



Joint UNDP/World Bank Energy Sector Management Assistance Program

Activity Completion Report

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Activity: ENERGY ASSESSMENT STATUS REPORT

JUNE 1984

Report of the Joint UNDP/World Bank Energy Sector Management Assistance Program
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ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM

The Joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP), started in April 1983, assists countries in implementing the main investment and policy recommendations of the Energy Sector Assessment Reports produced under another Joint UNDP/World Bank Program. ESMAP provides staff and consultant assistance in formulating and justifying priority pre-investment and investment projects and in providing management, institutional and policy support. The reports produced under this Program provide governments, donors and potential investors with the information needed to speed up project preparation and implementation. ESMAP activities can be classified broadly into three groups:

- Energy Assessment Status Reports: these evaluate achievements in the year following issuance of the original assessment report and point out where urgent action is still needed;
- Project Formulation and Justification: work designed to accelerate the preparation and implementation of investment projects; and
- Institutional and Policy Support: this work also frequently leads to the identification of technical assistance packages.

The Program aims to supplement, advance and strengthen the impact of bilateral and multilateral resources already available for technical assistance in the energy sector.

Funding of the Program

The Program is a major international effort and, while the core finance has been provided by the UNDP and the World Bank, important financial contributions to the Program have also been made by a number of bilateral agencies. Countries which have now made or pledged initial contributions to the programs through the UNDP Energy Account, or through other cost-sharing arrangements with UNDP, are the Netherlands, Sweden, Australia, Switzerland, Finland, United Kingdom, Denmark, Norway, and New Zealand.

Further Information

For further information on the Program or to obtain copies of completed ESMAP reports, which are listed at the end of this document, please contact:

Division for Global and
Interregional Projects
United Nations Development
Program
One United Nations Plaza
New York, N.Y. 10017

OR

Energy Assessments Division
Energy Department
World Bank
1818 H Street, N.W.
Washington, D.C. 20433

KENYA

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ABBREVIATIONS

CIDA	Canadian International Development Agency
E/DI	Energy/Development International
EAPC	East Africa Portland Cement Company, Ltd.
ESMAP	Energy Sector Management Assistance Program
GOK	Government of Kenya
GTZ-SEP	German Agency for Technical Cooperation - Special Energy Project
ICS	Improved Charcoal Stove
IFC	International Finance Corporation
ITDG	Intermediate Technology Development Group
IWS	Improved Wood Stove
KCFC	Kenya Chemical and Food Corporation
KPLC	Kenya Power and Lighting Company, Ltd.
MOFP	Ministry of Finance and Planning
MOERD	Ministry of Energy and Regional Development
NORAD	Norwegian Agency for International Development
USAID	United States Agency for International Development

This report has been prepared by Mr. Ken Newcombe (Energy Planner) on the basis of a mission to Kenya in March-April 1983 and reflects the situation as of that period. A draft of the report was discussed with the Government during a subsequent mission towards the end of 1983 and it incorporates the comments received on the earlier draft. However, since then, the Ministry of Energy has been expanded to include regional development functions and the Ministry of Economic Planning and Development has been merged with the Ministry of Finance. Consequently, these institutions are referred to in the report by their current names.

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I. BACKGROUND

1.1 The Kenya energy assessment mission of March 1981 produced a draft report which was reviewed with the Government in March 1982, and the final report was issued in May 1982. Some of the findings of the report were used in determining the agreement for the second Structural Adjustment Loan of June 1982, which included an undertaking by GOK to furnish the Bank with a comprehensive energy investment program providing for both production and conservation sector-wide. This document was sent to the Bank for review in March 1983, as agreed.

1.2 Economic conditions have deteriorated in Kenya since the 1981 energy assessment mission. Whereas net energy imports cost 36% of export earnings in 1980, by 1982 this figure had grown to 57%. GDP growth, reported at 3.8% in 1980, had fallen to about 3% in 1982 and showed little sign of improvement in 1983/84. Foreign exchange reserves have been drawn down consistently since 1980 to the point now where not all of the energy sector investment and aid essential to arrest the declining balance of payments situation can be fully used because necessary stringencies on government expenditure have limited effective counterpart contribution to some projects.

