資料　2：

ANSWERS TO THE QUESTIONNAIRES

ANSWERS PREPARED BY KPLC

THE GRAND FALLS HYDROPOWER PROJECT QUESTIONNAIRE

I-1 PROJECT IMPLEMENTATION

1. Executing agency will be determined by the Ministry of Energy (MOE). Organisation charts for TARDA and KPLC and a brief description of each are provided. Organisation of the MOE may be obtained from the ministry.

2. Members of steering committee will also be determined by MOE. Such committee is not normally necessary during the feasibility study as the executing agency liaises with the Consultant and other organisations in all the matters.

3. The organisations/agencies listed in the questionnaire would be consulted from time to time. Basic information on these agencies is provided.

I-2 INFORMATION FOR CONFIRMATION

1. It is expected that the Feasibility Study for the project would be conducted in two phases.

   Phase 1 would identify the optimum scheme - either High Grand Falls or Low Grand Falls and Mutonga. If low Grand Falls and Mutonga are chosen as optimum, then the least cost of the two schemes would be identified.

   In Phase 2, the scheme determined in phase 1 as least cost development would be progressed to full feasibility study level.

2. The transmission line connected with the proposed Grand Falls power station would be included in the feasibility study. Adequacy of the existing transmission facilities would be investigated and necessary reinforcement identified.

3. Financing for project implementation would be sought from bilateral and multilateral soft funding such as OECF and the International Development Association (IDA).

4. Sondu/Miriu was planned for commissioning in 1996. Due to delays in securing funds, it is now expected to be completed in 1998.

   Magwagwa has been identified as financially viable if phase 2 of Kano Plains Irrigation is implemented. The hydropower project is expected after the year 2000.

5. Power operation system of existing stations on the Tana River is included in of the National Power Development Plan (NPDP) 1986-2006 and relevant extracts, from section 9.4, have been provided to the JICA team.

6. Kenya Power Company (KPC) would be in charge of operation and maintenance of the project.

7. Applicable law & Act is the Kenya Law and Electric Power Act. The project would be exempt from custom duties and taxes. Project would be expected to conform with the Government Acts such as i) Water Act, ii) Health Act, iii) Monuments and Archives Act, etc.

Information on the Government Acts under which the various companies associated with power generation operate has been provided.

I-3 SOCIO - ECONOMIC CONDITIONS

1. Socio-economic information/data on Meru and Kitui districts has been provided.

2. Land use information around the project area will be provided by TARDA.

3. Land ownership, acquisition and compensation in the project area will be provided by TARDA.

4. a) Transportation network is good.
   b) JICA would be expected to provide vehicles for the project.
   c) Communication (radio) would be most economical for use at site during the study. This requires licensing from the Post Office.
   d) Lodging and office accommodation in Nairobi is good and can be easily obtained. It is expected that JICA would make arrangements for these facilities as was done for feasibility study for Magwagwa. For the site, these facilities would be available in Meru, about 80km from the project site. However, as travel time from Meru to site is about 3 hours each way, it would be advisable to establish a camp near the site for the Team's use. Such camp would require to be fully equipped with accommodation, water, electricity and security facilities best provided by a contractor.
   e) Accessibility to the project area is good.

5. a) There is no security problem in the area. There is a police station near the project site.
   b) Mission Hospitals are available in Nkubu, Ishiara, Kyeni, Chogoria whereas government hospitals are available at Meru and Embu. Health centres are also available at Kiambere and Tunyai.
   Malaria is prevalent in the project area, but anti-malaria drugs, mosquito nets and mosquito destroyers/repellants are easily available.

6. a) The tribe in the project area is the Tharaka.
   b) Around the area, other tribes include the Meru, Embu and Kamba.

I-4 ENVIRONMENTAL CONDITIONS

1. The nearest national park is Meru National Park which is 50km downstream of Grand Falls. Neighbouring this downstream is Kitui, Bisanadi, and Kora National Reserves.

2. Environmental Act/Regulations for environmental conservation and implementation are international standards.

3. **Issues to be addressed.**

   a) Only a small population will be affected.
   b) Change of ecology system due to construction and impoundment and effect on irrigation conservation areas downstream after project implementation will be established through the study.
   c) It is expected that an Environmental Assessment (EA) Consultant would do an EA Study concurrently with the Feasibility Study. At every stage this consultant would seek opinions and consult with NGO's and other interested groups. The comments/results from the EA study would be provided to the JICA team doing the Feasibility Study so that the EA issues are addressed in the project implementation.
   Information on NGO's working in the project area is unavailable now but will be confirmed later.

4. a) Guidelines for Environmental Assessment is the World Bank's Operational Directive (OD) 4.1 which has been provided.
   b) Inventory of Natural/Cultural assets and data would be compiled during the study.
   c) Environmental report for Kiambere hydropower project may be available from TARDA.

II. DEVELOPMENT PLANS

1. a) A copy of the National Development plan (NDP) 1989 to 1993 is available for perusal, but copies cannot be purchased as it is out of stock at the Government printers.
   b) NDP for 1994 to 1998 is under preparation by the Government and is expected to be available in mid December, 1993.
   c) The District development plan for Kitui District is provided, but the one for Meru is out of stock at the Government printers.
   d) Tana River basin master plan if available may be obtained from TARDA.
2. a) NPDP 1986 -2006 and NPDP Interim update for 1991 - 2010 are provided for the Team's perusal.

b) Projects covered in the 1986-2006 NPDP edition which have been implemented are:

(i) Gas Turbine at Kipevu;
(ii) Kiambere Power Station;
(iii) Turkwel Power Station;
(iv) Geothermal well drilling at Olkaria.

3. The Team confirmed that the National Water Master Plan is available from the JICA library.

4. Sessional Paper No.1 of 1986 - "Economic Management for Renewed Growth" - defines the long term plan by the Government.

II-2 NPDP recommended Grand Falls Feasibility Study to be done before the next full NPDP update.

1. Information on the operations and features of the existing power stations has been provided and is contained in the NPDP (Section 3 of the Interim Update of NPDP, 1991-2010).

2. Future Power Stations/Projects on Tana River Basin

a) Heightening of Masinga Dam - arrangements for a feasibility study are under way.
b) Usueni, Adamson's Falls, Kora are ranked lower than alternatives in economic merit. Feasibility Studies for them will be done at an appropriate date.
c) Mutonga - Preliminary studies were carried out during Kiambere Feasibility Study.

3. **Irrigation schemes***

a) Mwea
b) Tana Delta
c) Kanzalu
d) Lower Rupingazi
e) Thanantu
f) Bura

4. Water Transfer/Diversion schemes*
a) Thika dam to Nairobi
b) Masinga dam to Kitui
c) Tana River to Lamu

Note: * - This information is available from TARDA

III ENGINEERING MATTERS

1. a) Power supply network - shown on the Map of Kenya provided.
b) Annual Energy consumption, maximum power demand, and power consumption are included in the 1991/1992 annual

report provided.

c) Power demand forecast is included in the NPDP update.

d) Power development program is as contained in the update of the NPDP.

e) Features of Existing power stations and dams on Tana River Basin have been provided for the five major stations. Data for output flow and spillage per month is provided for each station for 1988 to 1993.

f) Future plans for power station and dam on Tana River is as per the NPDP. International interconnection so far is with Uganda and is not considered as firm energy.

2. a) Current construction cost of Power Plant is as contained in the NPDP update.

b) Fuel costs to be are world bank's latest figures.

c) O & M costs for each plant have been provided.

d) (i) The current Electricity Tariff has been provided.

(ii) Tariff by type of consumer and capacity is contained in the 1991/1992 Annual report provided.

III-2 OTHER INFORMATION AND DATA

1&2. Topographical and Geological maps available are those prepared at reconnaissance level and have been provided.

3. Meteorology and Hydrology data updated to 1989 is available in the NPDP. It is expected that the data would be brought up to date in this study.

Hydrology data for Grand Falls gauging station is available from 1948-1982 and is contained in the NPDP 1986-2006. Currently the flowmeter and level recorder are not functional at Grand Falls.

4. Construction Materials and equipment would be determined during the feasibility study.

5. Availability of Equipment for field investigation on weather/ climate observation is uncertain. Stream flow measurement and sediment observation equipment are the responsibility of the Ministry of Water Development. This equipment is used all over the country and JICA may not rely on it for any investigations the team may wish to make during the study. It would be necessary for JICA to provide this equipment for the project.

6. Inventory Data of Structures in the project area is not available.

7. Information on Unit prices is limited. Available information from recent tenders is provided for:

i) Ground survey and mapping;

ii) Drilling;
iii) Permeability test;
iv) Seismic prospecting; and
v) Test pitting.

8. Design Criteria and Standard would be International Standards. British Standards (BS) and IEC are widely used in Kenya.

9. Available Reports related to project Master Plan/regional are only at pre-feasibility level and are discussed in the NPDP. Other reports include: EPDC report for Kiambere Feasibility Study and National Water Master Plan by Nippon Koei (JICA).

ANSWERS PREPARED BY TARDA

1.3 SOCIO-ECONOMIC CONDITIONS:

(2) Land Use in and around the Project Area.

a) Land Use Map

The area is sparsely populated. There are no permanent settlements within the project area, and the area is entirely under shifting cultivation or grazing. Few semi-permanent and temporary homes/houses are found widely scattered within the area. The few seemingly permanent settlements just outside the project area include such as market/shopping centres like Ciakariga, Marimanti, Gatunga, and Tharaka (Kitui District) some schools, health centres/dispensaries and other community centres.

(3) Land ownership in and around the area, and land acquisition and compensation problems:

Land in the area is not registered, although owned by individuals. Officially it is termed Trustland. Land for the project would have to be acquired and compensation paid to the individual owners. The price of the land will be set through mutual agreement between a panel of elders representing the owners on the one hand, and the project executing agency on the other. The whole process would be arbitrated by the office of the District Commissioner (local administrator) and the Commissioner of Lands.
If ever any individual(s) will be unwilling to sell their land for a public project such as this one, then the law relating to compulsory acquisition may be invoked by the Minister of Lands.

