1	3/7	12/27/71
	VI	4/72	8	2	2 2/7	6/07/72
	VII	11/72	8	2	2 2/7	1/05/73
	VIII	5/73	7	2	2	6/08/73
	IX	1/74	9	2	2 4/7	2/12/74
	X	8/74	3	2	6/7	9/19/74
	XI	12/74	7	2	2	2/12/75
	XII	7/75	5	3	2 1/7	7/23/75
Subtotal			86		21 1/7	

1/ Excluding interest during construction.
2/ See footnote to para. 4.1 of the report.

PROJECT PERFORMANCE AUDIT MEMORANDUM

ETHIOPIA: FINCHAA HYDROELECTRIC PROJECT (LOAN 596-ET)

1. This memorandum is on an audit of achievements under the Finchaa Hydroelectric Project, for which Loan 596-ET of May 1969 to the Ethiopian Electric Light and Power Authority (EELPA), of US$23.1 million was closed in November 1975. It is based on the corresponding Project Completion Report (PCR) herewith attached as prepared by the Eastern Africa Regional Office, on Bank files and on discussions with Bank staff who had participated in the appraisal and supervision of the project.

2. EELPA was established by Imperial Charter in 1955 as a statutory corporation of the Ethiopian Government, the sole owner. The Bank has been associated with EELPA since 1964 with the first Loan (375-ET)[1/] of US$23.5 million. In 1969, the Bank made this second Loan (596-ET) of US$23.1 million, to cover the foreign exchange cost of the "Finchaa" station with three 33.3 MW hydroelectric generators and an associated 220 KV transmission line, plus graduate technical training abroad for some EELPA staff. By 1974, EELPA generated about 66% of the electricity sold in Ethiopia, predominantly hydroelectrically; and since February 1975, when the various small regional companies were taken over, has been responsible for public electricity supplies throughout Ethiopia, with the exception of a few industries which own and operate thermal plants for their own needs.

3. In June 1966 a loan had been approved by the United States Agency for International Development (USAID) to finance the foreign exchange cost of the project. However, when bids for civil works were received from US contractors, EELPA and their consultant (Harza Engineering Company of Chicago) responsible for feasibility report, project design and evaluation of bids, considered them to be high. In October 1968, therefore, the Ethiopian Government and EELPA sought Bank financing to obtain the lower costs expected by international competitive bidding. With the full concurrence of USAID, a Bank mission appraised the project in November 1968. To avoid disruption during changeover, USAID financed US$400,000 (on top of the US$700,000 already disbursed) for engineering consultants, through the period of bid document preparation/evaluation to Bank loan effectiveness.

4. The project (built mostly as planned) had a delay of about eight months and a cost overrun of about 7%. The hydro station, which accounted for about 80% of expected and 85% of actual project cost, took about eight months longer than expected to complete and cost about 14% more than estimated, the main reasons being the increased length of the access road tunnel to avoid landslides, and stronger support structure being needed for both the access road tunnel and the water tunnel. The transmission line, which accounted for about 20% of expected and 15% of actual project cost was commissioned about seven months behind schedule, mainly due to delivery problems with materials and understaffing by the contractor, and cost about 26% less than estimated. The Bank had debated during appraisal appropriate sizes for

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1/ See IBRD Report No. Z-17/3, of March 24, 1972, Operations Evaluation Report: Electric Power, Case Study: EELPA, Ethiopia.

contingency allowances and had decided that 10% for equipment and 15% for civil works were commensurate with the degree of confidence of the consultants and the quality of the studies made prior to appraisal. It would have needed a 39% (Eth $14.8 million) contingency allowance for civil works to have covered the actual cost in retrospect.

5. The EELPA states that the maps given to Harza (along with their terms of reference) were, at the time, marked as insufficient for final engineering design. Since the maps were not checked, this resulted in the reservoir being shallower than designed, although the effect is somewhat mitigated by the (then) unforeseen drain-off from the nearby Chomen Swamp, and the spillway height will need to be increased to get full output from the hydro station. This, however, is not an expensive change. Operating problems have developed, mainly in respect to "settlement" of the penstock and the presence of harmful organic matter in the cooling water system. Harza is still hopeful that the solution to both these problems will not prove costly. EELPA has not been entirely satisfied with Harza's services, and considers many problems with contractors could have been avoided with better consultant/ contractor communication and better consultant follow-up action. The fact that geological conditions were not as the consultants believed them to be was indeed the main factor in the relatively small cost overruns in both the civil works and the hydro station as a whole. Also, in retrospect, it is clear that the maps thus supplied by the Government should have been spot-checked. The consultants' supervision during construction, particularly of the drainage along the penstock and follow-up action to deal with problems, also seems to have been less effective and slower than could have been expected.

6. EELPA's financial performance was satisfactory during 1969-74. Financial covenants were adhered to, except for 1974 when the return fell below the required 7% due to addition of Finchaa's assets and the decrease in sales not being fully compensated by the 1972 tariff increase. Other financial indicators were close to their projected levels during this period. Sales of energy increased on average by 7.3% annually, compared to the 15.5% projected at appraisal, due to events unforeseeable at appraisal; e.g., fall in coffee prices, the oil crisis, droughts and civil disturbances. The average gross revenue per KWh sold was close to forecast until it rose in 1972 due to EELPA receiving a tariff increase, partly offset by higher than projected operating and fuel costs. EELPA was granted tax relief benefits unforeseen at the appraisal, which pushed actual net operating incomes above estimates in 1972/73. These tax cuts were later withdrawn and then reinstated; without them, and if the load growth continues well below the appraisal estimate, then the covenanted 7% return for 1975 will not have been met without a further tariff increase or similar action.

7. During 1970-74 EELPA's construction expenditure was about 12% less than envisaged, and the company financed about 37% of its investment by cash generation compared with the 43.5% expected. The construction program for the distribution systems and self-contained undertakings proved overoptimistic with respect to the ability of EELPA to carry them out and the resulting savings in investment costs more than offset the 7% cost overrun on the project. In this sense, the construction program for the expansion of the distribution systems and the self-contained undertakings was overdimensioned at the time of the appraisal.

8. At appraisal the project was the least-cost solution to meeting Ethiopia's increasing demand for electricity. The incremental financial return on investment was estimated to be 15.5%[1/] with an investment cost (including transmission) of US$303/kw installed (excluding interest during construction). Actual sales of energy increased at about half the forecast growth rate and the actual investment cost turned out to be about US$525/kw installed. The incremental return is expected to be about 13%, including the tariff increase in 1972 not assumed in the appraisal report, and about 9% excluding it. As electricity sales were increasing annually at about 18% and GDP by 4.8% (estimated to rise shortly to around 6%), the appraisal estimate of an annual 15.5% increase in electricity sales for the 1969-74 period was not unreasonable. The fact that sales grew at only half this rate meant that Finchaa was commissioned some six years too early, decreasing the Net Present Value of its costs and benefits to the economy (at 1974 price levels) from about US$27 million (had it been built to match demand) to about US$8.5 million (taking into account its usefulness during the 1973 dry season might raise the latter to about US$9 million). The competitiveness of Finchaa hydro versus a thermal alternative has strengthened since the appraisal because of the large increase in fuel prices.