1.3 Differences of opinion between the Government and oil companies concerning the refinery ownership structure and investment in modifications have delayed refinery upgrading and further aggravated the impact of the high cost of imported energy on economic development. In this situation relatively wide-ranging and quick assistance to the private sector and successful parastatals to implement fuel saving measures is vital, along with skilled advice to the Government on policy measures. There is also a need to determine a firmer, more analytically-based long-term energy investment program (including a least-cost power development strategy) and to determine the appropriate institutional structure for the power sector; as well as to strengthen the new Ministry of Energy and Regional Development in its ability to formulate policies and priorities for energy development.

II. STATUS OF ENERGY ASSESSMENT RECOMMENDATIONS

2.1 Energy Planning and Institutions

Recommendation

- (a) Place all energy related programs under the Ministry of Energy and Regional Development and strengthen its structure and staffing.

Response

The MOERD has grown substantially since 1981 and has procured the services of a number of expatriate advisors from Energy/Development International and the German GTZ-SEP (Special Energy Project). MOERD now has a greater capability to plan and establish investment programs for the sector than at the time of the assessment. However, there is still some disaggregation of responsibility and planning for woodfuels and agroforestry with an obvious woodfuel component, despite the cooperative agreement with respect to agroforestry between the MOERD and the Ministry of Agriculture and Livestock Development, and the Ministry of Environment and Natural Resources. Other agencies known to be involved are the Office of the President, and the women's organization Mandeleo Ya Wanake.

Recommendation

- (b) The mission supported the merger of Kenya Power Company, Ltd., and the Tana River Development Company, Ltd., to reduce overheads and improve efficiency in this subsector.

Response

This merger remains Government policy and has been pursued more actively in recent months. MOERD suggests that the unification of operations is almost effective and only the dual top management structure remains. MOERD officials believe the official merger will occur quite soon.

Recommendation

- (c) Establish an Energy Development Institute to focus on interdisciplinary research of socio-economic issues emphasizing applied energy economics. The Institute should not be concerned with energy technology R&D. This action is not a high priority.

Response

An agreement to establish the Kenya Energy Development Institute (KEDI) has been signed with Italian authorities.

2.2 Energy Conservation and Interfuel Substitution

Recommendation

(a) Large-scale substitution of solar water for electric heating in households and industry appears economically attractive and hence a detailed program of large-scale installation should be developed as a matter of priority.

Response

CIDA has provided assistance through the University of Western Ontario and Ontario Hydro in assessing the market for solar water heating in Kenya as a form of assistance to Government, and the commercial viability of local manufacturing. Petrosun International of Canada and Petrosun Kenya have contributed to and participated in this review and fully intend to proceed with a medium scale local manufacturing plan for solar collectors. The GTZ-SEP project is also in the process of establishing local manufacturing facilities for solar collectors, though on a much smaller scale. In addition, an engineer and an analyst funded by the World Solar Power Foundation of London and the World Wildlife Fund are documenting the number and performance of solar installations now in use in Kenya.

Recommendation

(b) Divert long haul freight to the railway on the Mombasa-Nairobi route as a matter of urgency. Savings of 12 million litres of diesel are forecast.

Response

GOK accepts this as a high priority policy objective but is unable to implement the transfer mostly because of the unreliability of rail operations, the main cause of which is lack of spare parts related in turn to limited foreign exchange availability. While containerization of the rail cargo handling system proceeds, it lags behind road transportation in quality and efficiency, further reducing the competitive position of rail.

Recommendation

(c) Do not implement the small diesel bus "Matatus" program on a large scale until its economic viability is well established.

Response

The matatus fleet appears to have grown rapidly since the time of the assessment mission, though without either Government support or hindrance. Fares are maintained by owner/operators at 1 Ksh below the public bus system, and the matatus mode is more flexible and convenient for commuters. Although the Government does not control the price of matatus, the fact that it is all diesel-powered is recognized by MOERD as undesirable.

Recommendation

(d) Review the import duty on coal to ensure that it will not act as a deterrent to the economic substitution of fuel oil. Import duty was 30% of c.i.f. value in 1981. This recommendation was assigned high priority.