1.4 ENVIRONMENTAL CONDITIONS:

(3) Expected Problems caused by Project Execution:

a) Resettlement: The area is similar to Kiambere H.E. Project area, with a sparse population. Except for the few who are resident in the area a majority of land owners are absent cultivators or migratory herdsmen. It follows therefore, only those resident in the area will require resettlement. The others will require compensation for land and developments.

b) Change of Ecology System due to construction and Impoundment: Whatever changes occur could be related to the presence of large body of water (the reservoir) and the effect it would have on plant and animal life. Due to the absence of a flood plain and the stony nature of the river course, there is no unique riverine vegetation which is likely to be lost. The creation of mosquito breeding opportunities is likely to increase the prevalence of malaria, at least near the shores of the reservoir. If there is increase in humidity (and possibly rain) as some people believe, this will be a welcome change. considering the area is semi arid.

c) Effect on the irrigation/conservation areas downstream after completion of the Project: Preliminary studies so far indicate that water perse is unlikely to be limiting irrigation downstream of the project. Rather it is the migratory nature of the river course and seasonal flooding which is threatening irrigation projects. Hence, assuming High Grand Falls Project, with a capacity for flood control (regulation) then the intake structures for irrigation projects and settlements close to the river bank will be preserved.

Needless to stress, any riverine vegetation which was sustained through seasonal flooding may have to be sacrificed, but it is expected other vegetation forms will replace them.

d) NGOs which may have interest in the Project: - Not known. Most probably will come forward when implementation plans are better known.

(4) Other Information on environmental Matters: Kenya Government expects/demands that Environmental Impact Assessment Studies for all major development projects be undertaken, complete with recommendations for any countermeasures required to minimise or eliminate the foreseen negative impacts. A pre-construction environmental impact study would have to be undertaken to serve as bench mark for future monitoring programmes. Such studies were undertaken recently for the Tana Delta Irrigation Project and the Kiambere H.E.P, both projects undertaken by TARDA. Local expertise is available for such studies.

After the construction of the project the executing agency will have to mount a programme to rehabitate any areas damaged or scarred during the construction.

II DEVELOPMENT PLANS

II-2 INFORMATION TO KNOW, ETC

(3) (P.5) Irrigation Schemes

a) Upstream of the Project

Mwea (existing)
Kibirigwi (existing)
Coffee and Horticulture (existing,variable)

Ishiara - (existing, with potential for extension).

Mitunguu - (existing, with potential for extension).

Rupingazi - proposed .

Thanantu Valley (including Nkondi) - proposed.

b) Downstream of the Project

Garissa - (existing).

Bura - (existing, with potential for extension).

Hola - (existing, with potential for extension).

Lower Tana Village Irrigation Project

- (Small scale, existing with potential for extension).

Tana Delta - under construction.

NB Total potential irrigation area is estimated to be 250,000 ha as revised by JICA 1992. (The study on National Water Master Plan - JICA 1992).

(4) Water Transfer/Diversion Schemes:

- Thika Dam to Nairobi (Upper Tana to Athi Basin)
- Masinga to Kitui
- Kiambere to Kitui North
- Tana River (Lower reaches) to Lamu.

III ENGINEERING MATTERS

III - 2 Other Information and Data:

(3) Availability of Data for Meteorology and Hydrology.

- All information and raw data relating to Meteorology is available from Kenya Meteorological Department in Nairobi, while information and data relating to hydrology, including gauging stations and water quality is available from Ministry of Water, Nairobi. However, supplementary information may be available from TARDA, relating to

- some gauging stations (originally set by MoW, but revived and operated by TARDA.

- Sediment Data (TARDA, Masinga Dam only).

Any other organisation collecting meteorological or hydrological data are likely to be doing so on short term basis and in any case, are registered with the Government departments responsible for these functions.

ATTACHED DATA TO ANSWERS

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 1

3.8 Legal and regulatory framework

The five power sector organisations derive their functional powers from various Acts of Parliament:

- KPLC, KPC and TRDC are subject to the Companies Act, Chapter 486 of the laws of Kenya (Revised Edition 1978);
- KPLC, TRDC are subject to the Electrical Power Act, Chapter 314 (Revised Edition 1986);
- KPLC and KPC have generation licences, which cover the operation, not the ownership, of plant;
- KPLC has licences for the distribution and supply of electricity covering all geographic areas of Kenya;

- KPLC, KPC and TRDC are subject to the State Corporations Act 1986, which covers all corporations where the Government has a majority holding, and it lays down more stringent rules than the Companies Act for items such as auditing, financial year and publication of accounts;

- KPLC is also governed by the Exchequer and Audit Act, Chapter 412 (Revised Edition 1987), which further strengthens the audit powers by giving powers to the Controller and Auditor General of the Government. It is also subject to the requirements of the Restrictive Trade Practices Act, Chapter 504 (Revised Edition 1990), which controls the activity of monopoly industries; and

- TARDA and KVDA were set up under Development Authority Acts in 1974 and 1979, respectively.

3.8.1 Summary of legislation dealing with power generation

1 The Tana River Development Authority Act 1974, Act No. 7 of 1974

- The act was amended by the Tana River Development Authority (Amendment) Act 1981 ie. Act No. 8 of 1981 to create the Tana and Athi Rivers Development Authority Act;

- The Tana and Athi River Development Authority Act was reprinted in 1991 as Cap. 443 of the Laws of Kenya;

- The preamble states that the Act is to provide for establishment of an authority to advise on the institution and co-ordination of development projects in the area of the Tana River and Athi River Basins; and

- The functions are set out in Section 8 and include inter alia to initiate such studies and to carry out such surveys of the Area as it may consider necessary and to assess alternative demands within the Area on the resources, including electric power generation, irrigation, wildlife, land and other resources and to recommend economic priorities.

  It is important to note that there is no provision within the functions giving power to the Authority to implement such studies or programmes except paragraph (j) which empowers the Authority "to cause the construction of any works necessary for the protection and utilisation of the water and soils of the Areas".

2 There are 3 other pieces of legislation which are similar to the Tana and Athi Rivers Development Authority Act. These are:

- The Kerio Valley Development Authority Act, Chapter 441, which was formed to provide for the establishment of an authority to plan and co-ordinate the implementation of development projects in the Kerio and Turkwel Catchment areas.

It provides for functions similar to those under the Tana and Athi Rivers Development Authority Act.

- The Ewaso Ng'iro South River Basin Development Authority Act, Chapter 447, and the Ewaso Ng'iro North River Basin Development Authority Act, Chapter 448. In addition to similar functions to those of the Tana and Athi Rivers Development Authority Act, these two Authorities are also charged with the "initiation, operation or implementation of such projects as may be necessary to exploit the natural resources found in this area" including inter alia, electric power generation.

- The Lake Basin Development Authority Act, Chapter 442, is charged with the planning and co-ordination of the implementation of development projects in the Lake Victoria catchment area. Its functions are similar to those of the other development authorities mentioned above.

3 All the above development authorities are state corporations under the State Corporations Act, Chapter 446, which defines a state corporation as inter alia a body corporate established before or after the commencement of the Act by or under an Act of Parliament or other written law (subject to the exclusions therein specified).

4 The Auditor General (Corporations) being an office created under Section 29 of the Exchequer and Audit Act, Cap. 412 is charged with the responsibility of auditing the accounts of State Corporations.

5 The main piece of legislation dealing with generation of electric power is the Electric Power Act, Chapter 314. The purpose of the Act, according to the preamble, is to facilitate and regulate the generation, transmission, transformation, distribution, supply and use of electric energy for lighting and other purposes. Basically the Act provides a mechanism for licensing the generation, distribution and supply of electric energy. The licensing provisions are as follows:

(i) Bulk Supply Licence, Section 10 of the Act

A Bulk Supply Licence means a licence granted to a public or local authority, company, person or body of persons ("bulk supply licensee") to generate and supply electrical energy to other bulk supply licensees or authorised distributors within the area defined in the licence. Under Section 10 (2) a bulk supply licence may be for a period not exceeding 50 years and the licensee may within 10 years of the date of termination make an application to the Minister for a renewal of such licence.

(ii) Distributing Licence, Section 18 of the Act

A Distributing Licence means a licence granted to a public or local authority, company, person or body of persons ("authorised distributor") to distribute or supply electrical energy for the purposes and within the area defined therein. Such licence also entitles the authorised distributor to receive a bulk supply from a bulk supply licensee. Under Section 18 of the Act, a distributing licence may be for any period whether limited or unlimited.

(iii) A Local Generating Licence, Section 34 of the Act

A Local Generating Licence means a licence authorising an authorised distributor (Local Generating Licensee) to generate electrical energy for the purposes of the distributing licence of such authorised distributor.

(iv) Generating Station Licence, Section 50 of the Act

This is required under Section 50(1) for the construction of any generating station on any land. No such construction is lawful without the authority of the Minister of Energy. The procedure on application for such a licence is set out in Section 135.

From the rules made under the Act and the various schedules thereto, there is reference to the following types of licences having been issued:

(a) Generating Station Licences to KPLC and KPC in respect of several generating stations.

(b) Bulk Supply Licences to KPC in respect of several power schemes.

6 Electric Power Supply Lines, Chapter 315

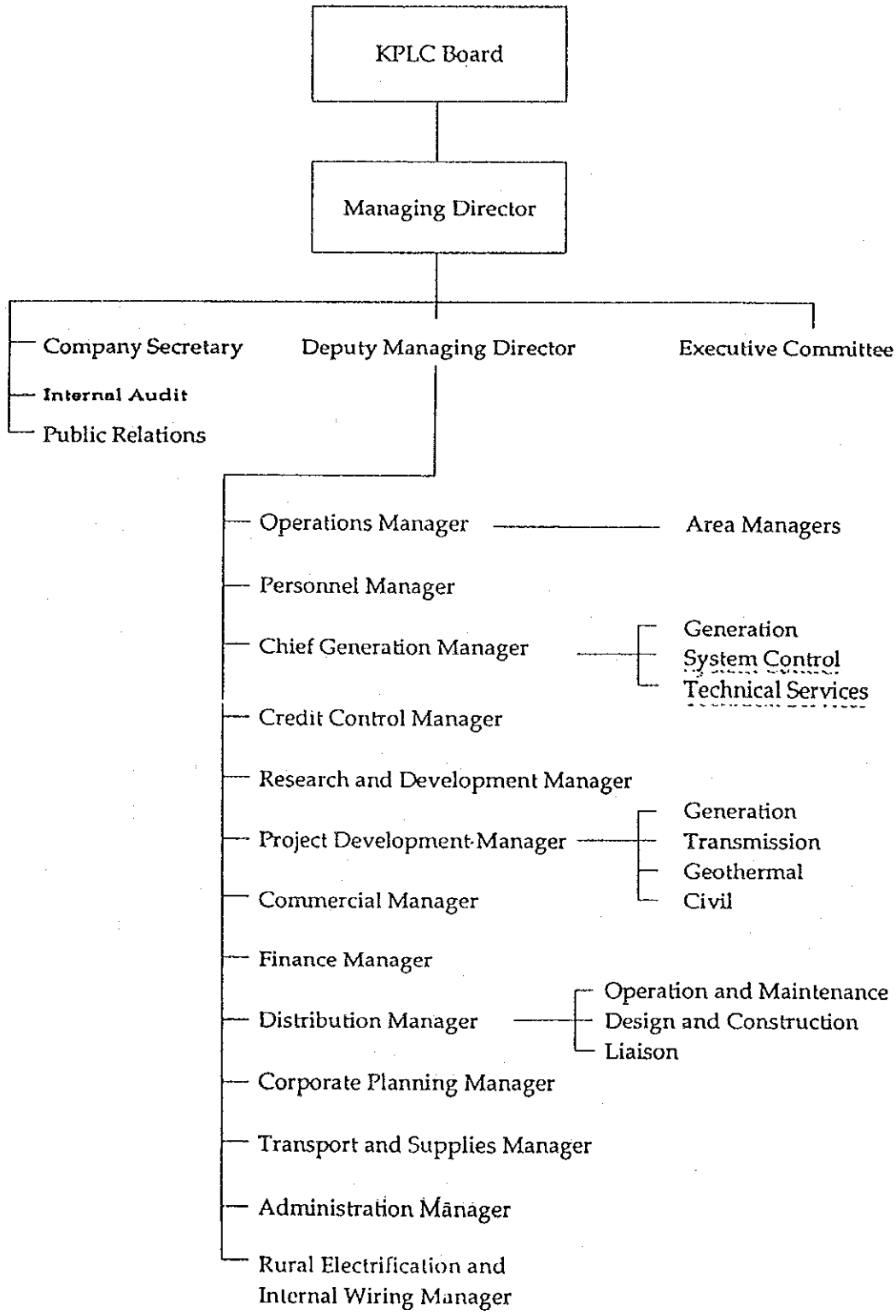
According to the preamble, the Act provides for the carrying of electric supply lines over land privately owned or occupied. Any person desirous of obtaining permission to lay and connect an electric supply line will apply to the Minister of Energy for permission to do so.