9. Eight supervision missions took place, averaging two missions per year. The first four included supervision of the previous project and three had only one man; the second four were all after project completion and averaged 2 two-man missions per year. This has been economical and adequate; the operational problems occurring after project commissioning had the right level of coverage by the Bank. The Bank's international bid practice contributed positively toward keeping down the cost of this project. However, the somewhat rapid project processing (first approach in October 1968, appraisal in November 1968 and loan signing in May 1969) invites the question whether troubles (cost overruns, surplus plant and operational problems) might have been prevented had the Bank paused to ask for a "second opinion" on the cost estimate, market forecast and geological/topographical studies; but this seems unlikely to be true. The cost estimate had benefitted from: (a) that made in the feasibility study produced by Harza for USAID, which indicated a likely saving of 15% in favor of international bidding, and (b) the USAID bidding prices themselves. Also there was nothing specific to indicate the geological and topographical information to be inadequate, and all the requisite surveys seemed to have been done. The market survey was based on past trends for the number of domestic and commercial customers (coupled with their average sales and the growth in GDP) and expected loads from existing and new industrial customers. The latest economic report in 1968 was forecasting a slightly increased growth in GDP during the period 1969-74 compared with the period 1964-68. The number of new customers was expected to grow at about the same rate in the immediate future as in the past. There were 25 well-established industrial customers and the prospects looked excellent for the establishment of a number of quite well-defined new industrial customers. There were no grounds, therefore, for the Bank doubting the market forecast. By the time that the Bank's supervision missions had become certain that a new (and lower) trend in growth had been established, the investment program had become too advanced to make any worthwhile economies.

1/ At the time of appraisal, the assumption was made that 100% of the investment cost would take place in 1973, thus yielding a rate of return of 19.3%. Recalculating this return by spreading the investment cost over the 1969-73 period in a pattern similar to the actual, the rate of return at appraisal would have yielded 15.5%.

10. To sum up, the lower increase in sales than envisaged at the time of appraisal resulted in the project being commissioned about six years too soon. This state of affairs, however, was unavoidable. Despite its premature commissioning, the project is still economic. It is the least-cost solution for meeting growth in electricity demand, as compared with other types of generating plants, and is expected to make a financial return on the incremental investment of about 13%, compared to 15.5% at the time of appraisal.

Attachment

FINAL COMPLETION REPORT

ETHIOPIA

LOAN NO. 596-ET

FINCHAA HYDROELECTRIC PROJECT 1/

1.	Borrower	- Ethiopian Electric Light & Power Authority
2.	Guarantor	- Empire of Ethiopia
3.	Amount of Loan	- US$23.1 million
4.	Date Loan Signed	- May 9, 1969
5.	Effective Date	- August 8, 1969
6.	Closing Date	- December 31, 1973, postponed to June 30, 1974, and subsequently to July 31, 1975.
7.	Period of Grace	- 5 years
8.	Term of Loan	- 25 years
9.	Interest Rate	- 6-1/2%
10.	Commitment Charge	- 3/4 of 1%
11.	Fiscal Year	- Ends July 7, (September 10 until 1973).
12.	Exchange Rate	- US$1 = Eth $2.07
13.	Appraisal Report No. & Date	- PU - 9a April 10, 1969
14.	Amortization	- Payments will be made through semi-annual instalments beginning June 15, 1974 and ending June 15, 1994.
15.	Joint Financing	- There was no joint financing of project but US aid financed the feasibility study and preparation of specifications and bidding documents before the Bank came into the picture.

1/ Revised on February 25, 1976, to incorporate comments from the Borrower.

16. Project Description (Original)

The Project comprises the construction of the 100-MW Finchaa hydroelectric power station together with the associated 220-kV transmission line and terminal substation near Addis Ababa. The principal features of the Project are described below:

(a) Civil Works

i. A low earth filled dam with a height of about 20 meters and a length of about 340 meters, creating a large storage reservoir with a useful volume of 650 million cubic meters and an annual average production of 532 million kWh at 60% plant factor;

ii. A 3 meter diameter pressure tunnel 4,200 meters long leading to a pressure shaft and an inclined surface penstock 1,450 meters long;

iii. A power station building with associated works on the floor of the canyon and an access road (partly in tunnel) from the dam site at the top of the escarpment to the power station, approximately 7 km in length.

(b) Mechanical & Electrical

i. Three 33.3-MW generators with Pelton type turbines operating at a head of 590 meters together with all other ancillary electrical and mechanical equipment;

ii. A 220-kV single circuit transmission line 215 km in length erected on steel towers with a terminal substation of 105 MVA capacity at the Addis Ababa end of the line.

17. Project Description (Actual)

The Project was carried out broadly in accordance with the original project description, the only variations of substance being an increase of about 400 meters in the length of the access road tunnel and the construction of a horizontal access tunnel to the valve chamber in place of a vertical access as originally designed. The latter change resulted in no extra cost but the increase in the length of the road tunnel because of the possibility of landslides, contributed substantially to the cost overrun on this aspect of the main contract.

18. Objective and Justification of the Project

At the time the project was planned it was intended to provide the additional generating capacity which was forecast would be required by 1972/73, and the Finchaa project represented the most economic form in which this additional generating capacity could be provided. This objective was achieved

although the first two generators which went into commercial operation in December 1972/January 1973, were some seven months behind schedule. However, load growth has been significantly lower than forecast due principally to a slowdown in the economy during 1969/70; a postponement of some major industrial developments during the early 1970s, specifically the proposed artificial fiber plant and a caustic soda plant (both 40 million kWh annually), a cement plant (25 million kWh annually), and latterly the political disturbances in the country. Annex 1 shows the actual sales of kWh in the different consumer categories compared with the forecast made at the time of the appraisal and Annex 2 details actual and forecast technical statistics relative to the interconnected system. Annex 1 demonstrates that the actual sales of kWh have been consistently under the appraisal estimate and by 1974 were some 46% less than the estimate for that year. As events have transpired, purely on the basis of productive capacity in an average dry year, Annex 2 demonstrates that Finchaa was brought into service some five to six years earlier than necessary. It was, in one respect, fortunate as the most serious drought in many years was experienced during 1973 and it was not possible to obtain the full output from the Koka and Awash power stations as this would have involved drawing the water in the Koka reservoir below the top of the intake. Extensive and prolonged load shedding would have been necessary had not Finchaa been available. This is evidenced by the fact that Finchaa produced 83 million kWh during the year ending September 10, 1973.

EELPA, through Government channels, originally applied to USAID for assistance in financing the Finchaa Project and consultants (Harza Engineering Company of Chicago) were engaged to carry out feasibility studies. These studies were followed by engineering design and preparation of bidding documents and bids (confined to American firms) were subsequently invited. The bids received were found to be seriously in excess of the engineers' estimates and EELPA, deciding that international competitive bidding might result in substantial savings, approached the Bank during the later part of 1968. Therefore, the Bank did to some extent pick up a project which had already cquired a large degree of momentum. Bids received under international competitive bidding were some US$2 million lower than the engineers revised estimates, which had been updated following the high American bids and were in some instances little more than 50% of the prices submitted by the American firms. The resultant savings enabled the remedial works on the Awash project (Loan No. 375-ET) and the feasibility studies for the next major development to be financed from the loan.

19. Construction Schedule and Problems Encountered

The main civil works contractor was Impresit of Italy; turbines were supplied by Be'l of Switzerland, generators by NEEB of Norway and the construction of t'e transmission line was carried out by Energoinvest of Yugoslavia. All the main contractors with the exception of Energoinvest performed well although a number of critical factors contributed to the delay of some seven months beyond the original scheduled date in commissioning the first unit. The more important of these are described below:

(a) the poor rock formation which was encountered when excavating the road tunnel was more extensive than envisaged and required the installation of arch supports and gunniting throughout the entire length of the tunnel;

(b) similar trouble with the power tunnel which necessitated many steel supports;

(c) delivery of the penstock valve was delayed due to the failure to pass the leakage test at the factory;

(d) collapse of a section of the penstock steel lining due to external water pressure. The affected portion had to be cut out and replaced with new steel plates. A drainage tunnel and drain wells also had to be constructed to relieve the affected portion of the penstock from external water pressure;

(e) late delivery of some essential materials and equipment;

(f) slow progress on the transmission line due to bad programming and inefficient management by the contractor;

(g) No. 1 generator erection period longer than scheduled combined with damage to No. 2 generator during transportation; and

(h) delay in design of the switchgear due to lack of effective communication between the consultant and the contractor.