Response

In its 1981 budget speech, the Ministry of Finance and Planning announced a 10% reduction of duty, from 30% to 20% of c.i.f. price, indicating that further reductions, perhaps to the elimination of duty, may be implemented later. Since then across-the-board increases in duty have lessened the impact of this reduction. The current import duty computes at 22.2% (US\$64.6 c.i.f. ex Maputo c.f. US\$14.36 duty per tonne). This issue will be fully addressed in the course of the coal handling and substitution study (4.3).

Recommendation

(e) Complete project preparation for, and execute oil to coal conversion at the East African Portland Cement Company, Ltd. (EAPC).

Response

EAPC has commissioned Norcem Engineering to do a full feasibility study of converting both from fuel oil to coal firing and from wet to dry processing. Expansion of overall production and the logistics of coal handling and transportation between Mombasa and Athi River also have been examined. The study is funded by a grant from NORAD. Savings of about US\$1 million

in foreign exchange will result although the investment is very marginal financially at the present coal import duty rate. The study indicates that severe constraints on port handling facilities may be faced for coal imports over and above the EAPC requirements.

Recommendation

(f) Study the prospects for converting from oil to coal in industries other than cement.

Response

GOK has promoted conversions to coal, coal-oil mixtures, and coal-water mixes in recent draft energy policy and investment strategies and the energy component of the draft five-year development plan. Recently, the Government's energy planners have completed an industrial survey and have begun an in-house coal use review to prepare for a major coal conversion study funded through ESMAP. In addition to a detailed coal market analysis, region by region, there is a need to clarify the coal handling capacity at Mombasa before committing to a detailed design phase on coal conversion at any of the several major fuel oil consumers besides EAPC. This would be an essential component of a proposed ESMAP project on interfuel substitution in the industrial sector (see 4.3).

Recommendation

(g) Develop a program to encourage energy conservation in small- and medium-sized industry, beginning with the establishment of a detailed data base on end-use.

Response

GOK has made progress here through a survey which was run jointly by MOERD and the Association of Manufacturers to establish energy use within factories. A 35% response rate was achieved, though no follow-up has proceeded. GOK has asked for ESMAP assistance to help prepare a detailed industrial energy conservation program. This assistance is to be provided as part of the preparatory market analysis phase of the coal substitution, conversion and handling feasibility studies.

Recommendation

(h) Establish an extension service for distributing and demonstrating improved stoves, concentrating first on improved "jikos" for cooking with charcoal in urban areas.

Response

The development of an extension service for improved charcoal and wood "jikos" has been delayed until recently by the absence of rapid production techniques and smallholder entrepreneur training for the very attractive (30-50% efficiency gain) jikos now fully developed and tested. The dissemination of production techniques and modular construction facilities must proceed marketing. This bottleneck is now being removed with assistance from ITDG and with the support of the USAID/EDI program; however, close monitoring of the program is likely to be required.

2.3 Energy Pricing

Recommendation

(a) Realign sales taxes on petroleum fuels to bring premium gasoline and automotive distillate prices close together and reduce the distortion in demand for diesel in relation to refinery production. This recommendation was assigned high priority.

Response

MOERD indicated that the Government's hesitation to reduce this differential was because of the financial impact on the agriculture and manufacturing sectors, both heavily reliant on diesel. As an alternative, MOERD has proposed a large increase in import duties for diesel vehicles although it has reservations about the political acceptability of this proposal.

Recommendation

(b) Reduce the differential between normal and off-peak power tariffs to better reflect economic costs and benefits.

Response

No action has been taken on this, partly because of the impact this would have on the 19,000 households with interruptable supply to whom the off-peak rate applies for electric water heating. MOERD recognizes that this domestic off-peak tariff will have to be

reviewed as part of any large-scale solar water heating investment project or as part of a comprehensive tariff study.

2.4 Petroleum

Recommendation

(a) Execute the optimal refinery configuration taking into account all options to meet the agreed demand.