London Secretaries
March 1993

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 1

6/10 From KPLC

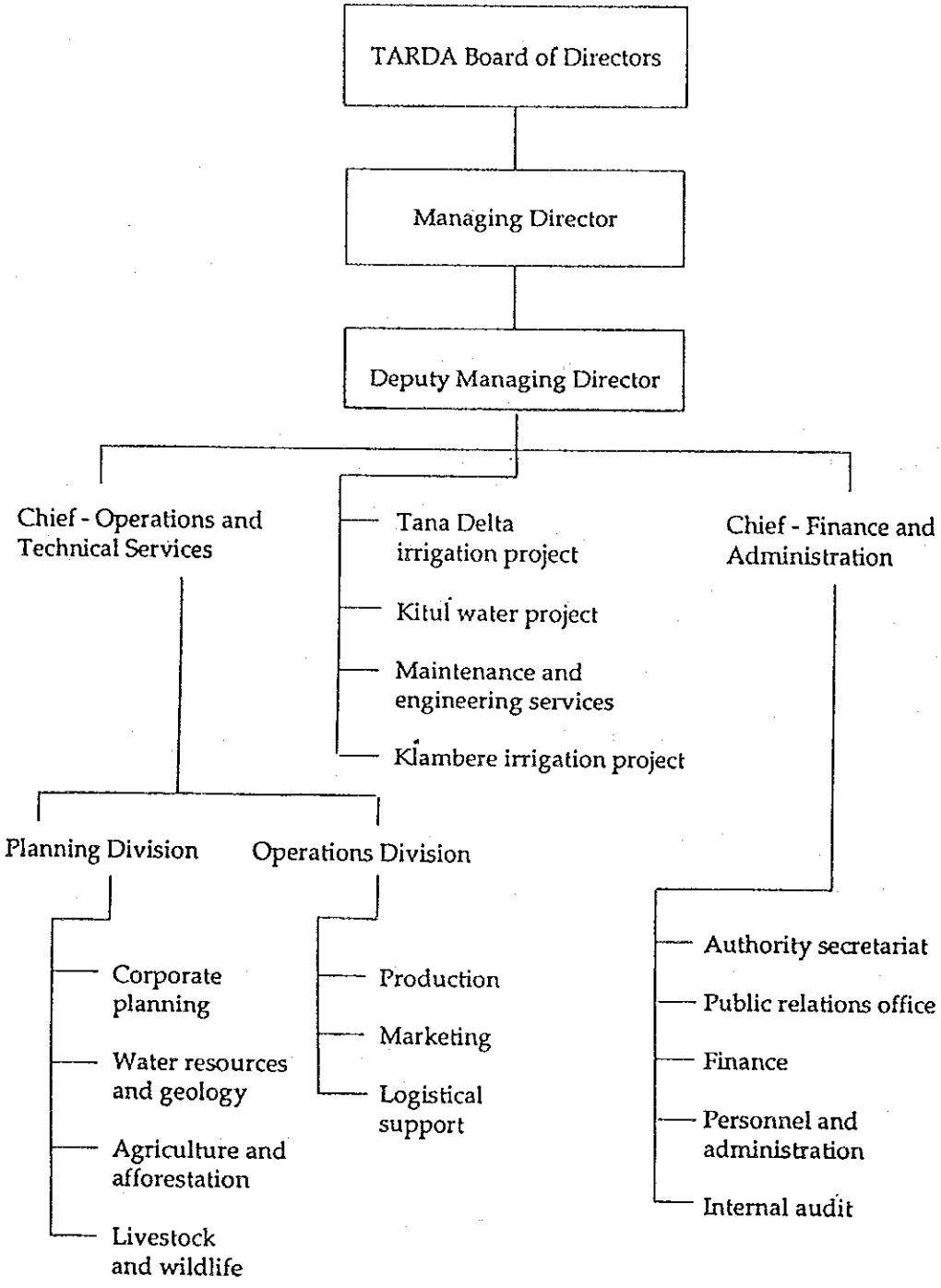
Figure 4.1 Organisational chart of the Kenya Power and Lighting Company Limited



ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. 1 - 1

Figure 4.2

Organisational chart of the Tana and Athi Rivers Development Authority



ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 1

6/9 From KPLC

4th March, 1992

1. Background on the electricity sector

Consumption of electrical energy in Kenya - over 99% of which is supplied through an integrated system - reached 2708 GWh in 1989/90, and the associated peak load was 520 MW. Electricity provided around 28% of commercial energy requirements in 1989; however commercial fuels met only around 30% of total national energy requirements. Large commercial and industrial consumers accounted for almost two-thirds of total sales; domestic and small commercial consumers took 30% of sales (only 5% of the population has access to domestic electricity supplies); and the balance comprised off-peak (domestic) and rural electrification scheme sales. The GDP elasticity of demand for electricity remained constant at around 1.7 throughout much of the 1970s and the early/mid 1980s, but has more recently declined to around 1.5. Electricity consumption is forecast to increase by an average of 6% per annum over the period to 2010, raising peak demand to over 1700 MW by that date.

The integrated generation system had an installed capacity (at end 1990) of 657 MW, of which 75% was hydroelectric plant, 17% conventional thermal plant and 8% geothermal plant. Further hydroelectric and geothermal schemes are under development. For more than a decade, power development plans have consistently identified geothermal generation as the least-cost option for base load generation. Several potential hydroelectric developments are also economic, but there is a continuing role for conventional thermal generation given the variability of hydrological conditions and the consequent hydro energy constraint. Currently over 85% of energy generation is from hydroelectric sources, including limited imports (5% of total supplies) from Uganda.

There was around 650 km of 220kV and 2000 km of 132kV transmission circuit in service in 1990; total losses in transmission and distribution accounted for just over 15% of net generation.

The generation and transmission of electricity in Kenya is presently the mandate of the following five companies under the general direction of the Ministry of Energy:

- KPLC is a limited liability Company responsible for distribution of electricity in the country, It owns some small hydro stations, standby thermal plant, some transmission system and the entire distribution system. It manages two bulk supply companies, namely KPC and TRDC, under management agreements and operates the entire generating and transmission systems on their behalf. The

Government and its institutions own the majority shareholding (over 60%) while the balance (about 39%) is owned by private individuals.

- The Kenya Power Company (KPC) is a wholly Government owned Company responsible for bulk purchases of power from Uganda and for the development of the geothermal resources and other power generating facilities in the Country. The Company, which was established in 1954, owns the existing geothermal power plant, two medium size hydroelectric power stations and some parts of the transmission system. It is managed by KPLC under a management agreement and sells electricity in bulk at cost to KPLC. All its financial requirements for debt service, operations and maintenance including local costs for project implementation are met by KPLC.

- The Tana River Development Company (TRDC) is a wholly Government owned Company which was established in 1964 for the development of hydro power in the upper reaches of the Tana River. Currently the Company owns three power stations in the Seven Forks hydro complex and some transmission system but is no longer involved in new development. The Company is managed by KPLC under a management agreement and sells electricity in bulk at cost to KPLC. All its financial requirements for debt service, operations and maintenance etc are met by KPLC.

- The Tana and Athi Rivers Development Authority (TARDA) was created in 1974 by the Government to undertake integrated planning and coordination of development activities in the Tana and Athi Rivers Basins. At the moment, it owns two hydroelectric power stations with large regulating reservoirs. The electricity generated by these stations is sold in bulk to KPLC. The Authority has an agreement with KPLC under which the responsibility of operation and maintenance of the power facilities is vested with KPLC. Its power assets and liabilities are in the process of being transferred to KPC.

- The Kerio Valley Development Authority (KVDA), is wholly owned by the Government and was created in 1979 to undertake integrated planning and coordination of development activities in the Kerio Valley. The Authority has developed the 106 MW Turkwel Gorge hydro project which is expected to go into commercial operation in the second half of 1991. On completion of the project, the station will be operated and maintained by KPLC. The power assets and liabilities of the Authority will also be transferred to KPC on completion of the project.

Rural electrification in the country is carried out under the Rural Electrification Fund (REF), which is a Government programme with KPLC acting as the implementing agency. KPLC contributes 2% of its gross annual electricity sales revenue to this programme and the balance of the cost is funded by the Government and friendly donor countries.

