

Document of  
The World Bank

FOR OFFICIAL USE ONLY

Report No. 16830

IMPLEMENTATION COMPLETION REPORT

KENYA

GEOTHERMAL DEVELOPMENT AND ENERGY PRE-INVESTMENT PROJECT  
(CREDIT 1973-KE)

June 30, 1997

Water, Urban and Energy 1 Division  
Eastern and Southern Africa Department  
Africa Region

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

## CURRENCY EQUIVALENTS

Currency Unit	=	Kenya Shilling (Ksh
US\$1.0	=	Ksh 56 ( as of January 1996 )

## WEIGHTS AND MEASURES

1 kilometer (km)	=	0.621 miles			
1 square kilometer (km <sup>2</sup> )	=	0.386 square miles			
1 kilovolt (kV)	=	1,000 volts			
1 megawatt (MW)	=	1,000 kilowatts			
1 megavolt ampere (MVA)	=	1,000 kilovolt amperes			
1 gigawatt hour (GWh)	=	1,000 kilowatt hours			
1 ton of oil equivalent	=	10,500,000 kilocalories			
bbbl	=	barrel	MJ	=	megajoule
cm	=	centimeter	Mm <sup>3</sup>	=	million cubic meters
GW	=	gigawatt	m <sup>3</sup>	=	cubic meter
ha	=	hectare	MVA	=	megavolt amperes
kgoe	=	kilogram of oil equivalent	MWh	=	megawatthour
ktoe	=	kilotonnes of oil equivalent	od	=	oven dry
kVA	=	kilvolt amperes	sv	=	solid volume
kw, kWh	=	kilowatt, kilowatthour	t	=	tonne
LPG	=	liquefied petroleum gas	TCF	=	trillion cubic feet
M	=	million	tpa, tpy	=	tonnes per annum, tonnes per year
			twe	=	tonnes of wood equivalent

## ABBREVIATIONS AND ACRONYMS

CIDA	Canadian International Development Agency
ESMAP	Joint UNDP/World Bank Energy Sector Management Assistance Programme
FINNIDA	Finnish International Development Agency
GoK	Government of Kenya
KfW	Kreditanstalt fuer Wiederaufbau
KPC	Kenya Power Company Limited
KPLC	Kenya Power and Lighting Company Limited
KVDA	Kerio Valley Development Authority
LBDA	Lake Basin Development Authority
MoE	Ministry of Energy
MoERD	Ministry of Energy and Regional Development
MoF	Ministry of Finance
NOCK	National Oil Corporation of Kenya
NPDP	National Power Development Plan
ODA	Overseas Development Administration
REP	Rural Electrification Program
TARDA	Tana and Athi Rivers Development Authority
TRDC	Tana River Development Company
UNDP	United Nations Development Programme

## FISCAL YEAR

July 1 - June 30

Vice President	: Callisto E. Madavo
Director	: Harold E. Wackman
Technical Manager	: Jeffrey Racki
Team Leader	: Joel J. Maweni

# IMPLEMENTATION COMPLETION REPORT

FOR OFFICIAL USE ONLY

## KENYA

### GEOHERMAL DEVELOPMENT AND ENERGY PRE-INVESTMENT PROJECT

(Credit 1973-KE)

#### CONTENTS

<b>PREFACE</b> .....	<b>i</b>
<b>EVALUATION SUMMARY</b> .....	<b>ii</b>
<b>PART I - PROJECT IMPLEMENTATION ASSESSMENT</b> .....	<b>1</b>
A. STATEMENT /EVALUATION OF OBJECTIVES .....	1
B. ACHIEVEMENT OF OBJECTIVES .....	2
C. IMPLEMENTATION RECORD AND MAJOR FACTORS AFFECTING PROJECT IMPLEMENTATION .....	3
D. SUSTAINABILITY OF PROJECT .....	6
E. BANK PERFORMANCE.....	6
F. BORROWER PERFORMANCE.....	7
G. ASSESSMENT OF OUTCOME .....	7
H. FUTURE OPERATION .....	7
I. KEY LESSONS LEARNED.....	8
<b>PART II - STATISTICAL TABLES</b> .....	<b>10</b>
Table 1: Summary of Assessments .....	10
Table 2: Related Bank Loans/Credits .....	11
Table 3: Project Timetable.....	12
Table 4: Loan/Credit Disbursements: Cumulative Estimated and Actual.....	12
Table 5A: Key Physical Indicators for Project Implementation .....	12
Table 5B: Key Financial Indicators for Project Implementation .....	13
Table 6A: Key Indicators for Operation of Moi South Lake Road.....	13
Table 6B: Key Indicators for Operation of Olkaria I Make-Up Wells .....	13
Table 7: Studies Included in Project .....	14
Table 8A: Project Costs .....	15
Table 8B: Project Financing .....	15
Table 9: Economic Costs and Benefits .....	15
Table 10: Status of Legal Covenants .....	18
Table 11: Compliance with Operational Manual Statements.....	20
Table 12: Bank Resources: Staff Inputs.....	21
Table 13: Bank Resources: Missions .....	21

**This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.**

## **APPENDICES**

- A. Mission Aide Memoire
- B. Borrower Contribution to the ICR
- C. Borrower Comments on Part I
- D. Map: IBRD No. 28876

# **IMPLEMENTATION COMPLETION REPORT**

## **KENYA**

### **GEOHERMAL DEVELOPMENT AND ENERGY PRE- INVESTMENT PROJECT**

**(Credit 1973-KE)**

#### **PREFACE**

This is the Implementation Completion Report (ICR) for the Geothermal and Energy Pre-Investment Project in the Republic of Kenya, for which Credit 1973-KE in the amount of SDR31.6 million ( US\$40.7 million equivalent) was approved on December 22, 1988 and made effective on November 14, 1989.

The Credit was closed on April 30, 1996 compared with the original date of June 30, 1994. Final disbursement took place on October 4, 1996 at which time a balance of 2.2 SDR million (US\$ 3.2 million equivalent) was canceled.

The ICR was prepared by Messrs. Joel Maweni of the Water, Urban and Energy 1 Division of the Africa Region and Josphat Sasia of the Bank's Nairobi Mission. The ICR was reviewed by Mr. Harold Wackman, Country Director for Kenya and Djibouti. The borrower provided comments that are included as appendix C to the ICR.

Preparation of this ICR was begun during the Bank's final supervision mission to Nairobi during May 18-26, 1996. The ICR is based on the appraisal report, supervision reports, correspondence between the borrower and the Bank during implementation and other material available in the Bank's project files. The borrower contributed to the ICR by preparing its own evaluation of the project's preparation and execution (Appendix B) and commenting on the draft ICR.

## EVALUATION SUMMARY

### Introduction

1. Kenya's known energy resources include hydro, geothermal power, biomass, wind and solar energy. Exploration for hydrocarbons has been going on but no significant reserves have been discovered. Adequate and reliable supplies of power and energy are crucial for economic growth as the current shortage of power supplies is seriously affecting economic activity that is essential for poverty reduction. Because of concerns about poor macro economic management, governance and multiparty democracy, in November 1991 donors decided to withdraw aid to Kenya. This action compounded the power sectors difficulties in raising resources for investment. When the aid embargo was subsequently lifted, difficulties in reaching agreement with donors on sector policies further delayed new investments in power generation. As a result, the power system is inadequate to meet current demand. Load shedding has become inevitable. The on-going rehabilitation of existing plants and the 88 MW capacity to be installed by the private sector under BOO arrangements are expected to ease the pressure on demand. Nevertheless, the additional capacity (about 338 MW) planned under the recently approved (June 19, 1997) Energy Sector Reform and Power Development Project (Cr. 2966-KE) is required to bridge the existing gap between demand and supply which is increasing private sector costs and discouraging new investment.

2. IDA has provided seven loans and credits totaling US\$307 million for financing power subsector investments in Kenya between 1971-1988. Three of the loans/credits financed hydroelectric development on the Tana River and while the other four financed geothermal development activities (including power plant construction). Four other loans/credits totaling US\$ 80 million were made for reforestation and related infrastructure. In the petroleum subsector, the Bank financed the construction of the products pipeline from Mombasa to Nairobi and two petroleum exploration promotion projects totaling US\$ 30 million. A complete listing of the Loans and Credits is available in Statistical Table 2.

### Project Objectives

3. The objectives of the project were: (i) to assist Kenya in preparing an expansion of its electric generating capacity at least cost through utilization of indigenous energy resources. This included mobilization and institutional development of a major geothermal development program to be implemented over the subsequent 20 years; (ii) comparative evaluation of potential hydro sites; (iii) development of options for energy pricing policies that encourage more efficient use of fuels and achieve savings and resource mobilization; and (iv) rural electrification policy and household fuel supply and distribution.

4. The objectives were clear, unambiguous and flexible and were aimed at facilitating provision of infrastructure needed for long-term economic growth in line with the Country Assistance Strategy. The project assisted GoK in preparing a least-cost power generation expansion plan largely through utilization of indigenous energy resources (geothermal, hydro, etc.). Some of the specific investments prepared under the project are to be implemented as part of the Energy Sector Reform and Power Development Project (Cr. 2966-KE) and the Sondu

Miriu Hydropower Project which has secured funding from OECF. Power generation based on indigenous resources will help Kenya to minimize its oil import bill especially given the rapid growth of demand for commercial energy. The studies on energy pricing options were required to assist with the design of reforms to improve sector efficiency.

### **Implementation Experience and Results**

5. The Kenya Power Company Limited (KPC) which was then managed by the Kenya Power and Lighting Company Limited (KPLC) under contract management arrangements, was successful in implementing and achieving the objectives of both the geothermal development and the energy pre-investment components of the project. With respect to the geothermal development component:

- (i) a total of 33 wells were drilled compared to the planned 32. On the basis of the drilled wells, adequate resources were proven for construction of a 64MW power plant at Olkaria North East; strong evidence of the commercial viability of developing Olkaria West was obtained; it was confirmed that about 20MW can be generated at the Eburru site compared to the estimated level of 55MW assessed during the appraisal stage of the project; and four out of eight make-up wells drilled in Olkaria East Production Field (EPF) were connected to the power plant and helped to restore the power station's output to its rated capacity of 45MW after having declined to about 31MW;
- (ii) Moi South Lake Road was successfully completed and has greatly improved communication to the power station and also stimulated economic activities (particularly horticulture and tourism) in the surrounding areas;
- (iii) a feasibility study and design and tender documents for a 2x32 MW power plant at Olkaria North-East were prepared; financing for the plant has been secured and implementation of the project is about to commence; and
- (iv) geothermal scientific equipment and supplies were procured and used in exploration and evaluation of the geothermal resources.