Response

The Bank Group (including IFC), USAID and GOK have narrowed the options for supplying refined products to an agreed reconfiguration of the refinery using thermal cracking technology. Discussions are continuing between GOK and oil companies over matters of revenue and profitability which will affect the implementation of any refinery modification program.

Recommendation

(b) Expand exploration for oil and gas, building on initiatives already proposed by the Bank.

Response

The Bank-assisted petroleum exploration promotion project has proceeded successfully through the first round of defining potential and soliciting interest in further exploration. These oil companies have begun to negotiate exploration agreements.

2.5 Electric Power

Recommendation

(a) Complete pre-investment studies for the Turkwell hydropower project as soon as possible and examine the longer term interconnection with supply sources in Uganda and Tanzania as a matter of priority.

Response

The Bank-assisted Olkaria Geothermal Expansion Project (approved in February, 1983) includes funds for technical assistance to devise a least cost development plan, considering also interconnection with neighboring country supply systems.

Recommendation

(b) Expand geothermal exploration in Olkaria field as a matter of priority and support continued exploration in Eburru and Lake Bogoria regions. Produce a detailed investment plan for developing the geothermal resource.

Response

Since the assessment, the Olkaria field has indicated even greater promise with the tapping of dry steam. In addition to the Olkaria Geothermal Expansion Project, work has begun under a subsequent project to expand geothermal exploration in the wider Olkaria region and the Rift Valley. A long-term investment plan should follow from these projects.

2.6 Fuelwood

Recommendation

(a) Examine prospects for increased commercialization of fuelwood and charcoal production, including pre-investment work for major peri-urban and rural plantations and large scale carbonization plants; the latter within the context of a centralized charcoal corporation, or a series of cooperatives.

Response

Although, there has been no systematic approach to pre-investment work on peri-urban woodfuel plantations, a conceptual beginning has been made by MOERD for Mombasa, although it would only cater for a small portion of the near-term demand. Preliminary design and costing of plantation development for a range of ecosystems near major demand centers have been completed by the Beijer Institute. These provide the basis for detailed comprehensive pre-investment work as a part of a national strategy to meet the centralized urban-industrial market. In addition, the UNIDO staff in the Ministry of Commerce and Industry have proposed a 270,000 ha fuelwood development on semi-arid land in the coastal belt to service an iron and steel industry, however, the viability of this project has yet to be established. The GOK has requested technical assistance to design investments in peri-urban plantations, to better manage recovery of woodfuels from existing resources, and to examine prospects for improving the efficiency of carbonization.

Recommendation

- (b) Improve the supply and demand data for charcoal.

Response

Data on charcoal supply remain deficient, but demand data have been provided by the Beijer Institute's 'Fuelwood Cycle' study, now complete. The characteristics of present and alternative charcoal production techniques and supply patterns can be the subject of assistance under the USAID Renewable Energy Project and the extended Dutch forestry-agroforestry projects, priority and funds permitting.

2.7 Other Renewables

Recommendation

- (a) All investment in ethanol production should cease immediately until detailed reviews are made of the industry. This action is regarded as of highest priority.

Response

GOK responded by halting all further new investment in ethanol production facilities as recommended. The KCFC plant, costing 1.5 billion Ksh to date, has been put into receivership but no liquidation has taken place. The planned Riana plant proposal also has been shelved. The Ministry of Finance and Planning has indicated that in due course it would like to define a rationalized ethanol development strategy and program for which technical assistance would be required.

Recommendation

- (b) Urgently review the entire ethanol program in order to rationalize and monitor production and end-use, focusing in the short-term on maximizing cash flow for the KCFC distillery.

Response

GOK has not initiated a formal review, although the problems encountered in implementing KCFC investments are being discussed by senior policymakers (see 2.3(b) below). Ethanol began to be delivered from the Muhoroni plant to blending depots in the first half of 1983, and has, by and large, proved successful. Still outstanding issues between oil companies and the Agrochemical Food Company on ethanol pricing and marketing are expected to be resolved soon.

Recommendation

(c) The potential to achieve energy self-sufficiency for all sugar mills and to generate surplus bagasse energy for sale should be studied.