Answer to 1-3 SOCIO-ECONOMIC CONDITIONS (1)

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES
NO. I - 3

Economic and demographic information about Meru

(i) Meru District number of inhabitants

Projected Population based on 1989 Census

1980	1985	1989	1990	1991	1992	1993	Annual Avg.Growth
856,228	1,000,336	1,138,000	1,173,961	1,211,058	1,249,327	1,288,806	3.16%

(ii) Meru District Average income

Meru District Annual Employment Earnings K.Pounds '000

1986	1987	1988	1989	1990
24,198	17,677	30,666	41,832	46,815

Meru District Number of Persons Employed

1986	1987	1988	1989	1990
26,410	27,028	29,391	29,025	31,003

Meru District Average Annual Earnings Per Worker Kshs

1986	1987	1988	1989	1990
18,325	13,080	20,868	28,825	30,200

Meru District Number of Persons Employed
as a per cent of Kenya Total No. Employed

1986	1987	1988	1989	1990
2.16%	2.12%	2.22%	2.14%	2.09%

Meru District Average Earnings Per Worker K.Pounds
as a per cent of Kenya average earnings per worker

1986	1987	1988	1989	1990
80.48%	54.07%	76.42%	92.98%	94.69%

Sources: Statistical Abstract 1991, Central Bureau of Statistics,
Ministry of Planning and National Development

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 3

Answer to 1-3 SOCIO-ECONOMIC CONDITIONS (1)

Economic and demographic information about Kitui

(i) Kitui District number of inhabitants

Projected Population based on 1989 Census

1980	1985	1989	1990	1991	1992	1993	Annual Avg.Growth
478,941	561,179	640,000	660,608	681,880	703,836	726,500	3.22%

(ii) Kitui District Average Income

Kitui District Annual Employment Earnings K.Pounds '000

1986	1987	1988	1989	1990
9,835	11,269	13,067	19,157	18,956

Kitui District Number of Persons Employed

1986	1987	1988	1989	1990
11,289	11,427	12,261	13,306	14,749

Kitui District Average Annual Earnings Per Worker Kshs

1986	1987	1988	1989	1990
17,424	19,723	21,315	28,795	25,705

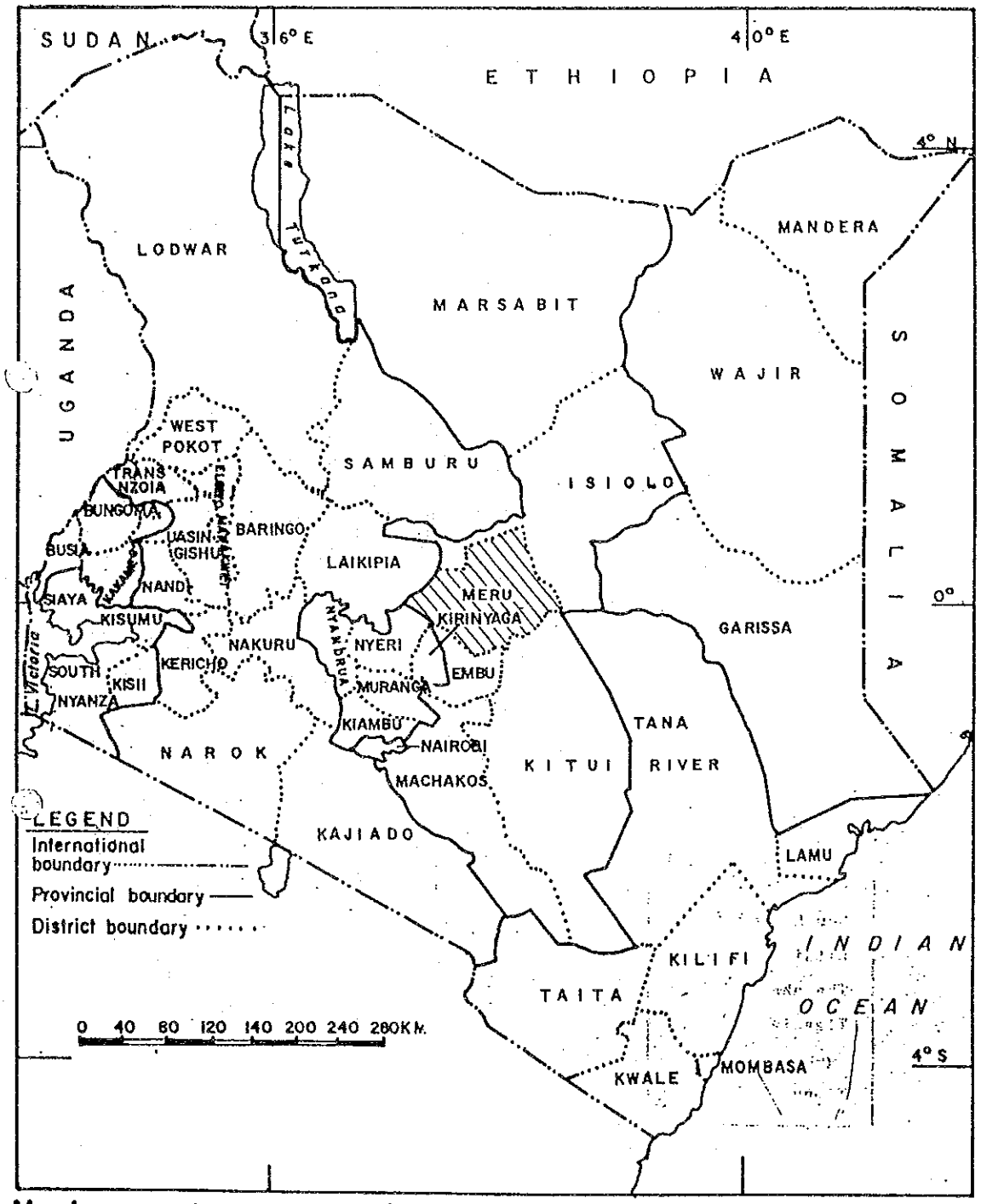
Kitui District Number of Persons Employed
as a per cent of Kenya Total No. Employed

1986	1987	1988	1989	1990
0.92%	0.90%	0.93%	0.98%	0.99%

Kitui District Average Earnings Per Worker K.Pounds
as a per cent of Kenya average earnings per worker

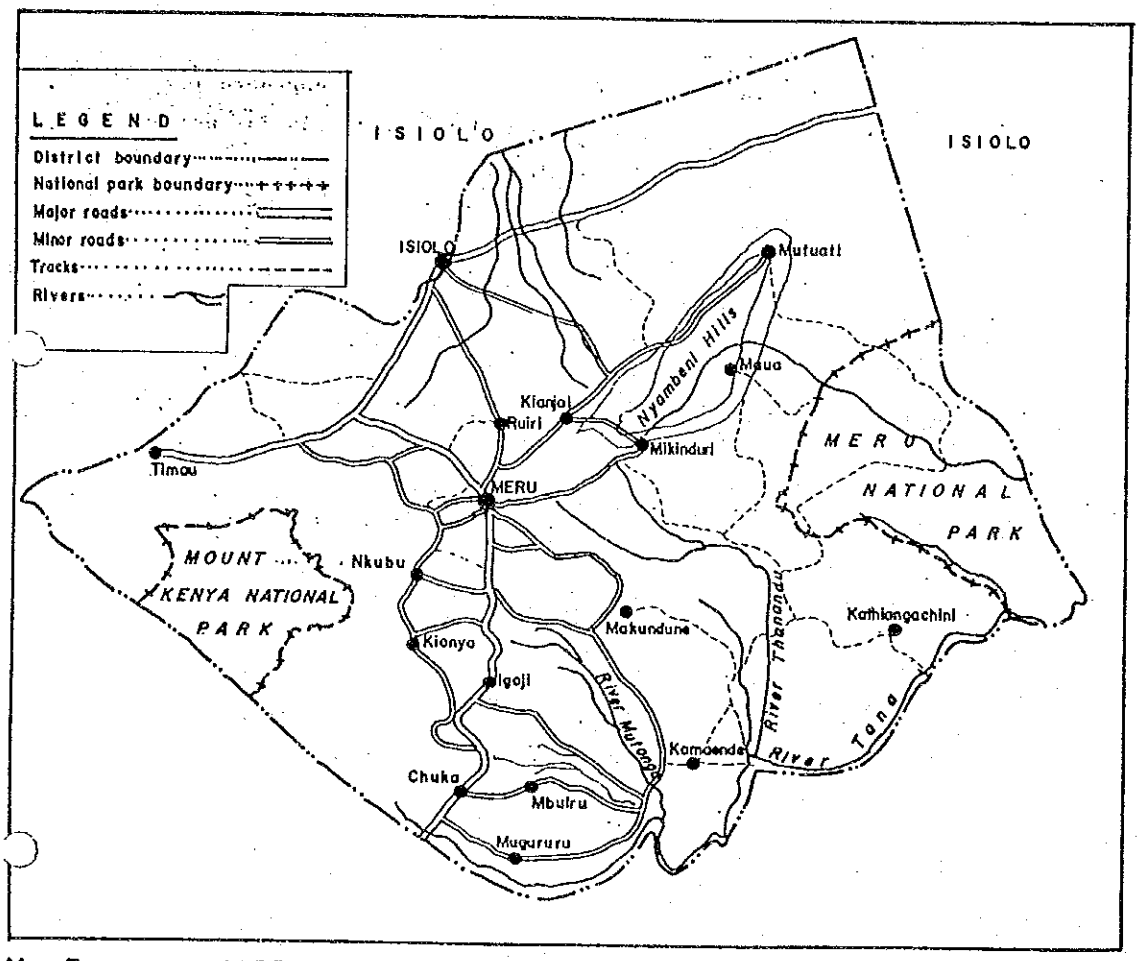
1986	1987	1988	1989	1990
76.52%	81.53%	78.06%	92.88%	80.60%