6. Thus, implementation of the component has: (i) facilitated the GoK's preparation of a least-cost power expansion program of which some of the plants are expected to be soon under implementation; and (ii) enabled KPC to continue operating the existing Olkaria I Power plant at its rated output of 45 MW through drilling and connection of make-up wells; (iii) enabled KPC to build its capacity in geothermal resource exploration and production; and (iv) contributed to the development of the Lake Naivasha area.

7. With respect to the Energy Pre-Investment Component the following results have been achieved:

- (i) an optimization and feasibility study of the development of Sondu Miriu Basin and its hydro resources was carried out as planned; an engineering report for the lower Miriu Weir area power station, and design and tender documents for a 60MW power plant were

prepared. Financing for the power plant has been secured and project implementation is about to commence;

- (ii) comparative reconnaissance, pre-feasibility and optimization studies on several potential hydropower sites, including benefits of irrigation and flood control were not carried out as originally planned. Instead, prefeasibility and feasibility studies were done for individual sites including the Ewaso Ngiro and Grand Falls sites;
- (iii) energy pricing studies originally intended to be funded under the credit were deferred and were subsequently funded under a project preparation facility for the Energy Sector Reform and Power Development Project. Implementation of the recommendations of the studies has enabled KPLC to progressively raise electricity tariff from 30% of LRMC at the beginning of the project to about 72% by October 1996, helped to improve the financial performance of the power sector and has facilitated deregulation of the petroleum subsector;
- (iv) the LPG study initially to be funded by CIDA was later carried out in FY1995/96 with resources of the Kenya Pipeline Company; and
- (v) implementation of rural electricity and cost minimization study financed by ADB is still in progress.

8. Thus the objectives of the energy pre-investment component were substantially achieved. The studies to assist with the preparation of the power sector investment program were carried out (items i and iii above). The energy pricing and other policy studies were delayed because the expected funding from donors did not materialize. Although the studies' original objectives were achieved (para. 7), their deferment contributed to delay in reaching agreement between the GoK and the Bank on electricity pricing and deregulation of the petroleum subsector, which in turn delayed implementation of the power subsector investment program. The adjustment in electricity prices in 1994 and 1996 enabled the power sector to improve its financial performance starting in FY1994/95, the fiscal year in which the first adjustment was in effect for a full year.

9. **Project Costs and Financing Arrangements.** Total project costs amounted to US\$70.95 million compared to the appraisal estimate of US\$59.58 million representing a cost overrun of about 19.1%. The cost overruns were attributable to the change in scope of the geothermal development component to include the connection of make-up wells for Olkaria I power plant, more extensive training and the treatment of salaries of geothermal field staff as project costs, which was not done at appraisal. Three out of the five cofinanciers identified at the beginning of the project did not provide funding. These were KfW for studies of potential hydro sites, FINNIDA for the rural electrification study and CIDA for the LPG study. The rural electrification study was later financed by the AfDB. Financing from KfW did not materialize as the focus of the studies was changed and other donors came forward to finance these. Financing from the other two donors appears not to have been firm at the time the IDA Credit was approved. Overall, the actual financing of the project shows that KPC ended up committing about three times the level of resources anticipated at appraisal. This was partly due to procurement difficulties with IDA (para. 12) and partly due to changes in project scope and the capitalization of training expenses and salaries of KPC's geothermal field staff.

10. **Performance of the Bank.** Overall, the Bank's performance during project identification, preparation, appraisal and implementation is considered satisfactory. The mid-term review was successful in putting project implementation back on track by clearly identifying problems and successfully proposing corrective measures at an appropriately early stage. Particularly useful was the introduction of an action plan agreed between KPC and the Bank to track implementation of important items. The Bank was also flexible in agreeing to reallocate funds among credit categories to take account of emerging needs and priorities. There were, however, differences of opinion between KPC and the Bank on procurement issues with the Bank staff raising concerns about the non-use of Bank procedures by KPLC and KPC alleging inconsistent positions by the Bank staff. As a result a number of items originally intended for Bank financing had to be funded by KPC.

11. **Performance of the Borrower.** Implementation start-up was slow mainly because of procurement delays and putting in place a project implementation team. Later on, there was a remarkable change in implementation when all project staff positions were filled, four engineers were trained in project monitoring and others were trained in project management and procurement. KPC produced high quality quarterly progress reports which facilitated its own and the Bank's monitoring of project implementation performance.

12. **Project Outcome.** The project objectives have been satisfactorily met (paras. 5-7). The Borrower has prepared adequate operational plans for the physical components of the project; i.e. the Moi South Lake Road and the make-up wells. Subprojects prepared under this project will be implemented under the Energy Sector Reform and Power Development and Sondu Miriu Hydropower projects. The project outcome is rated satisfactory (para. 24). The Incremental Economic Rate of Return (EIRR) is re-estimated at 15% when benefits are calculated as the value of incremental sales at the current average tariff or 23% when consumer willingness to pay is considered. The benefit of the project are much higher if the impact of the Moi South Lake Road and the institutional capacity for geothermal development are taken into account.

### **Summary of Findings, Future Operation and Key Lessons Learned**

13. **Project Implementation Experience-Most Important Findings.** The following were the most important findings:

- (i) up until mid-term review, significant project management weaknesses, particularly in procurement and monitoring of activities adversely impacted on project implementation;
- (ii) subsequent actions--engagement of the Geothermal Board of Consultants, the Geothermal Development Coordinator and a support group of procurement and project monitoring units greatly facilitated project implementation. Further establishment of an environmental unit enhanced KPC's capacity to process environmental studies. Training of staff through a properly designed TA program helped to efficiently sustain KPC's drilling program;
- (iii) efficient and timely provision of drilling spare parts and supplies was essential for implementation of KPC's drilling program, but was affected by procurement problems -

particularly the dispute with IDA on what appeared to IDA to be an open-ended arrangement with a procurement agent---the stopgap of which led to slower acquisition of spare parts by KPC;

- (iv) the requirement for IDA prior review of all expenditures financed under the credit slowed down project implementation; and
- (v) the GoK's payment procedures resulted in delayed payments to contractors and suppliers and in KPC incurring high interest charges. The delays in processing payments by KPC were quite frequent and occurred primarily at the Ministry of Energy.

**14. Project Operation Plan and Sustainability.** Satisfactory operation plans have been prepared for the Moi South Lake Road and the make-up wells for the Olkaria I Power Plant (paras. 25-28). The operation plan for the Moi South Lake Road include regular maintenance at stated intervals which are consistent with maintenance practices for bituminous roads. The Plan has been developed jointly by KPC and the Ministry of Public Works and Housing (MoPWH). MoPWH will implement and finance the road maintenance as agreed at appraisal. The operation and maintenance plan for make-up wells include monitoring of make-up wells and regular servicing of wellhead equipment. Project sustainability is likely because of the substantial institutional capacity that KPC has built in geothermal resource development, the adequate arrangements for maintenance and operation of project facilities and, above all the progress achieved in restructuring and commercializing sector operations, and in introducing private sector participation (para. 20).

**15. Lessons Learned from the Project.** The main lessons to be derived from implementation of this project are as follows:

- (i) it is possible with an appropriately designed capacity building program to improve skills to a point where an agency can operate with minimum long-term technical assistance (para. 30). The ingredients which seem to have been most critical in the design of KPC's program were: (a) the arrangement with PetroCanada International Assistance Corporation (PIAC) under which PIAC staff initially occupied line management positions but later switched to advisory roles; (b) senior management commitment to technical assistance goals and objectives; and (c) attractive working environment including remuneration packages;
- (ii) identifying the right mix of skills required for project implementation and ensuring that the staff are in place prior to project implementation (e.g. the position of geothermal coordinator) with clear roles and responsibilities is important for successful execution of the project (para. 12);
- (iii) a comprehensive mid-term review can be instrumental in identifying problems and taking corrective actions at a critical stage in project implementation (para. 12 ); and
- (iv) financial covenants need to be properly designed at the beginning taking into account the existing structural constraints in the sector. Although the agreed covenants required the power industry to achieve 30% self-financing levels, the investment financing arrangements were not

fully considered and the mechanisms (e.g. automatic adjustments for fuel price increases, exchange rate variations and autonomous regulatory arrangements) for ensuring tariff adjustments were not agreed upfront with the Government. As a result financial objectives remained elusive till towards the end of the project when the GoK agreed to adjust tariffs following completion of a tariff study (paras. 14-17). The mechanisms for securing Borrower compliance with financial covenants could have been put in place upfront at the project preparation stage. Alternatively, where the analytical basis for designing financial improvement measures does not exist at appraisal, a phased approach to improving financial performance should be considered such that significant steps are deferred to subsequent and more comprehensive sector projects. (e.g. the Energy Sector Reform and Power Development Project).



# IMPLEMENTATION COMPLETION REPORT

## KENYA

### GEOTHERMAL DEVELOPMENT AND ENERGY PRE- INVESTMENT PROJECT

(Credit 1973-KE)

## PART I - PROJECT IMPLEMENTATION ASSESSMENT

### A. STATEMENT /EVALUATION OF OBJECTIVES

#### Project Objectives

1. The project objectives were: (a) to assist Kenya in preparing an expansion of its generating capacity at least-cost through utilization of indigenous energy resources; (b) to develop options for energy pricing policies that would encourage more efficient use of fuels and achieve savings and resource mobilization; and (c) to address selected aspects of rural electrification policy and household fuel supply and distribution. The generating capacity expansion included the mobilization for a major geothermal development program that was to be implemented over the subsequent 20 years and systematic and comprehensive evaluation of about a dozen potential hydro sites.

#### Evaluation of Objectives

2. Oil remains the major source of primary energy and substantial amounts of foreign exchange are used to pay for crude oil imports. To reduce dependence on crude oil imports, the Government has continued to search for and develop domestic energy resources. The project objectives were intended to support GoK efforts to timely implement a least-cost expansion of capacity in the power subsector based primarily on geothermal resources and to create an efficient sector through appropriate pricing policies. The dominant role of indigenous resources--particularly geothermal resources---in the power expansion plan had been indicated by the National Power Development Plan completed under Credit 1486-KE.