Response

Major reviews of sugar mill efficiency have been completed by consultants under the Bank's sugar industry rehabilitation projects. These provide the basis for further analyses of the prospect for net energy production, though such work has yet to be undertaken. GOK has expressed keen interest in pursuing this option as a result of discussions during the follow-up mission.

Recommendation

(d) The expanded use of wind energy and biogas should be studied.

Response

The main emphasis of the new German aid program "Special Energy Project" (GTZ-SEP) is wind, biogas and solar for small scale rural applications. It appears well focused, realistic and well managed. It should achieve the objective specified by the energy assessment.

III. RELATED ACTIVITIES BY OTHER AGENCIES

3.1 A number of bilateral and other assistance agencies have embarked on programs which will help to resolve the principal issues identified by the energy assessment report. These include the CIDA-financed project reviewing the solar water heating market and the GTZ Special Energy Project (see 2.2(a)). The USAID project was mostly defined before the outcome of the energy assessment. This project focused on establishing six agroforestry centers leading to the training of extension workers of the Ministries of Agriculture and Environment and Natural Resources (Forestry Department). USAID cooperated directly with the Dutch in this project and in support of the Beijer Institute's 'Fuelwood Cycle' study. The Dutch Government intends to support the implementation of pilot projects on agroforestry arising from this study with US\$3-4 million over the next few years, again in cooperation with the Beijer Institute. USAID/EDI funding of advisory staff support for MOERD will probably cease during 1984, although a major program of advisory staff support has been proposed by CIDA which would provide more than adequate continuity. Ongoing project aid to the energy sector is concentrated heavily in rural energy and, in particular, on fuelwood-focused agroforestry, though further effort is necessary here to establish priorities and guidelines for effective resource management.

IV. PRIORITY AREAS FOR FUTURE TECHNICAL ASSISTANCE

4.1 A series of discussions were held with senior staff of the Ministries of Energy and Regional Development, Finance & Planning, Environment and Natural Resources, Commerce and Industry, the KPLC and the EAPC to determine areas where further technical assistance is required. Identified projects and studies are detailed in paras 4.2-4.7.

4.2 Power

(a) Power Sector Efficiency Audit: This study has since been completed under the UNDP/IBRD Energy Sector Management Assistance Program (ESMAP), at a cost of US\$60,000. The project involved auditing the KPLC power system to identify points in transmission, distribution and thermal generation where losses may be reduced economically. Within the distribution system, a review was made of design criteria, construction standards, and system planning, O&M and load control methodology in addition to inspection of equipment and facilities. Within the generation system, thermal power plant was examined to evaluate points of significant loss, and procedures for monitoring generation efficiency. Projects to modify or install equipment were identified and the scope of work in each case prepared to facilitate swift implementation. As a result of this work, two power sector rehabilitation projects have been identified:

(i) A Distribution Loss Reduction Project - comprising engineering services and investment in capacitors, reconditioning etc. which would be implemented over a 18-24 month period. The estimated cost of the project is \$7.7 million, of which 90% would be in foreign exchange; the payback period is approximately one year.

(ii) The Kipevu Steam Plant Rehabilitation Project - which would improve the operating efficiency of this oil-fired plant and raise its available capacity by 12 MW. The project would comprise repairs and rehabilitation of individual generating units as well as of the condenser/cooling and water treatment systems. The estimated cost is \$2.8 million and project has a two-year payback period.

A number of commercial and official assistance agencies have indicated interest in supporting these projects.

(b) Regional Interconnection Options: The Olkaria Geothermal Expansion Project (approved in February, 1983) includes a component to deal with the issue of possible power interconnection with neighboring country supply systems as part of a least-cost development study.

(c) Electricity Pricing Strategy: Tariff studies are required to determine a long-term and short-term electricity pricing strategy.