The transmission line contract was so far behind schedule at one point that serious consideration was given to the possibility of splitting the construction between two contractors. However, with overall completion slipping some six months or more behind schedule at that time due to the miscellany of other factors described above, it was decided to stay with Energoinvest and substantial completion was finally effected by August/September 1972, some seven months behind schedule. This however was still too late for commissioning tests on the No. 1 unit, for which purpose a water rheostat (to provide the required test load) had to be purchased. Liquidated damages on this contract amounting to Eth $242,000 were agreed by Energoinvest and were deducted from final payments.

As stated above, two of the three generating units went into commercial operation in December 1972/January 1973; the third generating unit, which was damaged during transit and had to await replacement windings and manufacturer's inspection before commencement of erection, finally went into commercial operation in September 1973. The manufacturer (NEEB of Norway) has agreed to extend the guarantee on this unit from the one year covered by the contract to three years after acceptance.

At the time of the preliminary Completion Inspection (January 1974) there were a number of minor outstanding matters still requiring attention by the manufacturers and contractors. These are described below:

(i) Two lightning arrestors were damaged during transit and replacements were still awaited. EELPA obtained maximum damages (Eth $150,000) from the manufacturer (Mitsubishi) for the resultant delay in commissioning the third transformer. This is now commissioned.

(ii) The standby diesel generator at the power station which was supplied by the main contractor (Impresit) was rejected for

non-compliance with specifications. Impresit acknowledged responsibility for replacing this with a new unit which was reported to be ready for shipment and scheduled to be installed during the latter part of 1975.

(iii) A damaged current transformer which was returned to the manufacturer (Brown Boveri) for repairs. Now reinstalled.

(iv) Minor outstanding items on the monitoring equipment, all of which have now been rectified.

(v) The main penstock valve was unstable under high load conditions and at the time of the inspection the automatic trip was not functioning. This matter was under investigation and the manufacturer, Bell of Switzerland, has now replaced the overvelocity trip transmitter, which has solved the problem.

(vi) Generator bearing oil leakage on Unit No. 3, which was suspected could be a problem with all three units. The manufacturer's (NEEB of Norway) engineer subsequently carried out modifications to deal with this problem.

Retention monies were withheld pending completion of these outstanding works and because of this it was necessary to postpone the closing date to June 30, 1974, (previously December 31, 1973). Delays in completion proved longer than originally anticipated and a further postponement to June 30, 1975 was necessary. All replacements had been made other than the standby diesel station set, and remedial works were completed at the time of the final Completion Inspection (July 1975). The loan was fully disbursed by November 1975. Despite repeated actions to expedite, delivery of the diesel generating unit has been delayed for reasons which cannot be explained by EELPA. However, they have been assured by Impresit that this was ready for shipment and should be delivered and installed till the end of 1975. EELPA are paying for this unit.

Two major problems arose after the penstock was filled and the power station commissioned. One, which seemed at first to be serious, is a slight penstock settlement between anchor points 1 and 2, just above the power station, evidence of which was first noticed by the Resident Engineer at the beginning of the 1973 rainy season. This was reported to the consultants (Harza Engineering Company) who investigated the position. Concurrently EELPA asked Acres of Canada, who were at that time carrying out the feasibility study for the next major hydroelectric project, to conduct an independent investigation and report their findings.

Acres' report, which was published in December 1973, confirmed that concern over the magnitude of deflections in the penstock seemed to be well justified. Although an absolute determination of stress levels was not possible, the report indicated the high probability that stresses were greater than should be accepted over the long term life of the penstock.

In Acres' opinion the penstock was not in serious danger in the short term so long as an extended program of regular surveillance is maintained. The report set out geotechnical field measurement and field monitoring programs which it recommended should be started as soon as possible and it further recommended that planning and engineering for permanent remedial works, with contingency plans if a worsening of the position is observed, should be put in hand without delay.

Harza's initial report, which was subsequently received, confirmed Acres' opinion that the penstock is not in serious danger in the short term, but since the movement in the overburden will continue and will tend to aggravate the position, it advised stabilization of the penstock at the earliest possible date. The report recommended that this could best be accomplished by placing it on a support system of concrete slabs and concrete cradles in lieu of the earth embankment.

Following a more detailed investigation, Harza has now decided that the stresses in the penstock caused by the deformations are not nearly as heavy as was first suspected and are well within the factor of safety. The cause of the trouble is seepage, during the rainy season, of water into the overburden on which the pipe is laid and whilst there must be continued concern with future movement, the first logical step is to reconstruct the drainage along the penstock to ensure water is taken away from the foundation material. Work on this phase has been already done and will be followed by the installation of a simple system to monitor future movement of the penstock.

Hopefully, the above remedial measures will solve the problem but, if not, Harza's first proposal which is described above will have to be reconsidered.

The second problem is the existence of organic matter in the lake water which is being deposited on the internal surfaces of the cooling water system and is likely to give rise to restricted flows in due course. Other features likely to be affected are the pipework to the flowmeters, power station water supply pumps, gauges and strainers, village water supply pumps and filters and the penstock valve chamber air valves.

The phenomenon, which has appeared since the lake was formed on completion of the dam, is assumed to be caused by deposits from the islands of grass which break loose from the swamp and float down to the lake to gather at the boom behind the dam. It became apparent in November and December of 1973 that deposits of some unidentified black substance in the penstock and the generator cooling system had become a significant operating problem, particularly because it was blocking water passages in the coolers. Analysis of water and sludge samples showed that the water contains a small amount of manganese while the sludge contains significant quantities. The presence of manganese crenothrix bacteria is also suspected because of the significant results obtained with chlorine treatment in restoring the flow rate through the coolers, but this cannot be confirmed without on site analysis.

Little real progress has been made to date with this problem; it has been suggested that monthly treatment of the coolers with hypochlorite should restore "flow through" to its normal level, but nothing is yet known of the possible corrosive action of the water on the coolers and nothing is known of other properties. Investigations are still being carried out in cooperation with the consultants (Harza) and it is essential that we maintain close contact with EELPA in connection with both this and the penstock problem to ensure that the appropriate recommendations and course of actions advised by the consultants to overcome these problems are acted upon.

A third problem arose because of the difference between the level of the tailrace and the old river bed which caused an increase in the water level in this area during the rainy season, sufficient to flood the turbine room floor every year. To overcome this problem, the tailrace was excavated 300 m downstream to a new junction with the riverbed and it is hoped this will give sufficient additional fall to eliminate the danger of flooding.

20. Cost of Project

Details of the original allocation of proceeds and the allocation of expenditures as finally disbursed are shown in Annex 3 and the original estimate of costs compared with the final breakdown of costs are shown in Annex 4.

Tendered prices for major contracts were substantially under the original estimates and a reassessment of costs in August 1970 showed a net saving in foreign costs of just over US$2.1 million. For this reason it was agreed to transfer US$0.4 million (later increased to US$0.52 million) to other works i.e. to cover the foreign cost increase in the Awash project and also to charge to 596-ET, the foreign cost of the feasibility study for the next generation project (US$0.475 million). The remaining savings in foreign costs were all absorbed in due course, principally because of increased costs of civil works and currency revaluations.

Consultants offshore costs are lower than originally estimated because of a continuing commitment under a USAID Loan Agreement until the Bank Loan became effective.