3. To support the preparation of a least-cost investment program, the project, included: (i) drilling of wells to determine whether geothermal resources are available for a 60 MW power plant at Olkaria N.E; (ii) drilling of make-up wells to maintain the generation capacity of the existing 45 MW Plant at the Eastern Production Field (EPF); and (iii) assessing the possibility of Eburru field sustaining a 55 MW development; (v) assessing the commercial viability of the West Olkaria and other parts of the Olkaria area. Further, to facilitate implementation of these works, the project included financing of required infrastructure and equipment--a drilling rig, construction of Moi South Lake Road; purchase of geothermal scientific equipment-- and of

technical assistance and training for capacity building. To support preparation of the hydro component of the investment program, the project included: (i) feasibility study of development of the Sondu-Miriu basin and its hydro resources; and (ii) comparative reconnaissance, optimization and feasibility work on several potential hydro sites.

4. With respect to efficiency improving measures, the project was to support studies aimed at assisting with determination of policy options for the pricing energy products; addressing LPG supply shortages; and developing a rural electrification policy. The studies were expected to provide a basis for discussion of sector reform questions within the GoK and between the GoK and funding agencies.

## **B. ACHIEVEMENT OF OBJECTIVES**

5. The project objectives have been substantially achieved. The objective of supporting preparation of a least-cost power subsector investment program was achieved with the:

- (i) successful drilling of 33 wells which: (a) confirmed the sustainability of a 64MW power plant at Olkaria N.E and the adequacy of resources to sustain a 20MW capacity at the Eburru prospect compared to the appraisal estimate of 55MW; (b) provided strong evidence of the commercial viability of the South West Olkaria Field; and (c) supplemented the resource for the EPF;
- (ii) carrying out a feasibility study, designing and preparing tender documents for a 2x32 MW power plant at Olkaria North-East--financing for the plant has been secured and implementation of the project is about to commence;
- (iii) procurement of geothermal scientific equipment and drilling supplies for use in the drilling of the wells;
- (iv) successful construction of the Moi South Lake Road which has helped to facilitate communication with the Olkaria fields; and
- (v) completion of a feasibility study for development of the Miriu-Sondu basin; and preparation of design and tender documents for a 60MW power station.

6. Procurement of a drilling rig was deferred because the amount allocated under the credit was not adequate to finance purchase of the rig, and it was realized that operation of two rigs was not required since the efficiency of KPC's drilling operation had increased from 18m to 60m per day. The decision not to acquire a second rig did not affect implementation of the drilling program and therefore there was no adverse impact on the achievement of the component's objective. Also although the pre-feasibility work on various potential hydro sites was not done, there was no significant adverse effect on project objectives, since these were replaced with studies of individual sites at Grandfalls and Ewaso Ngiro.

7. The objective of improving sector efficiency through appropriate pricing policies and other measures were substantially achieved, although the funding for the supporting studies was provided through a project preparation facility for the proposed Energy Sector Reform and Power

Development Project. The studies were not carried out under the project since the funding which had been expected at appraisal from other financiers did not materialize. This was apparently because at the time of approval for the IDA credit the commitments by the other financiers were not firm. The energy pricing studies on electricity tariffs and on petroleum pricing and marketing were completed in 1993. On the basis of the studies findings, electricity prices have been adjusted from 30% of long-run marginal cost in 1993 to about 72% as of today and the importation, pricing and marketing of petroleum products was deregulated in 1994. The LPG study was done in 1995 with funding from the Kenya Pipeline Company Limited and the tendering process for the identified investment (LPG import facilities at Mombasa) is in progress. The rural electrification cost minimizing study is still in progress and is being funded by the AfDB. The adjustment of electricity tariffs enabled the sector to start improving its financial performance, especially in FY1994/95, the FY in which the first tariff increase was in effect for a full year.

### C. IMPLEMENTATION RECORD AND MAJOR FACTORS AFFECTING PROJECT IMPLEMENTATION

8. During project implementation several changes were made in the scope of the project, an overall cost increase of about 19% and a number of changes in the financing plan occurred, and a number of problems arose with regard to project management, procurement, payments to contractors and suppliers and compliance with financial covenants.

9. **Changes in Project Scope.** The following changes were made: (i) four make up wells were connected with IDA funding; (ii) purchase of a drilling rig was deferred since the efficiency of KPC's drilling operations had increased and an additional rig was not necessary at the time; (iii) construction of drill crew housing, repair shops and workrooms and acquisition of related tools and equipment were deferred as low priority to allow use of IDA funding on high priority connection of make-up wells for Olkaria I Power Plant; (iv) comparative reconnaissance, pre-feasibility and optimization studies on several potential hydropower sites, including benefits of irrigation and flood control were replaced with studies of individual sites funded by other donors outside the scope of this project; (v) the energy pricing studies and the LPG demand and supply study were deferred and implemented with separate funding ( para. 11); and (vi) a number of consultants services/studies were introduced to respond to new assessment of priorities (e.g. management information systems) or to resolve differences of opinion between the Bank staff and KPC (e.g. Board consultants to review Sondu Miriu Hydropower Project).<sup>1</sup>

10. The changes in the IDA-financed components were made in consultation with IDA which showed flexibility in re-allocating funds in response to changing priorities. However, it appears that IDA did not always follow-up on the outcomes of studies and other activities it initiated ( e.g. Geothermal Board of Consultants, Board of Consultants Review for Sondu Miriu Hydropower Project). Nevertheless, KPC confirms that overall it benefited from these studies/activities. One possible negative impact of the changes was the deferment of the energy

---

<sup>1</sup> Although the Borrower's comment is that the relevant project should be Ewaso Ngiro, there was also a Board of consultants that reviewed Sondu Miriu Hydropower Project. This fact has been confirmed in a separate communication from KPC.

pricing studies which in turn delayed the implementation of the deregulation of the petroleum subsector and the adjustment of electricity tariffs. Timely implementation of the studies could perhaps have enabled the Government and the Bank to reach agreement on policy issues earlier, thus expediting implementation of the power subsector's least cost investment program. The current power shortages could perhaps have been avoided or lessened.

11. **Project Costs and Financing Arrangements.** Total project costs amounted to US\$70.95 million compared to the appraisal estimate of US\$59.58 million representing a cost overrun of about 19.1%. The cost overruns were attributable to the change in scope of the geothermal development component to include the connection of make-up wells for Olkaria I power plant and the treatment of salaries and the extensive training program for geothermal field staff as project costs, which was not done at appraisal. Three out of the five cofinanciers identified at the beginning of the project did not provide funding. These were KfW for the study of potential hydro sites, FINNIDA for rural electrification and CIDA for the LPG study (para. 7). The rural electrification study was later financed by the AfDB.

12. **Project Management and Procurement Record.** Project management weaknesses were identified at the mid-term review. These related particularly to monitoring of implementation activities, and to the preparation of progress reports. The subsequent introduction of action plans to track implementation activities and the training provided through seminars/short courses and the appointment of a Geothermal Development Coordinator helped to substantially overcome these weaknesses. By the end of the project KPC was preparing high quality project implementation progress reports. There was an unusually high degree of procurement problems at mid term-review. Bank records attribute the problems to KPC non-observance of IDA guidelines on procurement procedures, whereas KPC is of the view that the Bank had inconsistent positions on procurement issues. It is partly because of these difficulties that KPC's contribution to financing of the project increased substantially as it had to fund contracts which the Bank could not finance. However, by the end of the project, procurement had become satisfactory.

13. **Payments to Contractors, Suppliers and Consultants.** Serious delays were experienced in processing payments to contractors, suppliers and consultants due to the GoK's cumbersome procedures. The procedures required payment applications from KPC to be authorized at three stages outside of KPC (MoE, MoF and CBK). It appears that the bulk of the delays occurred at the parent Ministry level. This resulted in increased costs as KPC ended up paying substantial interest charges.

14. **Financial Performance.** Under the project, the GoK and the Bank agreed that the power industry's financial performance was to be measured on the basis of its contribution to financing the subsectors investment program (self financing ratios); debt service, current and debt/equity ratios. The agreed targets were: (i) self financing ratios (SFR) of 25% in FY88/89, 27% in FY90/91 and 30% in FY93/94 and subsequent years; (ii) debt service coverage ratios of at least 1.5, if lower the industry would not incur new debt without prior consultations with IDA; (iii) debt/equity ratios of 75% in FY1991, 70% in FY1991 and subsequent years; and (iv) current ratios of not less than 1.1. The table below summarizes the actual ratios achieved by the industry for the four performance indicators.

<b>Financial Ratio</b>	<b>1988/89</b>	<b>1990/91</b>	<b>1992/93</b>	<b>1993/94</b>
self-financing (%)	60	(15)	34	25
debt-service	2	1.5	1.2	2.1
debt/debt+capital (%)	10	79	119	94
current	0.9	0.9	0.9	0.9

15. The ratios indicate that the power industry was not able to achieve the four targets in most of the project implementation years, particularly the period up to FY1993/94. This was due primarily to non-adjustment of electricity tariffs, high levels of debt service, the impact of the depreciation of the Kenyan shilling on debt service and operational inefficiencies. However, the industry's financial performance started to improve gradually from FY1994/95 onwards, primarily because of the implementation of a program of tariff adjustments. In March 1994, the GOK raised the average tariff by 60% which increased the tariff from about 30% of long-run marginal cost (LRMC) to about 55%. A subsequent increase in October 1996 has raised the tariff to about 72% of the LRMC.

16. It should be noted that monitoring the overall performance of the industry was difficult due to the complex pricing arrangements, unclear asset ownership arrangements and unresolved policy issues regarding inter-company indebtedness for bulk electricity sales to KPLC by the Tana River Development Authority (TARDA) and the Kerio Valley Development Authority (KVDA) from their Masinga, Kiambere and Turkwell power plants. Restructuring of the power subsector to address these issues has started--KPC and TRDC have been merged and top management has been appointed for the new power generation company. Assets and liabilities and personnel will soon be allocated to KPLC and KPC which are now responsible for management of T&D assets and generation assets respectively.