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 3



Map.I LOCATION OF MERU DISTRICT WITHIN KENYA

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 3



Map.3 MERU DISTRICT PHYSICAL FEATURES

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 3

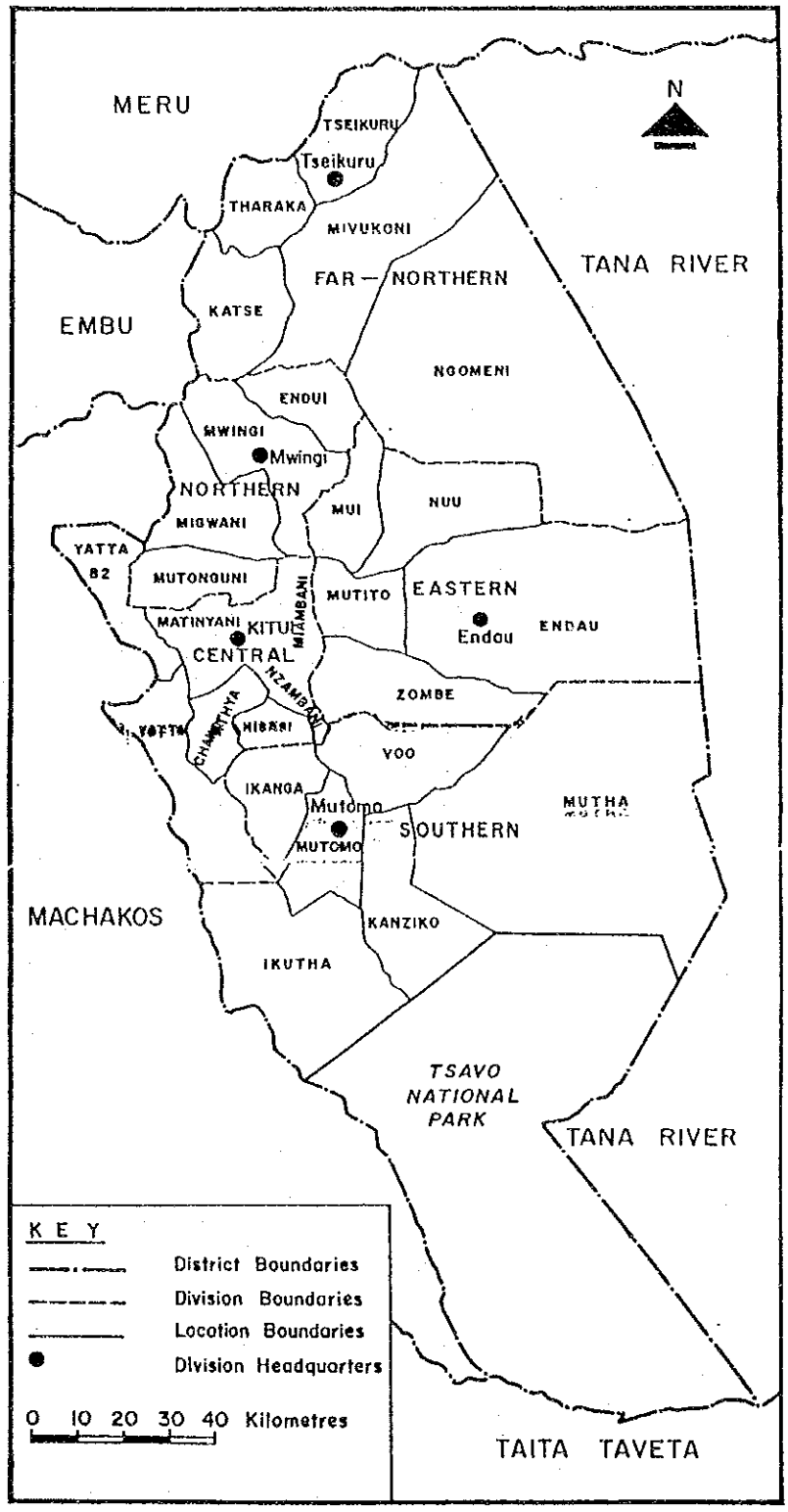


FIG. I : ADMINISTRATIVE BOUNDARIES :
KITUI DISTRICT

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 3

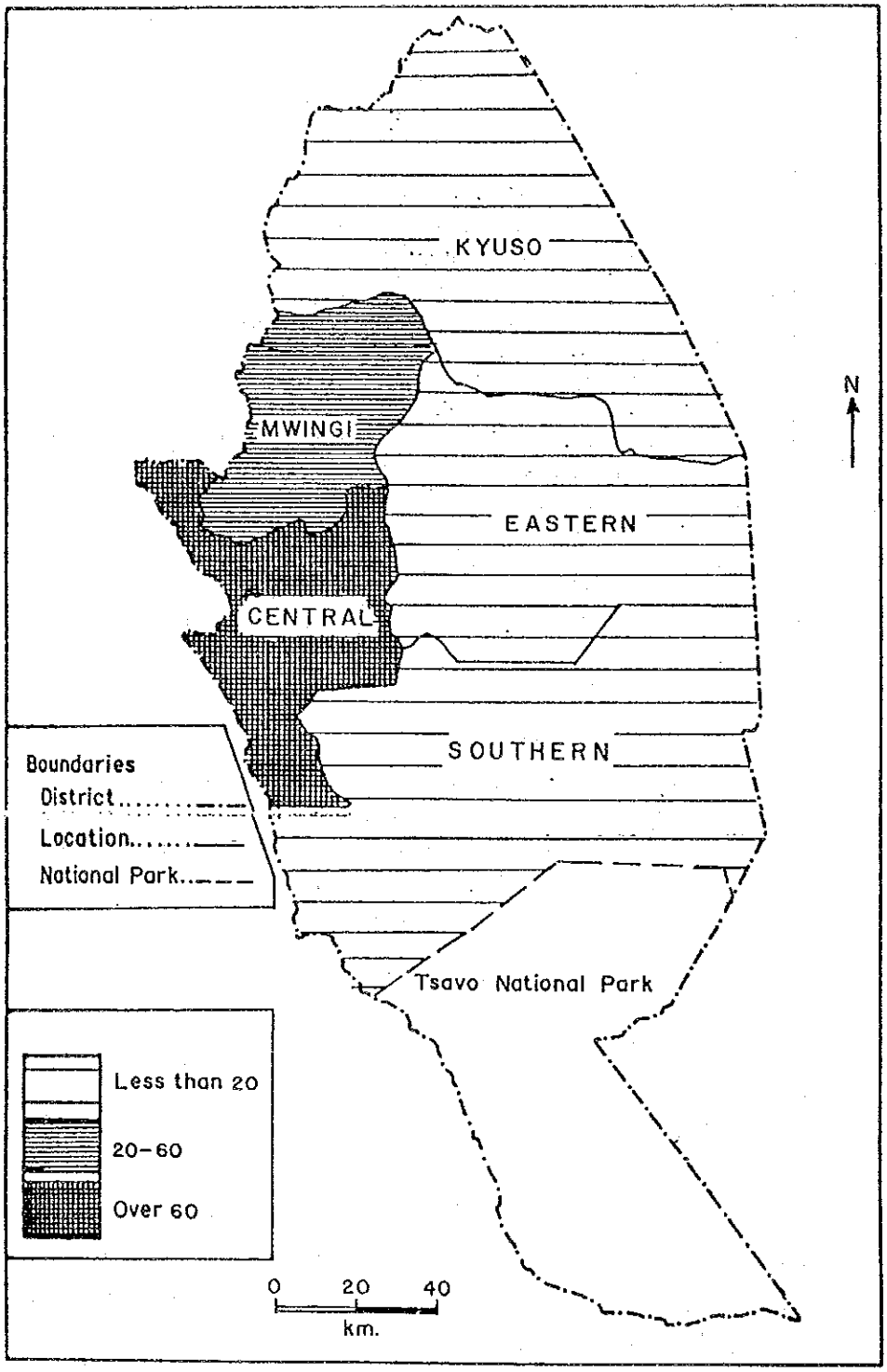
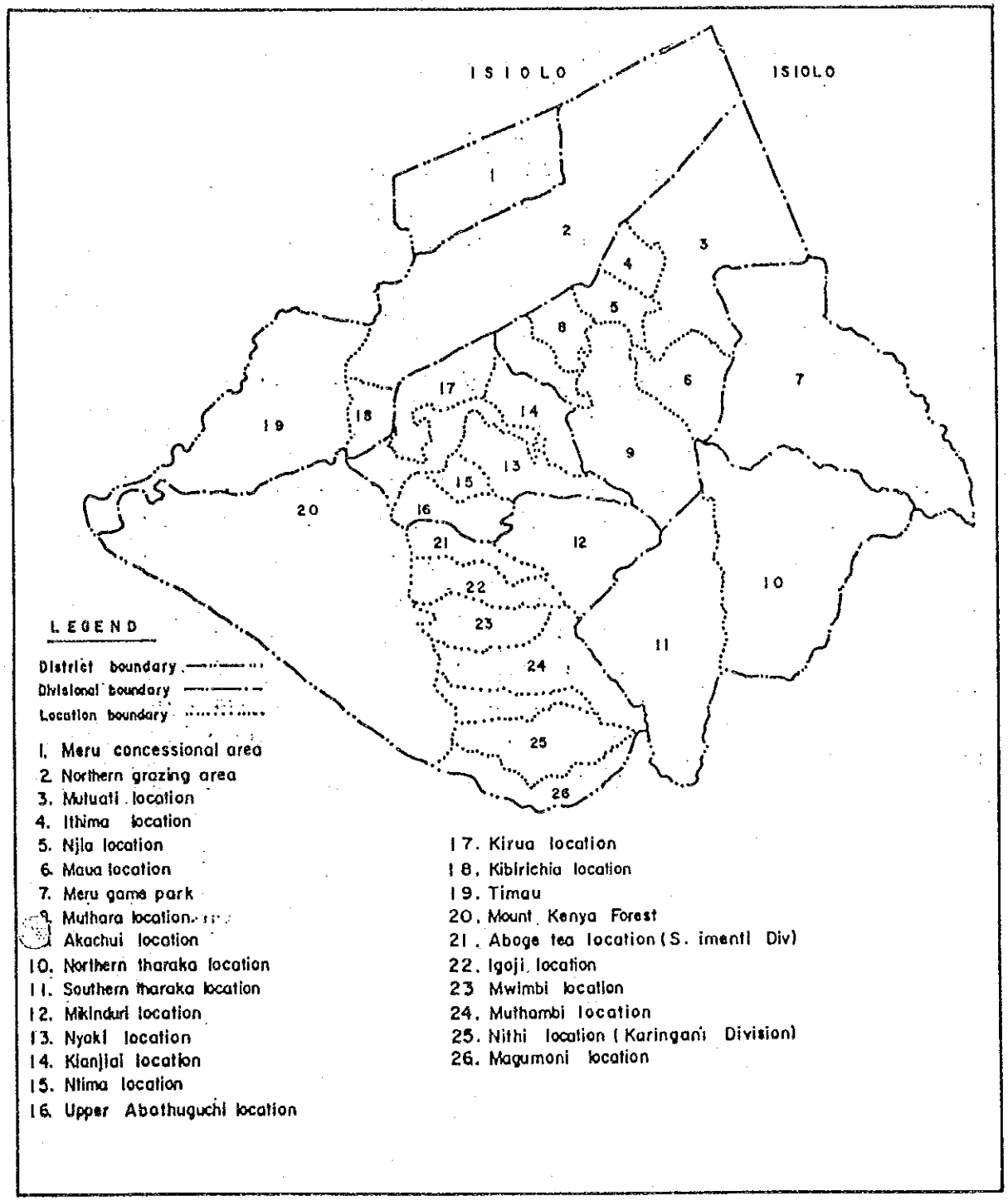


FIG. 2 : POPULATION DENSITY BY DIVISION - 1979

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 3



Map. 2 **MERU DISTRICT ADMINISTRATIVE BOUNDARIES**

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 3

KITUI DISTRICT POPULATION DENSITY

Division	Area Sq. Kms.	1979 census Population	Density	2000 expected Population	Density
Central	2,535	158,667	62	373,547	147
Eastern	4,776	49,665	10	116,926	24
Southern	6,590	73,857	11	173,880	26
Mwingi	2,245	109,880	48	258,689	115
Kyuso	6,668	72,214	10	170,012	25
Total	22,814	464,283		1,093,054	

Note: District Area including Tsavo National Park is 29,388 Sq. Kms.