A comparison of final costs with original costs is difficult because of currency revaluations since the loan was made. Annex 4 shows original and final costs both in US$ and Eth $. Final offshore costs in Eth $ have been adjusted for currency revaluations but in converting final local costs to US$ either the exchange rate of US$1 = Eth $2.5 prevailing at the time of the loan can be used, or the current exchange rate of US$1 = Eth $2.07. The latter has been selected as the more rational approach for the purpose of expressing final present day local costs in US dollars. It will be appreciated however, that in the circumstances it would be misleading to compare original costs with final costs in US$ and the assessment of cost increases discussed in the next paragraph is therefore based on the comparison of original and final costs in Eth dollars.

The final cost of the main civil works (excluding subcontracts for gates and screens, etc.) at Eth $ 52.4 million is some 21% higher than the original estimate of Eth $43.4 million but due to lower costs on equipment and transmission than originally estimated the overall cost of the Project at Eth $81.2 million is only some 7% higher than the original estimate of Eth $ 75.75 million. The increase in the offshore cost of civil works is more than offset by savings in the offshore costs of other aspects of the Project and total offshore costs at Eth $ 44.8 million are some 8.5% lower than the original estimate of Eth $ 49 million. However, the balance of the loan thus unspent on the Project is absorbed by the other charges to the loan which are described in a preceding paragraph.

The increases in the cost of Civil Works are principally due to the following factors:

(a) Overruns on Engineers estimated quantities on which tenders were based, including additional reservoir clearance and access road work.

(b) The need to extend the road tunnel and provide support throughout its entire length was not foreseen by the consultant at the time of the original survey.

(c) Additional expenditure on the power tunnel due to unforeseen rock difficulties.

(d) Revisions advised by the Engineer and approved by the Borrower during construction, remedial works due to collapse of penstock and various claims made by the contractor during progress of the work.

(e) Currency revaluations.

21. Rate of Return on the Project

As in the Appraisal Report, the rate of return on the project is taken to be the discount rate at which the present worth of the cost of the project equals the present worth of the net revenue deriving from it. The same assumption is used with regard to the project life (40 years), and average revenues and costs are based on the present tariff and costs of operating Finchaa and its associated transmission/distribution.

Finchaa is assumed to operate at around 10% load factor with an output of 80 million kWh per annum until 1979/80 after which with normal load growth the output from Finchaa will increase to 530 million kWh per annum by 1987 and will remain constant at this figure throughout the life of the plant. This assumes a station load factor of around 60% which is conservative.

Income per kWh is based on the present tariffs which gives 4.8 US¢ (3.9 US¢ at appraisal) per kWh (assumed to fall to 4.3 US¢ over the first 5 years and remain constant thereafter), and operational costs are on the basis of marginal costs applicable to Finchaa and its related transmission and distribution. Related distribution capital expenditures are assumed to commence around 1979 at US$1.3 million per year and reach completion by 1986.

On the basis of the above assumptions the rate of return is shown to be 13% compared with 19% at the time of the appraisal. The reason for the fall in the rate of return is principally because, whilst Finchaa is in operation from 1973 onwards, its output is not really required until 1979 and revenues for the first six years are ignored (this is partly offset by the higher income per kWh than taken at the time of the appraisal). Even so, with the opportunity cost of capital estimated at around 12%, this rate of return is satisfactory.

22. Consultants

The Project was designed by the Harza Engineering Company of Chicago. There have been some misunderstandings between the consultants and EELPA and criticism of the consultants performance during the survey and design stage. EELPA's main criticisms of their consultants are itemized below:

(i) Dependence upon inaccurate maps resulted in faulty survey work which later revealed that the reservoir behind the dam will not be as deep as originally planned. The difference is about 2.5 m. This is mitigated to some extent by the drain off from the Ghomen Swamp into the reservoir but it will entail increasing the height of the spillway eventually to get the full output from the power station. This will inundate large areas surrounding the Ghomen Swamp which will give rise to claims for compensation. (In point of fact, because of the errors in the map used by Harza, extensive inundation is already taking place);

(ii) The engineering arrangement in the valve chamber and the generator cooling water intake pits which are not conducive to ease of maintenance, and the intake gates which EELPA considers should have been hydraulically operated;

(iii) Lack of drainage channels along route of penstock;

(iv) Lack of efficient commissioning procedures;

(v) Failure to "lean" adequately on manufacturers and contractors; and

(vi) Tendency to load Project with headquarter costs and exceed estimate for engineering and supervision.

These complaints have all been discussed in detail with Harza and whilst there would seem to be some substance in items (i) to (iii) mentioned above, there are also mitigating circumstances. For instance in the case of item (i), the consultants were working on a tight budget and relied upon survey maps provided by the Department of Water Resources which had carried out the survey of the reservoir area. Harza has put forward convincing explanations on items (iv) to (vi).1/

1/ Regarding (vi), EELPA seems to consider loading the supervision cost with Head Office support costs unjustified in terms of the provisions of the contract.

The delays described in this report were largely outside the consultants' control and cost increases are not unduly excessive bearing in mind the nature of the project, currency revaluations and present inflationary conditions. However, there are areas where EELPA's criticism of the consultants performance would seem to be justified; the problem with the penstock settlement which is largely due to the slope, the type of soil on which it is laid, and the extremely heavy rains which are a feature of the rainy season should have been foreseeable and the installation should have been designed to eliminate the possibility of settlement. For instance, a different support system based on a concrete raft extending the whole length of the penstock might have avoided this problem but it would, of course, have been costly.

The problem arising from dependence upon inaccurate maps could have been avoided had the consultants carried out an independent survey although, in fairness, attention should be drawn to their statement that they were operating on a tight budget and if such additional work was not covered by their terms of reference, it would not be reasonable to expect them to carry out the work. All the same, for their own protection, one would have thought, a few spot checks would have been sensible and prudent, and might have revealed some of the inaccuracies.

Bearing in mind the foregoing comments and taking an overall view, the consultants performance on pre-project field studies and design would seem to have been less than satisfactory. Whilst supervision of construction was, in the main, satisfactory, some criticism is also justified on this aspect of the consultants' performance, particularly in regard to the inadequate drainage along the route of the penstock which has been a significant factor in the subsequent problem with settlement and which could have been avoided with more efficient inspection during construction.

23. Organization and Management

EELPA is under reasonably good management but, recognizing the need for extensive reorganization if it is to continue to deal efficiently with its engineering operations, it engaged, in June 1969, a firm of management consultants (McLintock Mann and Whinney Murray of the UK) to study the situation and put up recommendations for changes in the organization to meet the needs and challenges of the future.

The consultants published an Organization Manual in 1971 which, whilst meeting some of the desired criteria to strengthen EELPA's organization, was tailored to meet the constraints presented by EELPA's present establishment and policies. As a result, some of its recommendations are controversial and it did not deal with many of the more obvious problems such as the eventual need for decentralization. EELPA has been gradually dealing with the more obvious changes needed but the speed with which the recommendations can be implemented is governed by staff restrictions and other problems. For instance EELPA's principal weakness has been the extent to which the efficiency of its operations depended upon two of its senior officers: the Comptroller (Norwegian) and the General Manager (Ethiopian). The reorganization was intended to delegate some of these officer's responsibilities to their subordinate heads of department, but

this was proving a slow and difficult procedure. The situation has further deteriorated due to the recent political changes in the country which has resulted in the non-renewal of the Comptroller's contract and the nationalization of the two private electric utilities in the northern province (SEDAO and CONIEL) which are to be absorbed by EELPA. Also the closure of the University is going to result in a serious shortage of professional engineers - a matter which is already beginning to be a problem. The need to keep in touch with EELPA concerning these matters in particular are other reasons for maintaining close contact with the borrower for the foreseeable future.