17. Despite the structural weaknesses noted above and the non-compliance with financial covenants, the industry has sound accounting systems and procedures and KPLC has competent financial management and staff. Thus, financial statements were prepared broadly in conformity with generally accepted accounting principles. Nevertheless, in most years the audited financial statements were submitted after the due date. Both KPLC and KPC have now been exempted from the provisions of the State Corporations Act, thus enabling them to engage private sector auditors.

### **Factors Influencing the Implementation Record**

18. **External Factors.** The main factors which impacted negatively on project implementation were:(i) the exchange rate which changed from 16.8 Ksh/US\$ 1 at the start of the project in 1987 to 80 Ksh/US\$ 1 in 1993 and down to 56 Ksh/US\$ 1 at the end of the project and higher inflation rates--thus contributing to the industry's weak financial performance; (ii) the delays in passing of Payment Applications through MoE, MoF and CBK towards the close of the project; (iii) GoK failure to use Letters of Credit caused delays in effecting payments to suppliers and contractors; (iv) the delay in effecting tariff adjustments which was primarily responsible for the industry's non-compliance with financial covenants; and (viii) provisions of State Corporations Act that required KPLC/KPC/TRDC to be audited by Auditor-General (Corporations) delayed the submission of the audits in time.

19. **Internal Factors.** The following actions undertaken by KPC positively affected project implementation: (i) the establishment of the position of the Geothermal Development Coordinator and support group comprising of procurement and project monitoring units assisted greatly in implementation progress of the project; and (ii) similarly the establishment of an environmental unit in KPC facilitated the carrying out of environmental studies, the identification and monitoring of measures to mitigate adverse impacts of projects; and (iii) the training of staff through technical assistance contributed immensely to building geothermal exploration and drilling capacity in KPC. Initially project management and procurement weaknesses adversely affected project implementation, but there was adequate improvement by project completion.

#### **D. SUSTAINABILITY OF PROJECT**

20. Sustainability of the project is likely. The reasons for this assessment are:

- (i) the substantial institutional capacity that KPC has built in geothermal resource exploration, production drilling and operation and maintenance of geothermal resources;
- (ii) KPC has prepared an adequate operation plan for the geothermal wells connected under the project and has developed a program for connection of remaining wells as well as for drilling of further wells to enable operation of the existing Olkaria I Power Plant at its rated output up to year 2000;
- (iii) substantial progress has been made in meeting the sector objectives aimed at creating a more efficient sector through appropriate pricing and other measures. The energy pricing studies, originally intended for financing under this project, but later deferred, have been completed and some of the recommendations have been implemented (para. 7). In addition, the introduction of private sector participation in power generation,--two plants being constructed under BOO arrangements and others in the planning process--is expected to lead to improvements in sector efficiency. Measures to restructure the power subsector to enable it to operate on a commercial basis and to introduce an autonomous regulatory authority in the subsector are at an advanced stage of implementation. This progress, achieved in the course of preparation of the Energy Sector Reform and Power Development Project can be attributed, in part, to the withholding of funding to the sector by donors, until satisfactory measures had been taken by the GoK.

21. The sustainability of the project would be at risk if the Government's commitments to sector reforms, particularly private sector participation and sector restructuring (including legal reforms) were not maintained.

#### **E. BANK PERFORMANCE**

22. The Bank's performance in identification, preparation and appraisal was generally satisfactory, particularly putting in place a well defined project implementation structure and project staffing, although the Bank could also have insisted on clear upfront measures for improving the financial performance of the power industry. Overall, during implementation of the project the Bank's performance is considered satisfactory. The mid-term review was

successful in putting project implementation back on track by clearly identifying problems and proposing corrective measures during the critical stage of the project. Particularly useful was the introduction of an action plan agreed between KPC and the Bank to track implementation of important items. The Bank was also flexible in agreeing to reallocate funds among credit categories to take account of emerging needs and priorities. However, there were several differences of opinion on procurement matters between the Bank and KPC with the result that a number of items originally intended for Bank financing had to be funded by KPC.

#### **F. BORROWER PERFORMANCE**

23. The implementation agency's performance was satisfactory in project preparation and implementation. However, there were some start-up delays particularly in procurement and deployment of staff to project positions. Later on, there was a remarkable change in implementation when all project staff positions were filled, four engineers were trained in project monitoring and others were trained in project management and procurement. KPC's Geothermal Board of Consultants also provided a seminar on project management. KPC produced high quality quarterly progress reports which facilitated its own and the Bank's monitoring of project implementation performance. There were also delays in processing and making payments particularly at the parent Ministry's level through MoF and CBK and also due to GoK non-acceptance of letters of credit as a method of payment to suppliers and contractors. There were significant delays in submission of audited reports. This was attributable to the provision in the State Corporations Act that required KPLC/KPC to be audited by Auditor-General (Corporations).

#### **G. ASSESSMENT OF OUTCOME**

24. The project objectives have been satisfactorily met (paras. 5-7). The Borrower has prepared adequate operational plans for the physical components of the project; i.e. the Moi South Lake Road and the make-up wells for the EPF (paras. 25-28). Subprojects prepared under this project will be implemented under the Energy Sector Reform and Power Development and Sondu Miriu Hydropower projects. These are: the 64 MW Olkaria North-East Geothermal Power Plant to be constructed and operated KPC; the 64 MW Olkaria South-West Power Plant to be constructed and operated by an independent power producers. The project was rated satisfactory throughout its implementation and this Implementation Completion Report confirms that the project outcome is satisfactory.

#### **H. FUTURE OPERATION**

25. KPC has prepared future operation plans for the physical components of the project; i.e. the make-up wells for the existing Olkaria I Power Plant and for the Moi South Lake Road. An operation plan has not been prepared for wells drilled in the Olkaria North-East and Eburru areas as these wells will be operated under future power plants still to be constructed. For the Moi South Lake Road the operation plan includes regular maintenance at stated intervals which are consistent with maintenance practices for bituminous roads. These are shown in Statistical Table 6.

26. The plan has been prepared in consultation with MoPWH which is responsible for maintenance of the road including funding as agreed at project appraisal.

27. The operation and maintenance plan for make-up wells include monitoring of make-up wells and regular servicing of wellhead equipment. The plan is shown in Statistical Table 6.

28. KPC staff who are experienced in operating other existing wells feeding the Olkaria I Power Plant will operate and maintain the wells. The funding will be provided from KPC's operating budget.

## I. KEY LESSONS LEARNED

29. A number of lessons were derived from implementation of this project. These are summarized below.

30. Capacity Building has occurred under this project to the extent that the Kenya Power Company is now able to undertake geothermal exploration, drilling and scientific studies with minimum levels of technical assistance. Under the project, PetroCanada International Assistance Corporation, with financing from CIDA, provided training in drilling operations. IDA resources funded instruments, consumables and spare parts to support the drilling activities, and scientific conferences, short-term courses and a Geothermal Board of Consultants (GBC) to upgrade technical skills. The GBC was made up of internationally renowned experts in the field: it met periodically to review the results of KPC activities. Training in drilling operations was provided through experts who initially held line management positions. After the performance of KPC/KPLC had improved to a reasonable degree, the role of the experts changed to advisory. The successful capacity building has been widely recognized by donors and international experts in the field. The principal reasons for the success are:

- (i) senior management of KPC/KPLC gave high priority to developing an indigenous resource and rewarded high performance;
- (ii) the conditions of service for KPC/KPLC staff comparable with most jobs in the private sector enabled KPC/KPLC to retain highly skilled and dedicated professional staff;
- (iii) the prospect of line management positions as expatriate staff switched to advisory functions provided a competitive environment for high performance;
- (iv) short-term technical assistance was provided through IDA financing on a flexible basis to deal with specific issues as they arose; and
- (v) the interaction between KPC/KPLC and the experts provided through the GBC which combined both academicians and practitioners.

KPC/KPLC's experience demonstrates that it is possible to design successful capacity building programs provided certain pre-conditions are met (as enumerated above).

31. Identifying the right mix of skills required for project implementation and ensuring that the staff are in place prior to project implementation (e.g. the position of geothermal coordinator) with clear roles and responsibilities (para. 12) is essential for successful project execution.

32. A comprehensive mid-term review can be instrumental in identifying problems and taking corrective actions at a critical stage in project implementation. This was particularly the case with this project (para. 12).

33. Financial covenants need to be properly designed at the beginning taking into account the existing structural constraints in the sector. The Borrower's commitment to the financial goals should be also demonstrated prior to commencement of project implementation. Thus although the agreed covenants required the power industry to achieve 30% self-financing levels, the investment financing arrangements were not fully considered and the mechanisms for ensuring tariff adjustments were not agreed upfront with the Government. As a result financial objectives remained elusive till towards the end of the project when the GoK agreed to adjust tariffs following completion of a tariff study (para. 15). Alternatively, where the analytical basis for designing financial improvement measures does not exist at appraisal, a phased approach to improving financial performance should be considered such that significant steps are deferred to subsequent and more comprehensive sector projects. (e.g. the Energy Sector Reform and Power Development Project).

34. To efficiently implement a geothermal explorational and resource development program, it is important to have responsive procurement arrangements for spare parts and supplies--such as procurement agents located close to supply sources.

35. Efficient payment procedures are required at the Ministry level to avoid the incurrence of high interest charges by the implementing agencies.