MERU DISTRICT POPULATION DENSITY

Division	Area Sq. Kms.	1979 Census Population	Density	1988 Projected Population	Density
Nithi	640	142288	222	208236	325
South Imenti	918	103543	216	151533	316
Tharaka	1496	50277	34	73579	49
Igembe	2572	171597	67	251129	98
Tigania	652	140651	216	205840	316
North Imenti	392	198434	264	290404	392
Timau	790	23389	30	34229	43
Total	7,460	830,179	111	1,214,950	163

Answer to 1−3 SOCIO−ECONOMIC CONDITIONS (1)

Kenya GDP and GDP per capita 1987 – 1991

	1987	1988	1989	1990	1991
GDP at Current prices (K£ mill)	5,648.23	6,480.62	7,451.34	8,540.36	9,799.85
GDP at 1982 prices (K£ mill)	3,668.44	3,856.97	4,049.95	4,224.55	4,317.37
Kenya population (1989 Census)	19,934,476	20,600,287	21,397,000	22,111,660	22,850,189
GDP per capita current prices (KShs)	5,666.80	6,291.78	6,964.85	7,724.76	8,577.48
GDP per capita at 1982 prices (KShs)	3,680.50	3,744.58	3,785.53	3,821.11	3,778.85

Sources: Economic Survey 1991 and 1992, Central Bureau of Statistics,
Ministry of Planning and National Development

Answer to 1-3 SOCIO-ECONOMIC CONDITIONS (1)

EXCHANGE RATES (Kshs/unit as of end of the calendar year or fiscal year)

	1985	1986	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93 as at May 93	Avg. Annual Growth over past 6 years
BRITISH POUND STERLING	23.466	24.311	26.327	30.970	32.558	40.212	47.500	61.263	98.708	24.64%
CANADIAN DOLLAR	11.648	11.746	12.339	14.888	17.924	19.778	24.947	27.078	50.505	26.48%
DEUTSCHE MARK	6.621	6.621	9.057	9.918	10.578	13.830	16.200	21.051	39.354	27.74%
FINNISH MARKA	3.002	3.166	3.693	4.165	4.781	5.900	6.800	7.724	11.698	21.19%
FRENCH FRANC	2.159	2.237	2.723	2.945	3.172	4.119	4.681	6.264	11.682	27.47%
SWISS FRANC	7.863	8.514	10.822	11.977	12.278	16.295	18.540	23.412	43.549	26.12%
CONV. BELGIAN FRANC	0.324	0.360	0.434	0.474	0.513	0.675	0.772	1.022	1.915	28.07%
SWEDISH KRONOR	2.150	2.253	2.579	2.894	3.161	3.821	4.417	5.829	8.777	22.65%
JAPANESE YEN	0.081	0.100	0.112	0.136	0.147	0.151	0.203	0.257	0.580	31.49%
DUTCH GUILDER	5.876	7.292	7.989	8.800	9.519	12.281	14.112	18.682	35.140	28.00%
ITALIAN LIRA	0.010	0.012	0.012	0.013	0.015	0.019	0.021	0.028	0.043	23.12%
SPECIAL DRAWING RIGHT	18.655	21.400	24.080	26.755	27.580	30.841	33.054	48.000		
UNITED STATES DOLLAR	16.284	16.432	16.449	18.085	21.512	23.130	28.514	32.320	63.930	25.39%

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. 1 - 3

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 2 (5)

9.4 - Operation of Hydroelectric Plant

Rainfall and resultant surface runoff are highly variable in Kenya, both seasonally and from one year to the next. For example, the Tana River at Grand Falls has an average annual flow of 185 m^3/s, with the driest month being February (88 m^3/s on average) and the wettest month being May (404 m^3/s). The wettest year on record was 1968 with an average runoff of 367 m^3/s, and the driest was 1949 with an average runoff of only 66 m^3/s--a ratio of annual values of nearly 6 to 1.

The reservoirs at the hydroelectric projects regulate these highly variable flows to a certain extent and thus enable the hydroelectric projects to generate more continuously. A small head pond may be capable of regulating flow throughout the day from peak to off-peak hours, while a moderately sized reservoir may be capable of regulating flows on a seasonal basis as well. A large reservoir, such as Masinga, is capable of over-year regulation. In fact, should the critical dry period of the late 1940s reoccur, the Masinga reservoir would be capable of regulating flows over a 2-1/2-yr period to yield much improved firm energy from the Tana cascade.

In an all-hydroelectric power system, the optimum reservoir operating policy is to maximize the firm energy. This is achieved by drawing down the reservoir only when necessary which, in turn, leaves the reservoir as full as possible at the beginning of a dry period.

In a thermal-dominated power system the optimum policy is to maximize the average hydroelectric energy output, even at the expense of firm energy capability. This is achieved by drawing down the reservoirs greatly in the dry season (with attendant high energy output), so that they can then store more water in the wet season without spillage. This maximizes the displacement of thermal generation and hence minimizes fuel costs.

In a mixed hydroelectric-thermal system the optimum policy is not so clear cut, and therefore the degree to which the reservoirs are drawn down prior to each wet season must be optimized.

Three operating policies were defined for the Kenya system by their drawdown levels (rule curves) as follows:

- Rule Curve 1 - no drawdown
- Rule Curve 2 - 6.3 m drawdown at Masinga
  6.8 m drawdown at Kiambere
  10.4 m drawdown at Turkwel

- Rule Curve 3 - 9.5 m drawdown at Masinga
11.6 m drawdown at Kiambere
15.5 m drawdown at Turkwel.

The first rule curve resulted in the greatest firm energy, but had more spillage and consequently lower average energy production. Conversely, the third rule curve had the lowest firm energy but the highest average energy output. Table 9.5(a) shows the firm and average energy capabilities of several system configurations for each of the three operating policies.

Three development sequences were then compiled, one for each operating policy. The first development plan (using Rule Curve 1) had the lowest capital costs, due to the high firm hydroelectric energy output, but the highest operating costs due to the low average hydroelectric energy output. The third development plan was the converse. Overall, the second plan had the lowest discounted capital plus operating costs of $957.5 million. The costs for the other two plans were both over $1000 million. Table 9.5(b) lists the economic results for the three plans, not only for the entire planning period, but also for several intervals. This enabled assessment of whether the optimum policy shifts during the planning period. The results show a tendency to shift the optimum drawdown downward later in the period, but of the three policies tested, the second remained optimum until 2006.

9.5 - Power System Reliability

9.5.1 - Background

The reliability of a power system is a measure of the degree of certainty with which the generation and transmission facilities can meet power and energy demands.

There is always a finite possibility that the demand cannot be met, because there are uncertainties in both the forecast of demand and in the ability of generation and transmission facilities to supply the demands.

Uncertainty in the supply is principally caused by reduction of energy available to generating facilities, or reduction in power output of generating and/or transmission facilities. Reductions in energy supply in Kenya would be caused primarily by low runoff to hydroelectric plants, while power supply reductions would be caused by failure of equipment.

The uncertainty in demand for power and energy is a result of the inability to predict future requirements, especially 10 to 20 years hence.

These uncertainties have a bearing on the calculation of indices of system reliability, and are discussed in Sections 9.5.2 and 9.5.3. The methods used to quantify the reliability are presented in Section 9.5.4, followed by a discussion of the most appropriate reliability indices to use in the development planning process.

9.5.2 - Supply Uncertainty

Inability to supply the demanded energy from available resources or to deliver it at the required rate (peak power) constitutes a system failure. Power supply uncertainty is determined by generating and transmission equipment availability to meet peak system demand. Energy supply uncertainty is a function of hydroelectric energy availability and long-term availability of thermal generating equipment, as discussed below.

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. I - 2 (5)

(a) Hydroelectric Supply

As mentioned in Section 9.4, the annual hydroelectric energy varies widely depending on the annual rainfall amount. Computer simulations of the hydroelectric system operation during the 38 years of the reference hydrology (see Appendix C) indicated that the most severe drought which occurred was during the 1948 and 1949 water years. In that critical dry period, the reservoirs would have started full then draw down gradually over a 30-month period to their minimum operating levels. For this period, the firm energy release from the existing and committed system is as shown in Table 3.4. Incremental firm energy provided by new hydroelectric plants would contribute as noted in Section 5. For example, Low Miriu would add 140 GW·h annually to the firm energy.

The maximum capacity available from the hydroelectric projects would also have gradually decreased during the critical dry period, since the hydraulic head at these plants reduces as the reservoir levels reduce. Therefore, at the end of the drawdown period, the firm capacity that would be available is at a minimum. Table 3.4 lists firm capacity of existing and committed hydroelectric plants, while Table 5.1 lists this quantity for hydroelectric candidate projects considered.

The probability of recurrence of hydroelectric energy levels for this critical period is about 5% (2 years in 38), while the probability of recurrence of firm capacity levels for the last year of this period is about 2.5% (1 year in 38).

TABLE 9.5

OPTIMIZATION OF
HYDROELECTRIC SYSTEM OPERATION

(a) Energy Capability[1]

Existing System	Annual Firm Energy (GW·h)	Annual Average Energy (GW·h)	Incremental Change in Annual Firm Energy (GW·h)	Incremental Change in Annual Average Energy (GW·h)
Rule Curve 1	1227	1579	Base	Base
Rule Curve 2	1175	1688	-52	+109
Rule Curve 3	1078	1717	-149	+138
Existing System Plus Kiambere				
Rule Curve 1	1902	2374	Base	Base
Rule Curve 2	1823	2548	-79	+174
Rule Curve 3	1666	2586	-236	+212
Existing System Plus Kiambere Plus Turkwel[2]				
Rule Curve 1	2279	2848	Base	Base
Rule Curve 2	2174	2997	-105	+149
Rule Curve 3	2060	3041	-219	+193

(b) Economic Assessment

	Present-Worth Capital and Operating Costs ($ million)		
	Rule Curve 1	Rule Curve 2	Rule Curve 3
1987 - 1990	176.2	136.9	167.6
1991 - 1995	92.9	91.2	96.2
1996 - 2000	168.3	160.7	166.7
2001 - 2006	223.9	210.6	212.7
2007 - 2036	379.5	358.1	358.0
TOTAL	1040.8	957.5	1001.2

[1]Not including small hydro capability of 24.9 GW·h/yr (firm), and 66.0 GW·h/yr (average).