As far as the Project is concerned, the present position is not entirely satisfactory. The operating team for Finchaa comprises mainly transferees from other hydro operating stations and they have been moulded into a reasonably efficient and well trained team by an experienced expatriate power superintendent who left on completion of his contract in November 1973. However, this is a modern hydroelectric power station with sophisticated features and, when the question of a replacement was discussed, EELPA agreed that an experienced expatriate should take charge for at least a further two years until the acting superintendent, an Ethiopian national, is considered fully capable of taking over. EELPA has tried for two years, without success, to recruit an experienced replacement for this appointment and since the acting Superintendent has meanwhile operated the station successfully, we have had no option other than to agree to his appointment as power station superintendent.

24. Training

The loan included an amount of $100,000 to finance the cost of post graduate technical training abroad, but no separate category was established for this purpose and it is not possible to establish the actual amount spent on training. However, arrangements were made with the manufacturers of the turbines (Bell of Switzerland) and generators (NEEB of Norway) for works training of EELPA staff during manufacture and commissioning of the equipment and specified staff spent time in Switzerland and Norway for this purpose. Specified staff also spent some time, in the consultants' office in Chicago on project design and progressing.

25. Financing

A comparison of actual sources and application of funds with the appraisal estimates from FY1970 to FY1974 is given in Annex 5. A summary of that annex is given on the following page:

(Eth $ Millions)

	Appraisal Estimates	Actual	Increase (Decrease) over Estimates
Application of Funds			
Construction: Finchaa	66.7	81.2	14.5
Other	45.4	17.2	(28.2)
Total Construction	112.1	98.4	(13.7)
Dividend to Government	-	2.0	2.0
	112.1	100.4	(11.7)
Sources of Funds			
Internal Generation of Funds	87.3	71.6	(15.7)
Less Debt Service	38.5	34.8	(3.7)
Net Internal Generation	48.8	36.8	(12.0)
Borrowings			
IBRD 596-ET	56.1	52.7	(3.4)
Other	1.9	2.0	.1
	58.0	54.7	(3.3)
Consumers Deposits	1.0	1.4	.4
Decrease in Working Capital	4.3	7.5	3.2
	112.1	100.4	(11.7)

Equivalent amounts in US$ are not given in the above summary due to change in the official rate against the US$ from Eth $ 2.50 to Eth $ 2.07 and fluctuation in rates of other currencies explained earlier in Section 20- Cost of Project.

EELPA's construction program for the expansion of distribution systems and self-contained undertakings forecast at the time of the appraisal were reduced in scope mainly because of postponement of major industries and delay in obtaining financing for the Shasamanne Region expansion. The above comparison shows that underexpenditure on this part of the program more than offset the higher total cost of the project.

26. Summary of Financial Results

The appraisal estimates of the balance sheet, income and expenditure and sources and application of funds from FY1970 to FY1974 and their comparison with the amounts based on the audited accounts for those years are given in Annexes 5 to 7. The operating results as compared with the appraisal estimates show the following variations.

	% Variation from Appraisal Forecast				
	1970	1971	1972	1973	1974
Sales of GWh	-12	-13	-22	-28	-35
Revenues	- 8.4	-13.5	-11.5	-13.4	-18.5
Operating Expenses	- 9.4	-14.9	-12.1	-13.4	- 9.4
Net operating income	- 6.3	-10.5	-10.3	-13.4	-35.0

The revenues, operating expenses and net operating income were considerably lower than forecast. Fuel cost was 39% higher than estimated in FY1973 and 105% higher in FY1974 due to the inordinate increase in international fuel prices during this period. Income taxes were considerably lower than forecast but, if income tax relief in respect of Awash III project which is the subject of a legal dispute between the tax authorities and EELPA (note 1 to Annex 6) was not assumed as available in respect of both Awash III and Finchaa projects, the net operating income would be even lower.

The Loan Agreement includes a rate of return requirement of 7% per year. The first time EELPA failed to achieve this rate is during FY1974 (10 months) when the rate achieved on a yearly basis was 6.2%.

27. Auditors

EELPA's accounting records are well maintained and financial reports are prepared promptly. Its accounts are audited annually by the accounting firm of Mann, Judd & Co. of London and Addis Ababa.

28. Useful Lessons Arising from the Project

This has been a straight forward project with no serious problems during construction although operating problems have since arisen. The delays are no more than normally experienced in a construction program of this magnitude in a remote location and completion within seven months of the scheduled date in a 4-year development program is not unreasonable.

Probably the most useful lesson arising from this project is the value of international tendering under the Bank Guidelines, compared with tied aid. It was precisely because bids for the major contracts were so high under USAID tied procurement that the Bank was asked to take over the Project. The differences in bid prices when tender documents were re-issued under the Bank Guidelines were quite significant. Bids received were as much as 60% lower than those previously received for the same contracts under USAID tied procurement.

The criticisms made by EELPA concerning faulty survey work and lack of attention to design and specifications resulting in cost overruns, are problems which have been experienced with other hydro projects and justifies further consideration of the suggestion that a second opinion should always be obtained in the case of large hydro projects with special features such as road and penstock tunnels.

Another important lesson, arising from this project in particular, is that, whilst the timing for additional generating plant involving as it does a time lag of anything from 4 to 6 years (including design), must be determined on the basis of load forecasting, there must always be the possibility that the investment might ultimately prove premature. The problem does not arise to the same extent if the load growth exceeds the forecast as the under capacity can normally be met by temporary expedients such as load shedding or the installation of diesel or gas turbine units which are usually available on quick delivery but impose high operating expenses.

East Africa Regional Office
February 1976

ETHIOPIA

ETHIOPIAN ELECTRIC LIGHT AND POWER AUTHORITY

Comparison of Actual Sales of GWh 1969-1974 with Appraisal Forecast
(millions of kWh)

	General		Commercial and Industrial		Public Lighting		Off-Peak		Total	
	kWh	% Incr.	kWh	% Incr.	kWh	% Incr.	kWh	% Incr.	kWh	% Incr.
Appraisal Estimate										
INTERCONNECTED SYSTEM										
1969	78.16	14.0	118.32	14.3	3.52	11.0	5.0	2.1	205	12.8
1970	89.88	15.0	140.21	18.5	3.91	11.0	5.0	1.8	239	16.6
1971	102.91	14.5	170.75	21.8	4.34	11.0	5.0	1.5	283	18.4
1972	117.32	14.0	202.86	18.8	4.82	11.0	5.0	1.3	330	16.6
1973	133.74	14.0	235.91	16.3	5.35	11.0	5.0	1.1	380	15.2
1974	152.46	14.0	274.60	16.4	5.94	11.0	5.0	1.0	438	15.3
SELF-CONTAINED SYSTEMS										
1969	18.23	24.9	14.20	10.0	1.57	20.0	--	--	34	(13.5)
1970	22.48	23.3	15.62	10.0	1.90	21.0	--	--	40	17.6
1971	27.50	22.3	17.18	10.0	2.32	22.0	--	--	47	17.5
1972	34.27	24.6	18.90	10.0	2.83	22.0	--	--	56	19.1
1973	42.26	23.3	20.79	10.0	3.45	22.0	--	--	66.5	18.8
1974	51.92	22.9	22.87	10.0	4.21	22.0	--	--	79.0	18.8
Actual										
INTERCONNECTED SYSTEM										
1969	73.20	6.6	114.29	10.4	3.02	-4.4	4.79	-27.2	195.70	7.7
1970	77.51	5.9	124.80	9.2	3.84	27.5	5.94	24.0	212.09	8.4
1971	82.96	7.0	142.60	14.3	3.90	1.6	8.00	34.7	237.46	11.9
1972	80.10	-3.4	155.30	8.8	4.53	16.1	12.12	51.5	252.05	6.1
1973	78.10	-2.5	165.60	6.6	4.80	60.0	20.14	66.2	268.64	6.6
1974	70.40	9.8	142.60	-13.9	4.00	-20	17.20	-14.6	234.2	-12.9
SELF-CONTAINED SYSTEMS										
1969	17.03	17.2	13.23	10.5	1.54	16.0	0.02	-	31.82	-18.9
1970	19.28	12.9	12.79	-3.3	1.76	14.2	-	-	33.83	6.4
1971	21.89	13.5	13.58	6.2	1.81	2.8	11.23	-	48.51	42.0
1972	19.20	-11.9	19.8	46.0	1.90	5.0	6.60	-39.0	47.50	-2.1
1973	17.10	-10.9	22.00	11.1	2.10	10.5	8.80	33.0	50.00	5.3
1974	5.3	-10.5	19.66	-10.6	1.88	-10.5	8.46	-3.9	45.30	-9.4