## PART II - STATISTICAL TABLES

**Table 1: Summary of Assessments**

**A. Achievement of Project Objectives**

Objective Category	Substantial	Partial	Negligible	Not Applicable
Macroeconomic Policies				x
Sector Policies		x		
Financial objectives			x	
Institutional development	x			
Physical	x			
Poverty Reduction				x
Gender Concerns				x
Other social objectives				x
Environmental objectives				x
Public sector management				x
private sector development				x

**B. Project Sustainability**

Likely	Unlikely	Uncertain
x		

**C. Bank Performance**

Activity	Highly Satisfactory	Satisfactory	Deficient
Identification		x	
Preparation Assistance		x	
Appraisal		x	
Supervision		x	

**D. Borrower Performance**

	Highly Satisfactory	Satisfactory	Deficient
Preparation		x	
Implementation		x	
Covenant Compliance			x
Operation ( if applicable)		x	

**E. Assessment of Outcome**

Highly Satisfactory	Satisfactory	Unsatisfactory	Highly Unsatisfactory
	x		

**Table 2: Related Bank Loans/Credits**

<i>Loan/Credit Title</i>	<i>Purpose</i>	<i>Year of Approval</i>	<i>Status</i>
<b><u>Preceding Operations</u></b>			
1. Ln. 641-KE First Forestry Plantation	Plantations and roads	1969	N/A
2. Ln. 745-KE Kamburu Hydro Power	Dam, power plant and transmission lines	1971	N/A
3. Ln. 1133-KE Nairobi-Mombasa Oil Products Pipeline	Construction of pipeline, storage facilities, buildings and staff training	1975	PPAR completed in 1981
4. Ln. 1147-KE Gitaru Hydroelectric	Dam, power plant, transmission lines and management review and tariff study	1975	PPAR completed in 1981
5. Ln. 1132-KE/Cr. 0565-KE Second Forestry Plantation	Pine plantations, roads, technical assistance and EIA	1975	PPAR completed in 1982
6. Ln. S012-KE Olkaria Geothermal Engineering	Consulting engineering, training and studies	1978	PCR completed in 1990
7. Ln. 1799-KE Olkaria Geothermal	Drilling, generating station, transmission lines and technical assistance	1980	PCR completed in 1990
8. Ln. 2065-KE Petroleum Exploration Promotion	Data collection, promotion rounds, drafting of legislation, TA and training	1982	PCR completed in 1991
9. Ln. 2098-KE Third Forestry	Plantations, roads and TA	1982	PCR completed in 1991
10. Ln. 2237-KE Power IV, Third Olkaria	Expansion to First Olkaria Project	1983	PCR completed in 1990
11. Ln. 2359-KE Power V (Kiambere)	Dam, power plant, transmission lines and TA	1984	PCR completed in 1993
12. Cr. 1486-KE Geothermal Exploration	Exploration drilling and TA	1984	PCR completed in 1992
13. Cr. 1675-KE Petroleum Exploration	TA and Exploration Promotion	1986	ICR completed in 1996
<b><u>Following Operations</u></b>			
1. Cr. 2198-KE Forestry Development	Tree farming, forest conservation, institution building, studies	1990	Under supervision
2. Energy Sector Reform and Power Development	Includes component for Petroleum Exploration Promotion	1996	To be presented to the Board in June 1996

**Table 3: Project Timetable**

Steps in project cycle	Date planned	Date Actual/latest estimate
Identification		October, 1987
Preparation		December, 1987
Appraisal		May, 1988
Negotiations		September, 1988
Letter of development policy		Not applicable
Board presentation		December, 1988
Signing		February, 1989
Effectiveness	March, 1989	November, 1989
First tranche release		Not applicable
Midterm review		November, 1991
Second tranche release		Not applicable
Project completion		
Credit closing	June, 1994	April, 1996

**Table 4: Loan/Credit Disbursements: Cumulative Estimated and Actual**

(US\$ million)

	FY90	FY91	FY92	FY93	FY94	FY95	FY96
Appraisal estimate	7.3	19.3	32.2	37.6	40.7		
Actual Disbursement	8.5	23.6	27.5	31.1	35.1	39.9	41.4
Actual as % of estimate	116	122	85	83	86	98	102

Date of Final Disbursement - October 4, 1996

**Table 5A: Key Physical Indicators for Project Implementation**

Key Implementation Indicators	Estimated	Actual
1. Construction of Moi South Lake Road	24 Km	24 Km constructed
2. Develop energy pricing policies	Several energy pricing policies	Electricity Tariff Study done
3. Drill 32 wells	32 wells	33 wells drilled
4. Carry out an Environmental Impact Study	2 sites	N.E. Olkaria and Kipevu completed
5. Update National Power Development Plan		Update completed
6. Feasibility study for N.E. Olkaria		Study completed
7. Update of 2 x 32 MW Geothermal Plant Feasibility Study		Update study completed
8. Carry out Hydro sites pre-feasibility studies	Several	Individual feasibility studies carried out for Sondu Miriu and Ewaso Ngiro

**Table 5B: Key Financial Indicators for Project Implementation**

	<b>FY88</b>	<b>FY89</b>	<b>FY90</b>	<b>FY91</b>	<b>FY92</b>	<b>FY93</b>	<b>FY94</b>
Units Sold (Gwh)	2337	2412	2595	2708	2719	2859	2997
Average revenue (Ksh.kWh)	1.04	1.09	1.12	1.41	1.68	1.75	3.10
Sales Revenue	3256	3564	3841	5602	6596	7838	13039
Operating Expenses	2601	2829	3024	4450	5183	5830	11207
Operating Income	225	538	110	505	270	3142	2534
Financial Charges	629	427	948	829	1342	4097	546
Net Income	(404)	111	(838)	(324)	(1072)	(955)	1988
<b>Financial Ratios</b>							
Debt/Debt & Equity (%)	77	10	77	79	86	119	94
Debt Service Coverage (times)	1.9	2.0	1.8	1.5	2.0	1.2	2.1
Current	0.97	0.86	0.81	0.92	0.91	0.87	0.89
Self Financing (%)	46	60	24	(15)	37	34	25

**Table 6A: Key Indicators for Operation of Moi South Lake Road**

<b>Activity</b>	<b>Frequency</b>	<b>Budget (US\$ 000)</b>
patching of potholes	every 2 years	34.0
vegetation clearing	quarterly	2.5
erosion control	annually	3.0
road furniture	as necessary	3.5
shoulders and structures	as necessary	10.0
resealing	every 10 years	1000.0

**Table 6B: Key Indicators for Operation of Olkaria I Make-Up Wells**

<b>Activity</b>	<b>Frequency</b>	<b>Budget <sup>2</sup> (US\$000)</b>
geochemical analysis of water and steam quantity and quality	quarterly	
updating of reservoir engineering parameters	quarterly	
Updating of well output characteristics	monthly	
changing of master valves	1 every 10yrs.	100
cutting of grass along pipelines	4 times p.a.	
servicing of pipeline valves	2 times p a./well	
cleaning of orifice plates at separators	1 times p.m.	

<sup>2</sup> The operation plan for four wells will cost about US\$2,000 per year for the four wells connected under the project, excluding the replacement of master valves.

**Table 7: Studies Included in Project**

<b>Study</b>	<b>Purpose</b>	<b>Status</b>	<b>Impact</b>
1. Reservoir Modelling	Support field development & management	Complete	Confirmed resource over plant life
2. Engineering Report 2x30 MW	To facilitate appraisal and secure funding for the project	Complete	Able to secure funding
3. Miriu hydro optimization study	To determine the availability of a 60 MW Sondu Miriu Hydropower Project	Complete	Confirmed economic sustainability of a 60 MW power plant
4. Miriu engineering report	To facilitate appraisal and secure funding for the project	Complete	Managed to secure funding
5. Hydro sites pre-feasibility studies	To determine Kenya's inventory of hydroelectric potential	Individual feasibility study carried out for Sondu Miriu and Ewaso Ng'iro	Sondu Miriu HEP secured funding
6. Energy pricing study	To define policy options for pricing energy products	Tariff study complete	Tariff raised
7. Rural electrification study	Development of rural electrification policy	Ongoing/ADB funding	Yet to be determined
8. LPG study	To alleviate shortages	done with Kenya Pipeline Co. funding	Delayed liberalization of petroleum sub-sector
9. Environmental Impact Study for Olkaria N.E. Plant	To study possible effects of the development on the environment	Complete	Development possible with minimal Env. Impacts
10. Power Regulation and optimization study	To update the National Power Development Plan	Complete	Development of a least cost program that is the base for future projects
11. Kipevu Environmental study	To study possible effects of the development on the environment	Complete	As in (9)

**Table 8A: Project Costs**

Item	Appraisal Estimate (US\$M)			Actual (US\$M)		
	Local Costs	Foreign Costs	Total Cost	Local Costs	Foreign Costs	Total Cost
Geothermal Development	11.81	25.45	37.26	32.15	34.80	66.95
Hydroelectric Studies	1.05	4.95	6.00	0.50	3.30	3.80
Energy Studies	0.18	1.05	1.23		0.20	0.20
Base Costs	13.04	31.44	44.48	32.65	38.30	70.95
Physical Contingencies	1.30	3.14	4.45			
Price Contingencies	3.32	7.34	10.66			
<b>TOTAL</b>	<b>17.66</b>	<b>41.92</b>	<b>59.58</b>	<b>32.65</b>	<b>38.30</b>	<b>70.95</b>

**Table 8B: Project Financing**

Source	Appraisal Estimate (US\$M)			Actual (US\$M)		
	Local Costs	Foreign Costs	Total Cost	Local Costs	Foreign Costs	Total Cost
IDA		40.70	40.70	2.70	38.55	41.25
KFW	0.33	1.63	1.96			
ODA/JAPAN	1.18	5.87	7.05	0.50	3.30	3.80
FINNIDA	0.05	0.20	0.25			
CIDA	0.05	0.10	0.15			
KPLC	9.47		9.47	25.90		25.90
<b>TOTAL</b>	<b>11.08</b>	<b>48.51</b>	<b>59.58</b>	<b>33.65</b>	<b>41.85</b>	<b>70.95</b>

**Table 9: Economic Costs and Benefits**

For all projects, this table identifies the major costs and/or benefits that enter into the calculation of a re-estimated net present value (or economic rate of return) or, where the net present value (or economic rate of return) was not estimated, of cost-effectiveness in achieving project objectives.