[2]Including third units at Gitaru and Kindaruma, which provide 60 GW·h/yr additional average energy (but no firm energy).

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. II - 2 (3)

IRRIGATION SCHEMES

1. MWEA

Area developed 8,000 ha

Crop: Rice

Management: National Irrigation Board (NIB)

Water Requirement: 16 m^3/Sec

Backflow estimated at 50% of water requirement

2. THANANTU VALLEY (PROPOSED)

Potential irrigable area is 2500 ha

Water requirement is 2.5 m^3/Sec

Crops would be mainly industrial such as cotton and tobacco.

3. MITUNGUU (PROPOSED)

Potential irrigable area is 2500 ha of which 450 ha has been developed by Ministry of Agriculture (MoA). Crops are mainly food horticultural.

Water requirement is 2.5 m^3/Sec

4. RUPINGAZI (PROPOSED)

Potential project area is 3600 ha

Water requirement is 3.6m^3/Sec

Crops are horticultural mainly french beans

5. PRIVATE ESTATES

Total estimated area is 10,000 ha
Water requirement is 10m^3/Sec
Crops: Coffee and horticultural crops.

6. BURA

Project area is 2500 ha

Water requirement is 2.5m³/Sec

Crops: Cotton

Management: NIB tenant scheme

7. HOLA

Project area 860 ha

Water requirement is 0.9m³/Sec

Crops: Cotton

Management: NIB tenant scheme

8. TANA DELTA

Total area to be developed is 12000 ha

Project water requirement is 24m³/Sec

Back flow estimated at 50% water requirement

Crops: Rice

Management: Estate development under TARDA

9. OTHERS

Ishiara

Garrissa projects

Total water requirements 1m³/Sec

Crops: Food and horticultural

Answer to III–1 (1) Information for Power and Energy

Sales (GWh) by Consumer Category 1980 – 1991/92

Year	A Domestic & Commercial (small)	B Commercial and industrial (medium)	C Commercial & Industrial (large)	D Off–peak	E Street lighting	Rural Electrification	TOTAL
1980	412	447	518	114	11	–	1,502
1981	438	411	615	118	11	–	1,593
1982	455	406	645	114	11	9	1,640
1983	483	415	659	109	10	11	1,687
1984	513	465	696	116	9	15	1,815
1985	545	472	798	106	9	21	1,950
1986 6 mo	292	252	437	53	4	10	1,048
1986/87	633	536	919	111	9	25	2,233
1987/88	678	555	985	110	12	36	2,376
1988/89	729	516	1,046	113	14	49	2,467
1989/90	780	554	1,130	117	14	66	2,661
1990/91	823	585	1,178	109	14	76	2,784
1991/92	877	567	1,198	104	14	85	2,845
Average Annual Growth over last 9.5 years	7.2%	3.6%	6.7%	–0.9%	2.3%	27.4%	6.0%

From KPLC Annual Reports

INTERIM DPOATE OF NPDP
1991 - 2010

Table A2.1
Summary of Hydroelectric Plant Characteristics

Plant	Commissioning Year	Retirement Year	Installed Capacity (MW)	Maximum Simultaneous Output (MW)	Firm Output (MW)	No. of Units	Gross Head (m)	Reservoir FSL[1] (m)	Minimum Operating Level (m)	Average TWL[2] (m)	Reservoir Area[3] (m^3x10^4)	Live Storage (m^3x10^6)	Average Flow (m^3/s)
Selby Falls	1952	na[4]	0 4	0 4	)	2	na	na	na	na	na	na	na
Mesco	1933	na[4]	0.38	0.36	)	1	na	na	na	na	na	na	na
Ndula	1925	na[4]	2 25	2.0	)4 3[5]	2	na	na	na	na	na	na	na
Sagana Falls	1955	na[4]	1 S	1.5	)	2	na	na	na	na	na	na	na
Gogo	1958	na	2 0	1.6	)	3	na	na	na	na	na	na	na
Wanjii	1953, 1958	2028	7 4	7.4	6.3	4	115	na	na	na	0	0	na
Tana I	1932, 1950	2010	6 4	5 3	1.1	3	70	1113 0	1113 0	1051 0	0	0	9 3
Masinga	1981	2056	40.0	40 0	12.9[6]	2	50	1056 5	1031 0	1006 0	11 600	1410.0	69 1
Kamburu	1974, 1976	2050	94 2	84.0	64.0[6]	3	82	1006 5	990 0	935.3	1 520	135 0	91 9
Gitaru	1978	2053	145 0	145.0	145.0	2	144	924 0	922 0	780 0	310	12.5	91 9
Kindaruma	1968	2043	44 0	44 0	44 0	2	37	780 4	776 8	743 4	250	7 5	91 9
Kiambere	1988	2063	144.0	140.0	92 0	2	145	700.0	663 5	542.0	2 500	485.0	91 9
Subtotal (1988)			495.5	478.3	373.7								
Turkwel	1991	2066	106.0	106 0	85.7	3	370	1140 0	1095 0	770.0	3 860	614 0	19 3
Total			601.5	584 3	459 4								

[1]FSL - full supply level

[2]TWL - tailwater level without consideration of submergence due to high reservoir level of downstream plant.

[3]Area at FSL

[4]Retirement date not established but plant is already over 50 years old

[5]Total firm power of five small plants assumed to be 4 3 MW

[6]Firm capacity determined by reducing output by the head ratio (head at minimum operated level/rated head) to the power 1.5

Answer III−1 (1) Information and data for Power and Energy

AREA MAXIMUM DEMAND (MW)

AREA	1984	1985	1986 (Jan−Jun)	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	Average Growth over past 7.5 years
Nairobi	192	206	223	223	231	238	271	261	277	5.0%
Coast	74	82	82	89	107	98	105	120	124	7.1%
Central Rift	20	23	26	26	30	35	38	32	43	10.7%
West Kenya +	49	60	75	77	79	78	45	43	55	* 6.9%
Mt. Kenya	16	18	19	21	22	25	24	30	31	9.3%
North Rift +							19	28	26	
TOTAL SYSTEM (SIMULTANEOUS)	366	387	400	430	461	480	520	550	566	6.0%
% INCREASE P.A.	9.6%	5.7%		7.3%	7.2%	4.1%	8.3%	5.8%	2.9%	

+ Western Area was separated into West Kenya and North Rift in 1989/90

* Combined West Kenya and North Rift growth

KPLC Annual Reports

Answer III–1 (1) Information and data for Powe. nd Energy

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES NO. III - 1 (1)

Annual Energy Consumption and Production by Source

Source of Supply	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986 (Jan–Jun)	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
Hydro (GWh)	563	785	1,053	1,288	1,040	1,362	1,377	1,458	1,471	1,660	829	1,793	2,038	2,449	2,516	2,760	2,776
Oil thermal (GWh)	376	317	252	205	333	283	260	114	174	83	59	168	208	25	96	74	75
Geothermal (GWh)	0	0	0	0	0	39	96	262	233	336	179	374	348	322	336	298	272
Interconnected Diesel (GWh)	63	20	5	1	22	1	1	0	1	2	1	5	3	2	2	0	3
Isolated Diesels (GWh)										7	4	9	10	11	12	14	16
Gas turbine (GWh)	40	11	2	1	25	0	0	0	0	4	3	17	13	1	0	4	3
Gas turbine(JBE) (GWh)	0	0	0	0	0	0	0	0	0	0	0	27	52	20	10	17	0
UEB imports (GWh)	240	272	217	160	315	194	212	179	215	215	113	211	154	112	175	134	240
Total generation	1,282	1,405	1,529	1,655	1,735	1,879	1,946	2,013	2,094	2,307	1,189	2,605	2,827	2,943	3,147	3,301	3,386
Station use(GWh)	32	28	25	22	29	29	31	29	28	27	16	28	43	27	33	33	30
Net generation(GWh)	1,250	1,377	1,504	1,633	1,706	1,850	1,915	1,984	2,066	2,280	1,173	2,577	2,784	2,916	3,114	3,268	3,356
Growth in net generation(%yr)	10.0%	10.2%	9.2%	8.6%	4.5%	8.4%	3.5%	3.6%	4.1%	10.4%	–	–	8.0%	4.7%	6.8%	5.0%	2.7%
Transmission and Dis–tribution (T&D) losses	168	174	203	220	234	255	280	302	282	317	127	347	407	448	453	484	510
T&D losses % of net generation	13.4%	12.6%	13.5%	13.5%	13.7%	13.8%	14.6%	15.2%	13.6%	13.9%	10.8%	13.5%	14.6%	15.4%	14.5%	14.8%	15.2%
Total KPLC Sales(GWh)	1,082	1,203	1,301	1,409	1,468	1,592	1,631	1,677	1,775	1,944	1,035	2,208	2,340	2,418	2,595	2,708	2,760
Total REF sales (GWh)	–	–	–	2	4	6	7	10	15	19	12	25	36	49	67	76	85
Total Sales (GWh)	1,082	1,203	1,301	1,411	1,472	1,598	1,639	1,687	1,790	1,963	1,047	2,233	2,376	2,467	2,662	2,784	2,846
Annual Growth in Sales		11.2%	8.1%	8.5%	4.3%	8.5%	2.6%	2.9%	6.1%	9.7%		9.0%	6.4%	3.9%	7.9%	4.6%	2.2%
Maximum demand generated (MW)	207	223	256	269	290	313	317	334	349	367	400	430	461	480	520	550	566
Load factor (%)	70.3%	71.9%	68.2%	70.2%	68.1%	68.5%	70.1%	68.8%	68.3%	67.8%	68.2%	68.9%	69.7%	69.7%	68.8%	68.2%	68.0%

KPLC Annual Reports

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. III - 1 (1)

Answer to III--1 (1) Power and Energy

PLANNED ADDITIONAL GENERATION CAPACITY

Project Name	Expected Commissioning Date	Capacity (MW)
Kipevu MS Diesel (Phase 1)	1996/97	75
Olkaria N.E. Geothermal	1996/97	64
Kipevu MS Diesel (Phase 2)	1997/98	75
New Geothermal	1998/99	55
New Geothermal	1998/99	55
Sondu Miriu Hydro	1998/99	60
New Low Speed Diesel	1999/00	50
New Low Speed Diesel	2000/01	50
New Geothermal	2001/02	55
Oldorko Hydro	2002/03	72
New Low Speed Diesel	2002/03	50
Gitaru 3rd unit	2003/04	72
New Low Speed Diesel	2004/05	100
New Geothermal	2005/06	55
New Low Speed Diesel	2006/07	100
New Low Speed Diesel	2008/09	100
New Geothermal	2009/10	55