ETHIOPIA

ETHIOPIAN ELECTRIC LIGHT AND POWER AUTHORITY

Actual and Estimated kWh Generated and Sold, System Maximum Demand
Installed and Firm Capacity, Productive Capability
Interconnected System

Year Ending September 10 to 1973 and July 7 thereafter	kWh Generated (Millions)	kWh Sold (Millions)	% Annual Increase	Annual Load Factor	Maximum Demand MW	Installed Capacity MW	Firm Capacity MW	Productive Capacity Hydro Average Year	Productive Capacity Hydro Dry Year	Millions of kWh Thermal
Actual										
1964	126.8	107.8	17.2	54	27.1	57	35	135	100	49
1965	148.5	126.0	17.2	52	33.0	57	35	135	100	49
1966	158.2	137.3	8.7	55	33.0	62 1/	40	135	100	59
1967	189.9	162.2	18.2	55	39.6	94 2/	72	317	235	74
1968	211.9	181.8	11.8	56	43.3	94	72	315	233	74
1969	229.1	195.3	7.8	57	45.8	94	72	315	233	74
1970	248	212	8.8	55	50	94	72	315	233	74
1971	277	237	11.7	56	56.9	125 3/	103	497	368	74
1972	288	252	6.8	56	57.9	125	103	497	368	74
1973	307	269	6.7	54	64.7	220 4/	167	1,029	793	39
1974	265	235	-12.7*	55	67	220	167	1,029	793	39
1975	326	286	21.7	55	68	220	167	1,029	793	39
Forecast										
1976	340	299	4.55	55	70	220	167	1,029	793	39
1977	357	314	5.0	56	73	220	167	1,029	793	39
1978	411	536	6.3	56	84	220	167	1,029	793	39
1979	461	380	13.2 5/	56	94	220	167	1,029	793	39
1980	491	406	6.8	56	100	220	167	1,029	793	39

1/4.5 MW diesel plant purchased as emergency measure in view of Awash delay.
2/Awash II (32 MW) commissioned.
3/Awash III (32 MW) commissioned.
4/Finchaa (100 MW) commissioned and assumed 5 MW steam installation retired from service, leaving 4.5 MW diesel plant at Dire Dawa and 2 MW at Alem Maya as the only thermal plants in the Interconnected System.
5/Extensions to Shashamenne Region expected to be operational by early 1979.

Note: (1) 1974 was a 10 month year - actual annual increase based on a 12 month year was 4.4% in 1974 and 1.64% in 1975.
(2) Above figures exclude the proposed Cement Factory which is scheduled for commissioning by 1979/1980 but which may slip by a year or two.

ANNEX 2

ANNEX 3

ETHIOPIA

ETHIOPIA ELECTRIC LIGHT AND POWER AUTHORITY

FINCHAA HYDROELECTRIC PROJECT

Allocation of Proceeds of Loan

	Category	Amounts Expressed in Dollars Equivalent	
		Original Allocation	Allocation as Finally disbursed
1.	Electrical and Mechanical Equipment	3,500,000	2,078,471
2.	Transmission	4,000,000	3,216,293
3.	Engineering and Other Services		
	(a) Finchaa	1,500,000	1,173,331
	(b) Feasibility Studies	-	550,865
4.	Civil Works		
	(a) Finchaa	8,500,000	12,258,017
	(b) Awash III Tunnel Repairs	-	520,000
5.	Interest and other changes on loan	3,500,000	3,300,000
6.	Unallocated	2,100,000	3,023
	Total	23,100,000	23,100,000

ETHIOPIA

ETHIOPIAN ELECTRIC LIGHT AND POWER AUTHORITY

LOAN NO. 596-ET - FINCHAA HYDROELECTRIC PROJECT

ORIGINAL AND FINAL COST ESTIMATES

	Original Cost Estimate						Final Cost Estimate					
	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total	Local	Foreign	Total
	Eth $ 1000			US$ 1000			Eth $ 1000			US$ 1000		
Civil Works												
Access Road and Operators' Village	6,200	-	6,200	2,480	-	2,480	7,897	-	7,897	3,815	-	3,815
Maintenance of Access Road	-	-	-	-	-	-	648	820	1,468	313	342	655
Road from Dam to Powerhouse	1,902	4,240	6,142	761	1,696	2,457	5,867	7,513	13,380	2,834	3,133	5,967
Reservoir, Dam and Spillway	1,565	1,990	3,555	626	796	1,422	2,110	2,954	5,064	1,019	1,232	2,251
Intake	290	525	815	116	210	326	285	587	872	138	245	383
Tunnel, Shaft and Penstock	4,210	11,325	15,535	1,684	4,530	6,214	6,084	9,936	16,020	2,939	4,143	7.082
Powerhouse Structure and Yard	2,073	3,295	5,368	829	1,318	2,147	2,874	4,823	7,697	1,389	2,011	3,400
Contingencies	2,580	3,195	5,775	1,032	1,278	2,310	-	-	-	-	-	-
Sub-total	18,820	24,570	43,390	7,528	9,828	17,356	25,765	26,633	52,398	12,447	11,106	23,553
Equipment												
Turbines	125	3,675	3,800	50	1,470	1,520	185	2,407	2,592	89	1,040	1,129
Generators	375	2,850	3,225	150	1,140	1,290	187	2,456	2,643	90	1,071	1,161
Electrical Equipment	285	970	1,255	114	388	502	254	1,738	1,992	123	713	836
Mechanical Equipment	400	1,305	1,705	160	522	682	190	1,126	1,316	91	469	560
Sub-total	1,185	8,800	9,985	474	3.520	3.994	816	7,727	8,543	393	3,293	3,686
Engineering and Other Services	2,875	2,625	5,550	1,150	1,050	2,200	4,996	2,104	7,100	2,414	883	3,297
Contingencies	120	880	1,000	48	352	400	-	-	-	-	-	-
Sub-total	4,180	12,305	16,485	1,672	4,922	6,594	5,812	9,831	15,643	2,807	4,176	6,983
Transmission												
Switching Station	245	2,255	2,500	98	902	1,000	244	2,893	3,137	118	1,222	1,340
Transmission Line	2,630	7,050	9,680	1,052	2,820	3,872	1,317	3,932	5,249	636	1,632	2,268
Substations	190	820	1,010	76	328	404	1,147	812	1,959	554	342	896
Engineering	325	875	1,200	130	350	480	694	665	1,359	335	277	612
Contingencies	360	1,125	1,485	144	450	594	-	-	-	-	-	-
Sub-total	3,750	12,125	15,875	1,500	4,850	6,350	3,402	8,302	11,704	1,643	3,473	5,116
Compensation to land owners and General Overhead Expenses	-	-	-	-	-	-	1,500	-	1,500	725	-	725
TOTAL PROJECT	26,750	49,000	75,750	10,700	19,600	30,300	36,479	44,766	81,245	17,622	18,755	36,377
Additional Charges to Loan 596-ET												
Steel Lining - Awash III Tunnel	-	-	-	-	-	-	-	1,076	1,076	-	520	520
Feasibility Studies for next Hydro Project	-	-	-	-	-	-	-	983	983	-	475	475
GRAND TOTAL	26,750	49,000	75,750	10,700	19,600	30,300	36,479	46,825	83,304	17,622	19,750	37,372