Table 9: Economic Costs and Benefits

FY	Investment Costs (US\$ 000)				O& M (US\$ 000)	Energy Gen. (GWh)			Net Energy GWh	Benefits		Benefits	
	Drilling Prog.	Olkaria II	Olkaria III	Total		Olkaria II	Olkaria III	Total		at US\$.091	at US\$.143	(US\$000)	US\$ 000)
1997/98	66,000	20,238		86,238							(86,238)	(86,238)	
1998/99		79,441	20,347	99,788							(99,788)	(99,788)	
1999/00		42,060	69,533	111,593		256	256	218	19,829	31,161	(91,764)	(80,432)	
2000/01		10,925	44,016	54,941	3,053	468	468	399	36,345	57,114	(21,649)	(881)	
2001/02			11,284	11,284	5,957	468	64	532	41,312	64,919	24,071	47,678	
2002/03				-	5,957	468	468	936	72,667	114,191	66,710	108,234	
2003/04				-	5,957	468	468	936	72,667	114,191	66,710	108,234	
2004/05		1,200		1,200	5,957	468	468	936	72,667	114,191	65,510	107,034	
2005/06		3,800	1,200	5,000	5,957	468	468	936	72,667	114,191	61,710	103,234	
2006/07				-	5,957	468	468	936	72,667	114,191	66,710	108,234	
2007/08			3,800	3,800	5,957	468	468	936	72,667	114,191	62,910	104,434	
2008/09				-	5,957	468	468	936	72,667	114,191	66,710	108,234	
2009/10		1,200		1,200	5,957	468	468	936	72,667	114,191	65,510	107,034	
2010/11		3,800	1,200	5,000	5,957	468	468	936	72,667	114,191	61,710	103,234	
2011/12			3,800	3,800	5,957	468	468	936	72,667	114,191	62,910	104,434	
2012/13				-	5,957	468	468	936	72,667	114,191	66,710	108,234	
2013/14		1,200		1,200	5,957	468	468	936	72,667	114,191	65,510	107,034	
2014/15		3,800		3,800	5,957	468	468	936	72,667	114,191	62,910	104,434	
2005/16			1,200	1,200	5,957	468	468	936	72,667	114,191	65,510	107,034	
2016/17					5,957	468	468	936	72,667	114,191	66,710	108,234	
2017/18					5,957	468	468	936	72,667	114,191	66,710	108,234	
2018/19					5,957	468	468	936	72,667	114,191	66,710	108,234	
2019/20					5,957	468	468	936	72,667	114,191	66,710	108,234	
2020/21					5,957	468	468	936	72,667	114,191	66,710	108,234	
2021/22					5,957	468	468	936	72,667	114,191	66,710	108,234	
2022/23					5,957	468	468	936	72,667	114,191	66,710	108,234	
2023/24					5,957	468	468	936	72,667	114,191	66,710	108,234	
2024/25					2,904		468	468	36,322	57,077	33,418	54,173	
2025/26					2,904		468	468	36,322	57,077	33,418	54,173	
Re-estimated Internal rate of Return											15%	23%	

Table 9. Economic Costs and Benefits

<b>Costs</b>									
1	costs of drilling program which proved resources fro Olkaria II and III and other small-scale prospects								
2	investment costs for Olkaria II and III								
3	projected future costs for additional wells								
4	O&M costs for the two power plants and for the geothermal resource field								
<b>Benefits</b>									
1	electricity sales resulting form energy genetation from the two power plants								
2	electricity sales valued at existing average tariff of US\$0.091/kWh or US\$.143/kWh which represents consumer willingness to pay								

**Table 10: Status of Legal Covenants**

Agreement	Text Ref.	Covenant Type	Status	Original Fulfill Date	Revised Fulfill Date	Description of Covenant	Comments
Credit	3.01	2	c			Borrower shall pass on to KPC as equity contribution up to US\$9.7 million equivalent	
	3.04	5	c			Borrower shall carry out the studies under the project under terms of reference agreed between the Borrower and the Bank	
	3.05	5	c			Borrower shall inform IDA of any non-IDA funded drilling program	
	4.01(a)	1	c			Borrower shall : (i) maintain in accordance with sound accounting practices, records and accounts reflecting all expenditures; (ii) ensure that all records of expenditure are retained until at least one year after IDA has received audit report for the fiscal year; and (iii) enable IDA's representatives to examine such records	
	4.01(b)	1	cp			Borrower shall: (i) have records and accounts referred to in para. (a) of this section for each fiscal year audited by independent auditors acceptable to IDA and (ii) furnish copies of such audited accounts to IDA not later than eight months after the end of each fiscal year	Audits frequently submitted after due date primarily due to delays in carrying out the audit by the Auditor General
	4.02	2	cp			The borrower shall take all necessary steps in order to enable the power companies to meet the requirements of sections 6.02 through 6.06 of the Joint Project Agreement	GoK's unwillingness to adjust tariffs
Project	2.06	2	c			KPLC shall establish and maintain the position of Coordinator for Geothermal Development with suitable qualifications and experience	
	2.07	5	c			KPLC shall implement a managerial staffing and development plan for its geothermal section satisfactory to IDA	
	2.08	9	c			KPLC and KPC shall semi-annually review with IDA the geothermal drilling program results and performance	
	6.01(a)	1	c			KPC and KPLC shall maintain records and	

Agreement	Text Ref.	Covenant Type	Status	Original Fulfill Date	Revised Fulfill Date	Description of Covenant	Comments
						accounts adequate to reflect in accordance with sound accounting practices its operations and financial condition	
	6.01(b)	1	cd			KPC and KPLC shall have its records, accounts and financial statements for each fiscal year audited by independent auditors acceptable to IDA; and (ii) furnish to IDA not later than eight months after the end of each fiscal certified copies of its financial statements and the report of the independent auditor	Audit reports were usually submitted after due date due to delays by Auditor General in completing the audits
	6.02(a)	2	cp			The power companies shall produce for FY89, FY91, FY94 and thereafter, funds from internal sources equivalent to 25%, 27% and 30% respectively, of the average of the company's capital expenditures for that year and the following year	GoK's unwillingness to adjust tariffs
	6.02(b)	2	nc			Before November 30 of each year, KPLC shall review whether the power companies would meet the requirements set forth in 6.02 (a) and shall furnish IDA a copy of such review	Reviews carried out during missions
	6.02(c)	5	nc			If any such review shows that the power companies would not meet the requirements in (a) for the next fiscal year, KPLC shall take all necessary measures to meet the requirements	GoK's unwillingness to adjust tariffs
	6.03(a)	2	nc			KPLC shall take all necessary steps to ensure that the power companies shall not incur any debt, unless their net revenues for the previous fiscal year shall be at least 1.5 times debt service requirements for any succeeding fiscal year	GoK's unwillingness to adjust tariffs
	6.04(a)	2	cp			KPLC shall take all necessary steps to ensure that the power companies maintain a ratio of current assets to current liabilities of not less than 1:1	GoK's unwillingness to adjust tariffs
	6.04(b)	2	nc			Before November 30 of each year, KPLC shall review whether the power companies would meet the current ratio requirement, and furnish IDA the results	Reviews carried out during missions

Agreement	Text Ref.	Covenant Type	Status	Original Fulfill Date	Revised Fulfill Date	Description of Covenant	Comments
						of such review	
	6.04(c)	5	nc			If such review shows that the companies would not meet the requirements set forth in 6.04(a) KPLC shall promptly take all necessary measures including adjustment of tariff levels and rates, in order to meet the requirements	GoK's unwillingness to adjust tariffs
	6.05(a)	2	cp			The power companies shall maintain a ratio of debt to equity of no greater than 75% in FY90 and 70% in FY91 and thereafter	GoK's unwillingness to adjust tariffs
	6.06	9	nc			KPLC shall annually furnish to IDA a report on the annual return earned by the power companies on their average revalued net fixed assets in operation	GoK's unwillingness to adjust tariffs

**Covenant Class**

- 1 = Accounts/audits
- 2 = Financial performance/revenue generation from beneficiaries
- 3 = Flow and utilization of project funds
- 4 = Counterpart funding
- 5 = Management aspects of the project or executing agency
- 6 = Environmental covenants
- 7 = Involuntary resettlement
- 8 = Indigenous people
- 9 = Monitoring, review, and reporting
- 10 = Project implementation not covered by categories 1-9
- 11 = Sectoral or cross-sectoral budgetary or other resource allocation
- 12 = Sectoral or cross-sectoral policy/regulatory/institutional action
- 13 = Other

8. **Present Status:** C = covenant complied with; CD = complied with after delay; CP= complied with partially; NC = not complied with

**Table 11: Compliance with Operational Manual Statements**

Statement Number/Title	Description/Comment on Non-Compliance
	Not Applicable

**Table 12: Bank Resources: Staff Inputs**

Stage of Project Cycle	Planned		Revised		Actual	
	Weeks	US\$	Weeks	US\$	Weeks	US\$
Through Appraisal	NA	NA	NA	NA	48.8	91.7
Appraisal-Board	NA	NA	NA	NA	20.2	75.2
Board-Effectiveness	NA	NA	NA	NA	6.0	15.4
Supervision	NA	NA	NA	NA	75.9	210.5
Completion	15	28.5	15	32	3.3	8.2
<b>TOTAL</b>					<b>184.2</b>	<b>401.0</b>

**Table 13: Bank Resources: Missions Stage of Project Cycle**

Stage of Project Cycle	Month/year	Number of persons	Days in field	Specialized staff skills represented	Performance rating		Types of problems
					Implementation status	Development objectives	
Through Appraisal	11/84	2	7	NA	NA	NA	NA
	9/85	2	6	NA	NA	NA	NA
	10/87	5	9	NA	NA	NA	NA
	5/88	5	17	NA	NA	NA	NA
Appraisal through Board Approval to Effectiveness	NA	NA	NA	NA	NA	NA	NA
Supervision	7/89	1	7	PE	NA	NA	NA
	11/89	1	7	PE	1	1	NA
	6/91	1	11	NA	NA	NA	NA
	11/91	1	21	NA	NA	NA	NA
	8/92	3	12	PE/GE/Econ	NA	NA	NA
	3/93	2	17	Econ/PE	NA	NA	NA
	4/94	5	20	Econ/PE/GS /Econ/SFA	2	1	Financial performance
	4/95	2	8	SFA/PS	S	S	Financial performance
Completion	5/96	1	4	SFA	S	S	Financial performance
Completion	3/97	4	16	FA/OO/PE/RE	S	S	Financial performance

Note: PE = Power Engineer; ES = Environmental Specialist; GE = Geothermal Expert; Econ. = Economist; SFA = Senior Financial Analyst; SPS = Senior Procurement Specialist; OO = Operations Officer; RE = Reservoir Engineer; GE = Geothermal Specialist.

**Kenya**  
**Geothermal and Energy Pre-Investment Project**

**Credit 1973-KE**

**Supervision Mission (May 18-22, 1996)**

An IDA mission comprising J. Maweni visited Nairobi during May 18-22, 1996 to supervise the Geothermal and Energy Pre-Investment Project (Credit 1973-KE). The principal objective of the mission was to discuss arrangements for preparation of the Implementation Completion Report (ICR). Since the IDA Credit closed on April 30, 1996, the ICR should be submitted to the Bank's Board by October 31, 1996.

The mission discussed the contents of an ICR with KPLC staff and provided them with a copy of the Bank's guidelines. The following schedule for preparation of the ICR was agreed.