4.3 Coal Handling and Substitution Including Industrial Audits

With the possible complete conversion of the cement industry to coal-firing, it is timely to review in detail the entire market for coal in industry and to define the required coal handling facilities at the port and inland to interface with each point of end-use. This project would review the prospects for coal use in all large industries, comparing coal with other fuels to ensure a least-cost strategy for interfuel substitution. The coal market thus defined, including the cement industry, will then become the basis for a detailed review of the present coal handling capability and prefeasibility work for expanded port and inland handling facilities as required. In the process of defining the coal market the potential for improving energy efficiency will be established for the top 15-20 industries on the basis of a detailed energy audit. GOK is keen to proceed quickly with this project which is expected to cost about US\$500,000 and would be completed in 12 months. Detailed terms of reference are available.

4.4 Solar Water Heating

Pursuant to the recommendation of the assessment mission, GOK was keen to proceed to detailed evaluation and project development for a major solar water heater installation program. The first stage of the project - financial analyses and market assessment - has already been partly completed with CIDA assistance. The project would review this phase before proceeding to detailed design of an investment package incorporating a financing plan and operational strategy for installation under KPLC's administration of 20,000-30,000 household solar systems plus industrial and commercial systems for hotels, hospitals and other users of low-grade hot water over a 4-5 year period. The Kenyan power system is energy - rather than capacity - constrained; hence, solar energy may well displace oil-fired generation at the margin. The project will assess the capacity of local solar system manufacturers to meet the anticipated demand and will identify training requirements for installing the systems. It is expected to cost about US\$50,000 and would be completed in six months.

4.5 Commercialization and Improved Management of Woodfuel Production

The establishment of a national plan for commercial woodfuel plantations to meet urban and industrial demands is a high priority and must also incorporate a program for improved management of the existing woodfuel resource. Accordingly, this project would build on the work of the Beijer Institute and others to design and cost peri-urban woodfuel plantations for Nairobi, Mombasa and elsewhere, develop methods to improve the recovery of existing forest residues including improved efficiency of carbonization, and develop improved management techniques for the coastal mangrove forests. The component to be funded first under ESMAP, with financial support from the Netherlands Government, is commercial peri-urban woodfuel plantation design and costing, including plantation management and woodfuel marketing reviews and carbonisation

techniques in respect of a total of 25,000 ha. Expected cost is \$250,000 over nine months.

4.6 Efficient Bagasse Utilization

GOK wishes to further define the prospect identified by the energy assessment for upgrading sugar mill process energy efficiency to generate surplus bagasse for sale as power, or as a densified solid fuel for industry and households. A detailed review of the markets for surplus power and energy in both sugar production zones and of the incremental costs and benefits of serving these markets would complement the Bank's Sugar Industry Rehabilitation Program. The Kenyan sugar industry is deteriorating financially due to the low sugar prices set by GOK which owns 98% of the Western zone industry. Any significant additional cash flow generated through relatively small investments with high financial rates of return would help to improve this situation but would not negate the need for revising sugar industry pricing policies. Therefore, it is likely that this project will have to be deferred until the more pressing issues of policy and management of the sugar industry are resolved.

4.7 Rationalizing Ethanol Production

The assessment mission's conclusions regarding the need for urgent action to rationalize ethanol production is even more pertinent in the present situation than two years ago. The Ministry of Finance and Planning wishes in due course to draw on the Bank's assistance for this purpose. The project would review options for use or disposal of existing KCFC plant and blending facilities. A production cost and end-use monitoring system also should be established as a management tool for the rest of the industry to permit ongoing adjustment in line with market conditions and economic viability.

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM

Activities Completed

<u>Energy Assessment Status Report</u>		<u>Date Completed</u>
Papua New Guinea		July, 1983
Mauritius		October, 1983
Sri Lanka		January, 1984
Malawi		January, 1984
Burundi		February, 1984
Bangladesh		April, 1984
<u>Project Formulation and Justification</u>		
Panama	Power Loss Reduction Study	June, 1983
Zimbabwe	Power Loss Reduction Study	June, 1983
Sri Lanka	Power Loss Reduction Study	July, 1983
Malawi	Technical Assistance to Improve the Efficiency of Fuelwood Use in Tobacco Industry	November, 1983
Kenya	Power Loss Reduction Study	March, 1984
<u>Institutional and Policy Support</u>		
Sudan	Management Assistance to the Ministry of Energy & Mining	May, 1983
Burundi	Petroleum Supply Management Study	December, 1983