ANNEX 4

ETHIOPIA

ETHIOPIAN ELECTRIC LIGHT AND POWER AUTHORITY

Comparative Balance Sheets
1970 - 1974
(Eth$ Thousands)

	1970		1971		1972		1973		1974	
FIXED ASSETS	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual
Fixed Assets in Operation	157.48	121.31	166.23	157.06	173.73	159.81	256.73	163.38	264.23	247.89
Less: Reserve for Depreciation	31.77	30.25	37.12	34.91	42.76	39.86	49.60	45.23	57.64	51.40
Net Fixed Assets in Operation	125.71	91.06	129.11	122.15	130.97	119.95	207.13	118.15	206.59	196.49
Work in Progress	25.50	51.79	48.00	46.51	67.50	73.63	-	82.02	5.00	3.01
Total Net Fixed Assets	151.21	142.85	177.11	168.66	198.47	193.58	207.13	200.17	211.59	199.50
Investments - at Cost		.17		.17		.17		.17		.17
CURRENT ASSETS										
Cash	.57	5.34	-	.97	-	.96	.49	.87	1.87	.98
Receivables and Prepayments	5.50	3.46	6.20	3.64	6.90	4.42	7.60	4.32	8.40	7.15
Inventories	4.00	4.48	4.30	5.57	4.60	5.41	5.50	5.21	5.90	7.09
Total Current Assets	10.07	13.28	10.50	10.18	11.50	10.79	13.59	10.40	16.17	15.22
Total Assets	161.28	156.30	187.61	179.01	209.97	204.54	220.72	210.74	227.76	214.89
EQUITY										
Share Capital	75.00	55.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00	75.00
Reserves and Surplus	7.54	27.94	12.22	13.28	18.00	16.11	24.94	19.99	33.40	22.95
Total Capital	82.54	82.94	87.22	88.28	93.00	91.11	99.94	94.99	108.40	97.95
LONG TERM DEBT										
Supplier's Credits	.81	.82	.54	.50	.27	.25	-	-	-	-
IBRD Loan: 375-ET	55.46	55.42	53.66	52.95	51.76	51.83	49.76	50.36	47.66	49.49
596-ET	12.53	5.77	30.72	22.92	48.42	43.62	57.75	51.06	57.01	52.32
USAID	2.82	3.12	2.82	3.02	2.82	3.14	2.82	3.47	2.82	3.48
Total Long Term Debt	71.62	65.13	87.74	79.39	103.27	98.84	110.33	104.89	107.49	105.29
CONSUMERS DEPOSITS	3.40	3.56	3.60	3.83	3.80	4.07	4.00	4.36	4.20	4.62
CURRENT LIABILITIES										
Bank Overdraft	-	-	4.51	.65	4.42	3.20	-	.32	-	.94
Payables and Accruals	1.80	3.34	2.00	5.93	2.20	4.90	2.40	3.31	2.60	5.46
Provision for Taxes and Dividends	1.92	1.33	2.54	.93	3.28	2.42	4.05	2.67	5.07	.63
Total Current Liabilities	3.72	4.67	9.05	7.51	9.90	10.52	6.45	6.50	7.67	7.03
Total Equity and Liabilities	161.28	156.30	187.61	179.01	209.97	204.54	220.72	210.74	227.76	214.89
Debt/Equity Ratio	46/54	44/56	50/50	47/53	53/47	52/48	52/48	52/48	50/50	52/48
Average Net Fixed Assets in Operation	108.71	91.83	127.41	106.60	130.04	121.05	169.05	119.05	206.86	157.32

Note: All figure columns show the position as on September 10, except 1974 actual which is as on July 7, 1974.

ETHIOPIA

Ethiopian Electric Light and Power Authority

Comparative Income Statement

1970 - 1974
(Eth$ Thousands)

	1970		1971		1972		1973		1974	
	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated (12 months)	Actual (10 months)
Sales in GWh	279.0	245.7	330.0	285.9	386.0	299.5	446.5	319.5	517.0	279.5
Average Per KWh in Eth Cents	8.89	9.03	8.79	8.57	8.58	9.60	8.40	9.91	8.16	10.03
Gross Operating Revenue	24.80	22.71	29.00	25.08	33.10	29.30	37.50	32.47	42.20	28.67
Operating Expenses										
Operation and Maintenance	8.70	8.15	9.80	9.09	10.70	9.96	11.40	10.91	12.30	10.77
Fuel and Lubricants	1.82	1.65	1.91	1.99	2.06	2.30	1.95	2.71	1.80	3.08
Depreciation	4.68	3.88	5.35	4.66	5.64	4.98	6.84	5.70	8.04	6.17
Income Taxes 1/	1.92	1.83	2.54	.93	3.28	1.82	4.05	1.67	5.07	0.53
Total Operating Expenses	17.12	15.51	19.60	16.67	21.68	19.06	24.24	20.99	27.21	20.55
Net Operating Income	7.68	7.20	9.40	8.41	11.42	10.24	13.26	11.48	14.99	8.12
Gain (Loss) on Foreign Exchange	-	(1.45)	-	1.23	-	(1.00)	-	(.44)	-	-
Other Income	-	.37	-	.12	-	.20	-	.08	-	.01
Net Income Before Interest	7.68	6.12	9.40	9.76	11.42	9.44	13.26	11.12	14.99	8.13
Interest Charges	3.95	3.85	4.72	4.42	5.64	5.61	6.32	6.24	6.53	5.17
Net Income	3.73	2.27	4.68	5.34	5.78	3.83	6.94	4.88	8.46	2.96
Dividend to Government	-	-	-	-	-	1.00	-	1.00	-	-
Transfer to Surplus	3.73	2.27	4.68	5.34	5.78	2.83	6.94	3.88	8.46	2.96
Operating Income - % of Average Net Fixed Assets in Operation 2/	7.1	7.8	7.4	7.9	8.8	8.5	7.8	9.6	7.2	6.2

1/ Income taxes are based on the assumption that tax relief benefits in respect of Awash III and Finchaa projects are available to EELPA for these years. The Inland Revenue Department (IRD) withdrew these benefits in respect of Awash III from FY 1971. On an appeal by EELPA the Tax Appeal Commission reinstated these benefits. The IRD has filed an appeal in the high court against this decision and the matter is sub-judice. A decision against EELPA would increase its tax liability for these years by about Eth$ 5 million.

2/ The rate of return for ten months of FY 1974 is 5.2% which works out to 6.2% on a yearly basis.

3/ All the figure columns are for years ended September 10, except 1974 Actual column which is for ten months ended July 7, 1974.