Action	Responsibility	Date
Prepare and submit to IDA (i) operation plan for the project; and (ii) draft ICR; and (iii) statistical tables 5, 6, 7, 8A and 8B	KPLC	August 1, 1996
Prepare and submit to KPLC draft ICR	IDA	August 31, 1996
Discussion of ICR drafts during ICR mission	IDA	September 7-15, 1996
Finalize ICR Report	IDA	October 15, 1996

Since the project comprises primarily: (i) drilling of exploration, developmental and make-up wells; (ii) studies; and (iii) construction of the Moi South Road, an operational plan is applicable only to those physical components which require maintenance/monitoring; viz, the make-up wells connected under the project and the Moi South Road. To expedite the preparation and completion of ICR, it was agreed that the Borrower's evaluation will be submitted to IDA prior to the ICR mission and at the same time with the operational plan. IDA's evaluation will be submitted to the Government prior to the ICR mission and during the mission the Government will have an opportunity to revise its evaluation taking into account the Bank's evaluation. Cofinanciers, AfDB for the National Rural Electrification Study, OECF for the Engineering Study for Lower Miriu, JICA for the Organization Study for the Sondu Basin and EIB for the recently completed LPG study would be invited to participate in the ICR mission.

The mission noted that a number of items which were part of the original project scope were not carried out. Among these are: (i) purchase of a drilling rig; (ii) provision of housing for drilling crews; and (iii) a study of potential hydro sites. The potential hydro sites study was replaced with individual studies (e.g. for Grand Falls and Ewaso Ng'iro Hydropower Plants). In some cases, items were introduced which were not in the original project scope (e.g. connection of additional make-up wells). The ICR will need to assess to what extent these changes in the project scope affected achievement of project objectives.

The mission also discussed the status of preparation and audit of financial statements for KPLC and KPC. The mission understands that, for FY1994/95, no disbursements were made under the SoE disbursement procedure and, therefore, there is no requirement for submission of an SoE audit report. Audited financial statements for KPLC and KPC for FY1994/95 were due to be received in the Bank by February 28, 1996. Delays have been encountered in the audit process and the mission understands that submission of the outstanding reports is expected by June 30, 1996.

  
E.D. Wasunna

Chief Projects Development Manager  
KPLC

  
J.P. Maweni

Task Manager  
World Bank

**Distribution:**

Mr. B. Kipkulei, Permanent Secretary, Ministry of Finance

Mr. C.N. Mutitu, Permanent Secretary, Ministry of Energy

Mr. S. K. Gichuru, Managing Director, KPLC

Mr. J. Sasia, Operations Officer, World Bank Mission, Nairobi

Mr. R. Anson, Chief, Operations Unit, World Bank Mission, Nairobi

Mr. S. O'Brien, Chief, World Bank Mission, Nairobi

## BORROWER CONTRIBUTION

**GEOHERMAL DEVELOPMENT AND ENERGY PRE-INVESTMENT PROJECT****Credit 1973-KE****REPUBLIC OF KENYA****Evaluation Summary****Introduction**

The Bank Group has helped to finance six power projects (Loans 745-KE of 1971, 1147-KE of 1975, S-12-KE of 1978, 1799-KE of 1980, 2237-KE of 1983, and 2359-KE of 1983), and one credit to help finance the Geothermal Exploration Project (Credit 1486-KE of 1984).

Three other loans were made for reforestation (Loans 641-KE of 1969, 1132-KE/Credit 565-KE of 1975 and 2098-KE/credit 1213) in the Energy Sector. In the petroleum sub-sector the Bank financed the construction of the products pipeline from Mombasa to Nairobi (Loan 1133-KE of 1975), and two petroleum exploration promotion projects (Loan 2065-KE of 1981 and Credit 1675-KE of 1986).

**Project Objectives****(a) Summary Of Original Project Objectives**

The project's principal objective was to assist Kenya in preparing the necessary expansion of its electric generating capacity at least cost through utilization of indigenous energy resources. This includes in particular the mobilization and institutional development for a major geothermal development program to be implemented over the next 20 years. It also includes comparative evaluation work on potential hydro sites. Another important objective was to develop options for energy pricing policies which encourage more efficient use of fuels and achieve savings and resource mobilization. The project was also to address selected aspects of rural electrification policy and household fuel supply and distribution.

The project was to (i) carry out a drilling program of 32 geothermal production, exploration, reinjection and make-up wells; (ii) provide associated equipment, infrastructure, engineering, training and advisory services; (iii) reconnaissance work on promising hydro sites; (iv) define selected aspects of rural electrification policy and household fuel supply and distribution.

(b) Special Credit Covenants/Agreements

The following agreements were reached with the Government and KPLC/KPC:-

- (i) the power sector should generate from internal sources not less than 25% in FY89, 27% in FY91, and 30% in FY 94 and thereafter (after debt service and working capital requirements) of its average annual investment program for the year in question and the following year.
- (ii) the power sector should only incur new debt if a debt service coverage ratio of not less than 1.5 could be maintained, maintain a current ratio of not less than 1.1 and a debt/debt plus equity ratio of not more than 75% in FY90 and 70% in FY91 and thereafter.
- (iii) KPLC would maintain the position of coordinator for Geothermal Development, endowed with line authority for the full range of KPLC/KPC's geothermal activities, during the project implementation period.
- (iv) KPC would inform IDA about the drilling program for each well based on approved overall drilling program.
- (v) KPC and IDA would review drilling program, results, and performance semi-annually, with resulting action plan(s), acceptable to IDA, to be prepared by KPC within one month of such review.
- (vi) Government would afford IDA the opportunity to review and comment upon any non-IDA funded geothermal drilling in Kenya.
- (vii) Government would carry out the energy studies, under TOR mutually agreed between the Government and IDA.
- (viii) Government would pass on to KPC as equity contribution up to US\$9.7 million equivalent of the proposed IDA credit.
- (ix) Government would onlend to KPC the remaining bulk of the credit at 7.59% with a maturity of 20 years, including seven years of grace, with the foreign exchange risk borne by KPC.
- (x) KPC and KPLC would send to IDA not later than eight months after the end of the financial year audited accounts; separate project accounts would be maintained; and the auditor's opinion would include a separate statement covering credit amounts withdrawn on the basis of statements of expenditure.

(c) Evaluation of Project Objectives

The principal objective was to assist Kenya in preparing the necessary expansion of its generating capacity at least cost through utilization of indigenous energy resources including geothermal and hydro.

Drilling of the wells was to determine whether 60 MW of geothermal reserves are available at the Olkaria N.E. provide additional acreage dedicated to the maintenance of the existing 45 MW at the Eastern Production Field, assess the possibility that Eburru can sustain a future 55 MW development and assess commercial viability of the West Olkaria and other portions of the Olkaria area.

Feasibility study of development of the Sondu-Miriu basin and its hydro resources; and comparative reconnaissance, optimization and prefeasibility work on several potential hydro sites were to be done with a view of improving Kenya's inventory of hydroelectric potential.

Other studies were to define policy options for pricing energy products, curbing of LPG supply shortages and minimization of rural electrification costs.

Procurement of the drilling rig, construction of the Moi South Lake Road, purchase of geothermal scientific equipment, technical assistance and training were for the improvement of the geothermal infrastructure and institutional strengthening.

**Implementation Experience and Results**

(a) Project's Success and Sustainability

- (i) Drilling of wells in Olkaria N.E proved 78.1 MWe which reservoir modelling confirmed can economically sustain a 2X32 MW power plant while the drilled make-up wells will maintain the generation for the 3X15 MW EPF plant at rated capacity up to the year 2000. The six wells drilled in Eburru confirmed that about 20 MWe can be generated as opposed to the appraisal estimate of 55 MWe. Assessment of Olkaria West field will be completed with the drilling of well OW-308 which is at 900 m.
- (ii) Procurement of a drilling rig rated for drilling to at least 2,800 m. was deferred due to improved drilling rate using the present rig with technical assistance provided under Petro Canada International Assistance Corporation. Drilling rate improved from 18 to 60 metres per day.
- (iii) Construction of Moi South Lake Road was successfully completed and greatly improved communication with the Geothermal Project. Construction of drill crew housing, repair shops and workrooms were deferred to the next operation and funds under these categories reallocated for the connection of make-up wells for the existing 3X15 MW power station. Purchase of tools and equipment will await construction of the

workshops.

- (iv) Geothermal scientific equipment and supplies were procured and used in exploration and evaluation of the geothermal resources.
- (v) Engineering study for the 2X30 MW power plant was completed and design and tender documents are ready for a 2X32 MW power plant.
- (vi) Feasibility study of development of the Sondu-Miriu basin and its hydro resources and an engineering report for the Lower Miriu weir and power station were completed and design and tender documents finalized for a 2X30 MW power plant.
- (vii) Comparative reconnaissance, optimization and prefeasibility work on various potential hydro sites, including benefits of irrigation and flood control was to be undertaken but this was done on individual sites.
- (viii) Energy pricing study was completed and KPLC was able to raise electricity tariff to reflect the philosophy of economic costs.
- (ix) LPG study was not done.
- (x) Rural electrification cost minimization study is in progress but it is financed by the African Development Bank (ADB).

(b) Summary of Actual Costs Compared to Estimates

See statistical tables 8A and 8B appended.

(c) Factors that Affected Achievement of Major Objectives

Identification of new items with higher priorities resulted in deferring some of the original project components. This was undertaken during the mid-term review.

Recommendation for engagement of consultants for several areas was undertaken but the results thereof did not influence the project objectives substantially, despite the effort and funds dedicated to them.

Performance of the Bank and the Borrower.

The performance of both the Bank and the Borrower was satisfactory.

(e) Assessment Of Project Outcome.

The project has a satisfactory outcome. Most of the project's major objectives were achieved and it is expected that satisfactory development results will be realized. Communications of the project was improved by the construction of the Moi South Lake Road. Connection of four make-up wells restored the power station output to the rated capacity (45 MW), after falling to 31 MW.

**Summary of Findings, Future Operations, and Key Lessons Learned.**

(a) Important Findings of the Project Implementation Experience.

Engagement of Board Of Consultants helped to reduce the use of individual consultants.

Training of staff through technical assistance helped in capacity building and ensured sustained efficient drilling operations in an area where there are no other drilling companies available for contracting.