ANNEX 6

ETHIOPIA

Ethiopian Electric Light and Power Authority

Comparative Funds Statement

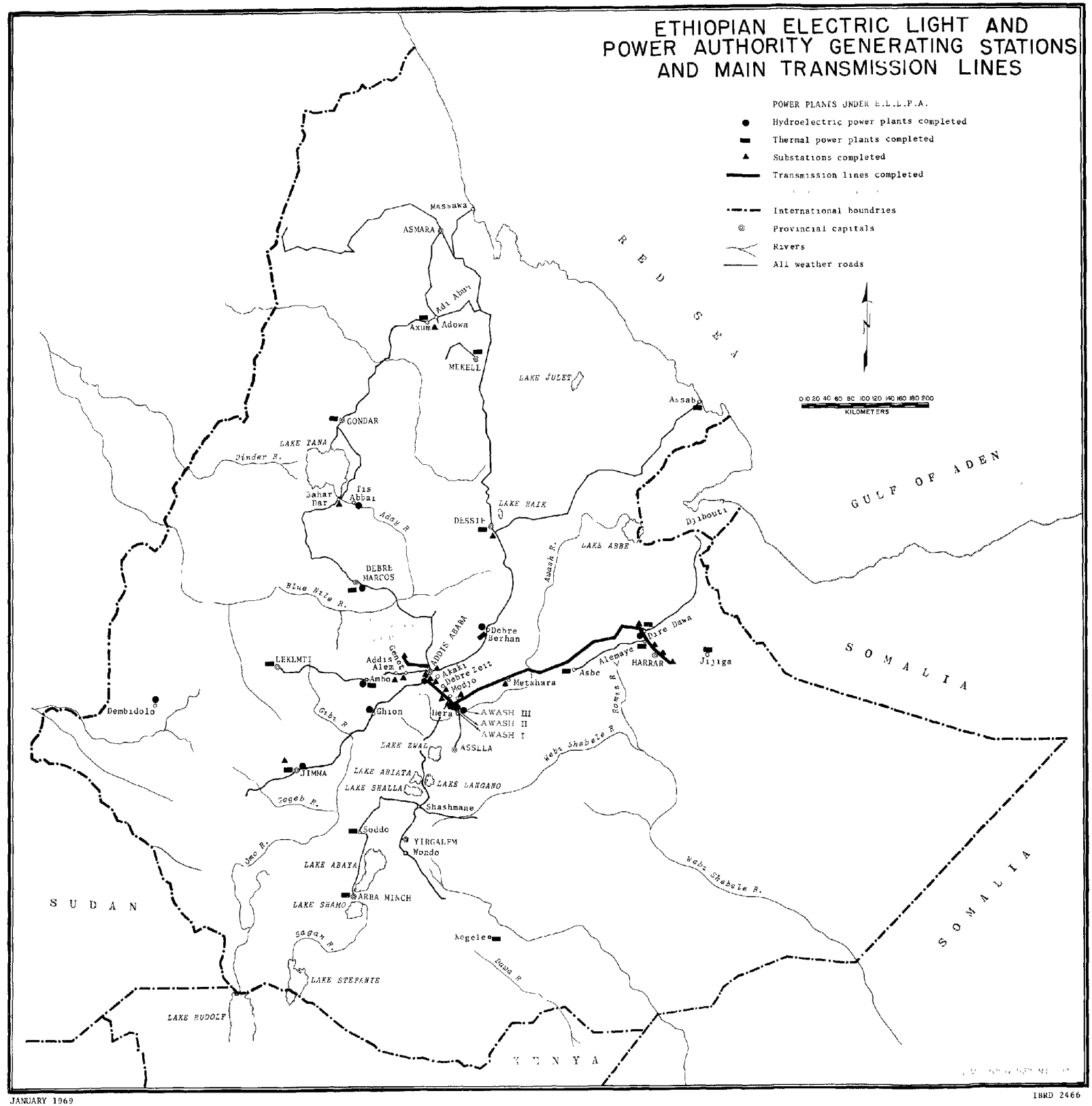
1970 - 1974

(Eth$ Thousands)

	1970		1971		1972		1973		1974		Total 1970-1974	
	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated	Actual	Estimated (12 months)	Actual (10 months)	Estimated	Actual
SOURCES OF FUNDS												
Internal Generation of Funds												
Net Income Before Interest	7.68	6.12	9.40	9.76	11.42	9.44	13.26	11.12	14.99	8.13	56.75	44.57
Depreciation	4.68	3.88	5.35	4.66	5.64	4.98	6.84	5.70	8.04	6.17	30.55	25.39
Loss (gain)on Foreign Exchange	-	1.45	-	(1.23)	-	1.00	-	.44	-	-	-	1.66
Total Internal Generation	12.36	11.45	14.75	13.19	17.06	15.42	20.10	17.26	23.03	14.30	87.30	71.62
Consumer Deposits	.20	.28	.20	.27	.20	.24	.20	.29	.20	.26	1.00	1.34
Borrowings												
IBRD 375 ET	1.90	1.00	-	-	-	-	-	-	-	-	1.90	1.00
569 ET	10.88	5.77	18.19	17.40	17.70	20.27	9.33	7.41	-	1.85	56.10	52.70
USAID	-	.49	-	-	-	.12	-	.33	-	.06	-	1.00
Total Borrowing	12.78	7.26	18.19	17.40	17.70	20.39	9.33	7.74	-	1.91	58.00	54.70
Total Funds Provided	25.34	18.99	33.14	30.86	34.96	36.05	29.63	25.29	23.23	16.47	146.30	127.66
APPLICATION OF FUNDS												
Construction Expenditure												
Finchaa Project	16.50	18.11	22.50	26.32	19.50	25.45	8.25	8.20	-	3.16	66.75	81.24
Other	9.40	2.17	8.75	4.15	7.50	4.43	7.25	4.09	12.50	2.34	45.40	17.18
Total Construction	25.90	20.28	31.25	30.47	27.00	29.88	15.50	12.29	12.50	5.50	112.15	98.42
Interest on Loans												
IBRD 375 ET	3.04	3.09	3.01	3.08	2.93	2.90	2.82	2.90	2.71	2.29	14.51	14.26
596 ET	.88	.57	1.69	1.16	2.70	2.40	3.49	3.10	3.82	2.76	12.58	9.99
USAID	-	.16	-	.16	-	.14	-	.13	-	.12	-	.71
Other	.03	.03	.02	.02	.01	.17	.01	.11	-	.01	.07	.34
Total Interest	3.95	3.85	4.72	4.42	5.64	5.61	6.32	6.24	6.53	5.18	27.16	25.30
Repayment of Loans												
IBRD 375 ET	1.70	1.70	1.80	1.64	1.90	1.71	2.00	1.88	2.10	.86	9.50	7.79
596 ET	-	-	-	-	-	-	-	-	.74	.59	.74	.59
USAID	-	-	-	-	-	-	-	-	-	.05	-	.05
Suppliers Credits	.27	.27	.27	.27	.27	.25	.27	.25	-	-	1.08	1.04
Total Repayments	1.97	1.97	2.07	1.91	2.17	1.96	2.27	2.13	2.84	1.50	11.32	9.47
Total Debt Service	5.92	5.82	6.79	6.33	7.81	7.57	8.59	8.37	9.37	6.68	38.48	34.77
Dividend to Government	-	-	-	-	-	1.00	-	1.00	-	-	-	2.00
Increase (Decrease) in Working Capital	(6.48)	(7.11)	(4.90)	(5.94)	.15	(2.40)	5.54	3.63	1.36	4.29	(4.33)	(7.53)
	25.34	18.99	33.14	30.86	34.96	36.05	29.63	25.29	23.23	16.47	146.30	127.66
Times Annual Debt Service Covered by Internal Generation of Funds	2.09	1.97	2.17	2.08	2.18	2.04	2.34	2.06	2.46	2.14	2.27	2.06

ANNEX 7

Note: All the figure columns are for years ended September 10, except 1974 Actual column which is for ten months ended July 7, 1974.



JANUARY 1969

IBRD 2466