Establishment of the position of the Co-ordinator for Geothermal Development and a support group consisting of procurement and project monitoring units assisted greatly in the implementation of the project.

Establishment of an environmental unit at the project helped in monitoring, carrying out studies and identifying mitigating factors to counter negative effects associated with the project.

(b) Plans for Future Project Operations and Sustainability.

The Moi South Lake Road will be kept under regular maintenance. This will include patching of pot holes, vegetation clearing, erosion control and re-carpeting.

The productivity of the make-up wells will be monitored and wellhead equipment serviced regularly.

(c) Lessons for Future Project in the Sector/Subsector

Stoppage of the overseas procurement agent affected the drilling operations greatly as it was no longer possible to provide emergency supplies. It is necessary to have the services of agent(s) for efficient project implementation. They should be located at the major drilling industry centres such as Houston, Scotland and Singapore.

The Bank's "No Objection" had to be obtained for every expenditure resulting in delays in implementation of the project. It is recommended that a threshold amount should be set below which expenditure can be incurred without seeking Bank's approval, provided the initial allocation is agreed upon.

There were serious delays in effecting payments to contractors, suppliers and consultants due to the bureaucratic disbursement procedures through the Government. This resulted in increased costs as the implementing agency paid a penalty in form of interest charges. It is strongly recommended that the implementing agency be authorized to submit withdrawal applications directly to the Bank for payment. Copies of these withdrawals can be passed to other interested parties as the situation may demand.

The perspective in which the Task Managers (3 over the Credit period) viewed the Project was different and this had a bearing on the decision making process.

20-JUN. '97 (FRI) 17:54 WB OP UNIT

FAX: 254-2-260384

From : ERD

PHONE No. : 217593

Jun. 28 1997 5:30 PM

BORROWER'S COMMENTS ON PART I

Appendix C

REPUBLIC OF KENYA  
MINISTRY OF FINANCE

Telegraphic Address: 22921  
FINANCE - NAIROBI  
Telephone: 38111  
When replying please quote



THE TREASURY  
P.O. Box 30007  
NAIROBI  
KENYA

Ref. No. EA/FA 63/35/043  
and date

20th June, 1997

Harold E. Wackman  
Country Director  
Kenya and Djibouti  
World Bank Regional Office  
Nairobi

Dear Sir

**KENYA: GEOTHERMAL DEVELOPMENT AND ENERGY PRE-  
INVESTMENT PROJECT (CR. 1973-KE): IMPLEMENTATION  
COMPLETION REPORT**

Please refer to letter dated June 5, 1997 from Mr. Joel Maweni on the above subject. The Government of Kenya wishes to comment as follows:

**Financial Performance**

From the reports submitted to yourselves in the past the following are our computed ratios

RATIO	1988/89	1990/91	1992/93	1993/94
SELF FINANCING (%)	60	(15)	34	25
DEBT-SERVICE	2	1.5	1.2	2.1
DEBT/DEBT + EQUITY (%)	10	80	119	94
CURRENT	1	1	1	1

## ECONOMIC LIFE OF GEOTHERMAL PLANTS

On table 9 economic costs and benefits, we wish to comment as herebelow:

The Economic analysis has based the rate of return (IRR) on 15 years operating life of the Geothermal Plant, without consideration of any residual value of the plants. However, if the net benefits of the project are extended to the full 25 years of economic life of Geothermal Plants, it appears from the analysis of table 9 that the project IRR for the Tariff values US\$0.091 and US\$0.143 would be higher at approximately 15% and 23% respectively.

Referring to table 10 Page 26. The following Keys should be applied.

Item 6.01(b) Status should be CD and Not CP

Item 6.02(a) Status should be CP and Not NC

Item 6.04(a) Status should be CP and Not NC

On item 11, the BOC did not organise any management course for the project staff, although a one week Geochemistry course was conducted for the technical staff at the Geothermal Project.

Under the statistical tables (No. 7), Item 3, Column 2 should refer to Miriu Hydro Project while column 4 should read 60 MW Plant.

Page 12, Item 9 last line, refers to BOC to review Sondu Miriu. The project should be Fwaso Ngiro.

We agree with the other observations in the report. Finally, we thank the Bank for having made available the proceeds from the Credit to finance the project.

Yours Sincerely,



C. I. Shakaba

**AUTHORIZED REPRESENTATIVE**

20-JUN. '97 (FRI) 17:55 WB OP UNIT

FAX: 254-2-260384

From : ERD

PHONE No. : 217593

Jun. 20 1997 5:36PM

cc. The Permanent Secretary  
Ministry of Energy  
Nyayo House  
Nairobi

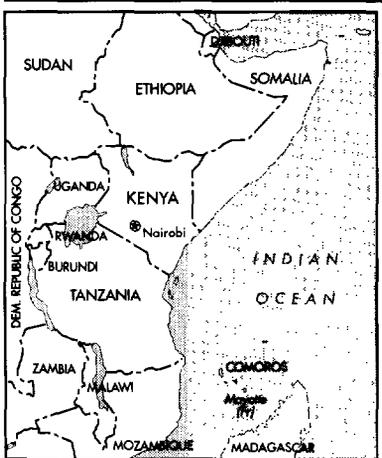
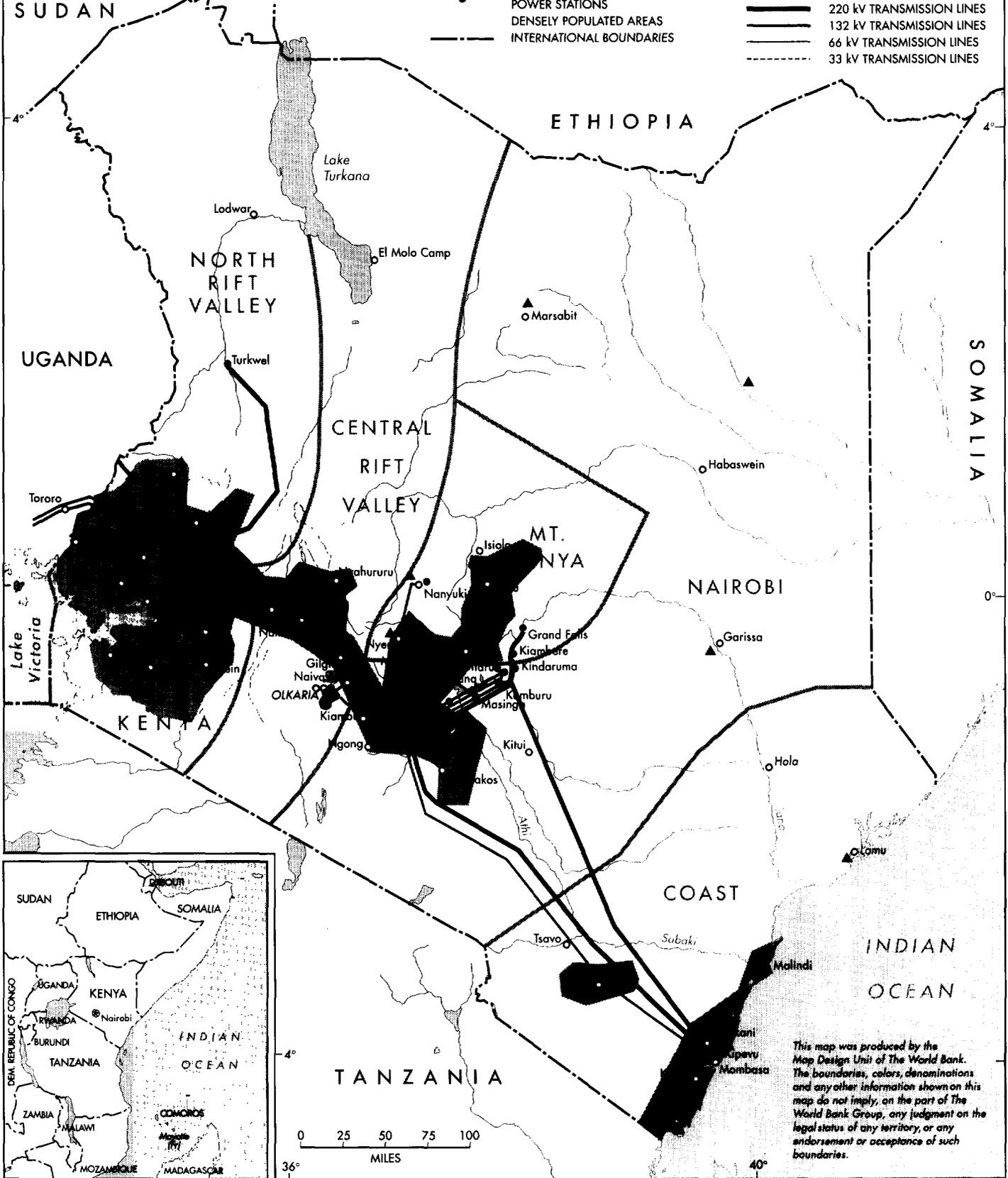
The Managing Director  
Kenya Power Company Limited  
Sima Plaza  
Nairobi

**MAP SECTION**

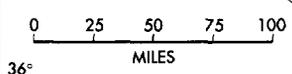


# KENYA GEOTHERMAL DEVELOPMENT AND ENERGY PRE-INVESTMENT PROJECT

- |   |  |   |                           |
|---|--|---|---------------------------|
| ○ | PLANNED FACILITIES                     | ● | EXISTING FACILITIES:      |
| ○ | GEOTHERMAL POWER STATION               | ● | OLKARIA GEOTHERMAL FIELD  |
| ○ | DIESEL POWER STATIONS                  | ● | HYDRO POWER STATIONS      |
| ○ | 220 kV TRANSMISSION LINES              | ▲ | DIESEL POWER STATIONS     |
| ○ | 132 kV TRANSMISSION LINES              | ■ | STEAM POWER STATION       |
| ○ | POSSIBLE SITES OF HYDRO POWER STATIONS | — | KPLC DISTRIBUTION AREAS   |
| ○ | DENSELY POPULATED AREAS                | — | 220 kV TRANSMISSION LINES |
| ○ | INTERNATIONAL BOUNDARIES               | — | 132 kV TRANSMISSION LINES |
|   |  | — | 66 kV TRANSMISSION LINES  |
|   |  | — | 33 kV TRANSMISSION LINES  |



This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.







## IMAGING

Report No.: 16830  
Type: ICR