Answer to III–1 Information and Data for Power and Energy

ATTACHED DATA OF ANSWE
TO QUESTIONNAIRES
NO. III - 1 (1)

EXPECTED TRANSMISSION EXPANSION

Transmission Line Additions	Master Plan On–Line Date	Expected Implementation Dates
132 kV 1 Cct. Rabai to Bamburi 15 km	1991	
220 kV 2 Cct. Turkwel to Lessos	1991	
220 kV 1 Cct. Kiambere to Embakasi 160 km	1993	1993/94 – 1995/96
220 kV 2 Cct. Dandora – Nairobi N.– Olkaria 92 km	1994	1993/94 – 1995/96
220 kV 1 Cct. Embakasi to Rabai 450 km	1995	1993/94 – 1996/97
132 kV 1 Cct. Lessos to Kisumu 85 km	1995	1993/94 – 1995/96
220 kV 2 Cct. at Olkaria development 8 km	1996	
220 kV 1 Cct. Olkaria to Lessos 170 km	1996	
132 kV 1 Cct. Masinga to Kiganjo 89 km	1996	
132 kV 1 Cct. Low Miriu to Kisumu 49 km	1997	
132 kV 1 Cct. Low Miriu to Chemosit 45 km	1997	
132 kV 2 Cct. Mombasa Thermal to Rabai 28 km	1999	
132 kV 1 Cct. Oldorko to Olkaria 90 km	2002	
132 kV 1 Cct. Masinga to Nanyuki 140 km	2002	
132 kV 1 Cct. Gitaru to Kamburu 8 km	2003	
132 kV 1 Cct. Lessos to Eldoret 32 km	2003	
220 kV 1 Cct. Dandora to Embakasi 20 km	2004	
220 kV 2 Cct. Embakasi to Rabai 450 km	2004	
220 kV 1 Cct. Kiambere to Embakasi 160 km	2005	
220 kV 2 Cct. New Geothermal to Nairobi N. 80 km	2006	
220 kV 1 Cct. Olkaria to Lessos 170 km	2006	
132 kV 2 Cct. Mombasa to Rabai 28 km	2007	

SUBSTATION EXPANSION

Substation Additions	Master Plan On–Line Date
132 kV Switchgear – Naivasha, Lanet, Musaga, Voi	1991
132 kV Switchgear – Rabai and Bamburi	1991
220 kV Substation – Turkwel and Lessos	1991
132 kV Switchgear – Mombasa Diesel	1993
220 kV Switchgear – Kiambere and Embakasi	1993
220 kV Switchgear – Dandora, Nairobi N. and Olkaria	1994
220 kV Switchgear – Embakasi and Rabai	1995
132 kV Switchgear – Mombasa Diesel/GT	1995
132 kV Switchgear – Lessos And Kisumu	1995
220 kV Substation – Olkaria	1996
220 kV Switchgear – Olkaria and Lessos	1996
132 kV Switchgear – Masinga and Kiganjo	1996
132 kV Switchgear – Miriu, Chemosit, Kisumu	1997
220 kV Switchgear – Geothermal	1998
132 kV Switchgear – Mombasa Thermal	1999
220 kV Substation – L.Grand Falls and Kiambere	2000
220 kV Switchgear – Geothermal	2001
132 kV Substation – Masinga Kiganjo Nanyuki	2002
132 kV Switchgear – Mombasa Thermal	2002
132 kV Substation – Oldorkro and Olkaria	2002
220 kV Switchgear – Geothermal	2003
132 kV Switchgear – Gitaru and Kamburu	2003
220 kV Switchgear – Lessos and Eldoret	2003
132 kV Switchgear – Mombasa Thermal	2004
220 kV Switchgear – Dandora, Embakasi and Rabai	2004
220 kV Switchgear – Mutonga and Kiambere	2005
220 kV Switchgear – Kiambere and Embakasi	2005
220 kV Switchgear – Geothermal and Nairobi N.	2006
132 kV Switchgear – Mombasa Thermal	2007
220 kV Switchgear – Geothermal	2008
132 kV Switchgear – Mombasa Thermal	2009

Answer to III–1 POWER AND ENERGY (2)

INTERCONNECTED SYSTEM PLANT OPERATION COSTS (K.SHS.) AND GROSS GENERATION (GWH)

STATION	INSTALLED CAPACITY (KW) at 1991/92		1986	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
HYDRO									
KPLC Ndula		Lub.Oil,Water & Stores	0	0	0	0	0	0	0
		Salaries & Wages	249,649	488,736	688,925	722,880	1,479,500	1,359,080	2,204,780
	2,000	R & M	231,260	725,958	636,774	1,135,500	2,296,260	458,560	208,120
		Depreciation	1,578	2,872	1,124	3,760	3,860	3,360	3,400
		Other Generation Costs	9,624	21,751	49,063	161,200	335,740	416,620	334,880
		Sub–total	492,111	1,239,317	1,375,886	2,023,340	4,115,360	2,237,620	2,751,180
		Total Generation Kwh	1,386,619	5,873,750	4,593,370	6,877,950	3,620,000	229,450	0
Sagana		Lub.Oil,Water & Stores	0	0	23	0	0	0	0
		Salaries & Wages	362,455	732,504	1,159,431	746,758	173,740	884,080	1,660,860
	1,500	R & M	341,843	720,190	924,448	531,333	379,560	608,300	513,340
		Depreciation	2,941,678	6,029,743	6,119,183	22,011	24,480	21,820	22,780
		Other Generation Costs	16,316	35,762	174,006	15,462	78,860	177,080	415,880
		Sub–total	3,662,292	7,518,199	8,377,091	1,315,564	656,640	1,691,280	2,612,860
		Total Generation Kwh	3,830,048	11,064,670	9,284,220	11,406,180	12,249,000	9,981,700	9,581,400
Gogo		Lub.Oil,Water & Stores	0	0	0	0	0	0	0
		Salaries & Wages	0	0	869,860	766,880	1,548,420	1,412,040	1,902,520
	2,000	R & M	0	0	752,960	1,430,900	741,360	2,007,800	1,388,290
		Depreciation	0	0	8,800	46,600	56,620	68,040	76,700
		Other Generation Costs	0	0	178,220	318,380	600,740	640,740	381,940
		Sub–total	0	0	1,809,840	2,562,760	2,947,140	4,128,620	3,749,450
		Total Generation Kwh	0	0	3,984,830	2,951,000	1,397,000	5,906,190	6,101,430

Answer to III–1 POWER AND ENERGY (2)

INTERCONNECTED SYSTEM PLANT OPERATION COSTS (K.SHS.) AND GROSS GENERATION (GWH)

STATION	INSTALLED CAPACITY (KW) at 1991/92		1986	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
Selby		Lub.Oil,Water & Stores	0	0	0	0	0	0	0
		Salaries & Wages	69,920	111,940	212,360	244,740	302,700	270,980	416,120
	400	R & M	30,220	46,180	47,140	64,440	32,960	94,240	198,220
		Depreciation	3,940	5,920	3,520	6,840	6,320	7,240	7,840
		Other Generation Costs	11,020	31,900	45,280	72,460	33,520	63,840	152,820
		Sub–total	115,100	195,940	308,300	388,480	375,500	436,300	775,000
		Total Generation Kwh	140,200	500,620	504,221	753,255	875,000	617,540	690,470
Mesco		Lub.Oil,Water & Stores	0	0	0	0	0	0	0
		Salaries & Wages	8,197	160,304	311,869	275,180	378,220	457,280	551,000
	380	R & M	354,594	113,584	77,517	200,820	138,960	371,180	149,920
		Depreciation	0	0	0	0	0	0	0
		Other Generation Costs	3,141	12,238	58,559	44,260	105,820	726,020	109,260
		Sub–total	365,932	286,126	447,945	520,260	623,000	1,554,480	810,180
		Total Generation Kwh	945,316	2,722,160	2,890,690	2,685,490	2,540,000	1,800,600	2,609,040
Tana		Lub.Oil,Water & Stores	13,412	56,926	46,455	135,921	0	117,606	232,801
		Salaries & Wages	929,595	1,835,150	3,856,105	4,731,559	5,415,720	7,704,752	8,179,004
	14,400	R & M	1,112,855	3,288,292	4,273,832	3,703,787	3,177,900	11,473,861	5,653,274
		Depreciation	0	0	0	0	0	0	0
		Other Generation Costs	507,178	1,179,573	2,647,179	3,785,032	2,154,840	3,867,265	1,482,904
		Sub–total	2,563,040	6,359,941	10,823,571	12,356,299	10,748,460	23,163,484	15,547,983
		Total Generation Kwh	32,986,357	77,109,600	82,001,100	77,039,600	93,462,000	79,857,700	71,892,000
Wanjii		Lub.Oil,Water & Stores	1,317	32,767	1,412	783	0	48,694	89,758
		Salaries & Wages	1,022,829	1,548,148	2,788,456	2,591,838	4,132,460	3,818,424	4,236,749
	7,400	R & M	1,247,281	1,753,290	2,261,031	1,522,525	1,842,420	1,543,062	2,006,894
		Depreciation	0	0	0	0	0	0	0
		Other Generation Costs	168,913	314,834	563,370	480,660	916,240	423,866	335,702
		Sub–total	2,440,340	3,649,039	5,614,269	4,595,806	6,891,120	5,834,046	6,669,103
		Total Generation Kwh	18,334,636	54,400,650	45,650,900	57,124,000	54,863,000	44,316,400	42,178,400

Answer to III–1 POWER AND ENERGY (2)

INTERCONNECTED SYSTEM PLANT OPERATION COSTS (K.SHS.) AND GROSS GENERATION (GWH)

STATION	INSTALLED CAPACITY (KW) at 1991/92		1986	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
TRDC Kamburu		Lub.Oil,Water & Stores	110,371	245,304	167,856	223,799	0	355,660	404,160
		Salaries & Wages	1,369,691	2,352,833	6,713,737	6,351,817	4,439,600	3,644,055	4,140,972
	91,500	R & M	14,024,002	2,911,236	2,046,722	1,417,314	4,176,200	2,987,304	3,394,664
		Depreciation	0	0	0	0	0	0	0
		Other Generation Costs	735,188	1,540,991	(267,834)	1,715,478	2,296,180	2,427,656	2,758,700
		Sub–total	16,239,252	7,050,364	8,660,481	9,708,408	10,911,980	9,414,675	10,698,496
		Total Generation Kwh	183,909,989	415,249,000	432,337,000	403,178,000	382,025,000	430,869,000	401,967,000
Gitaru		Lub.Oil,Water & Stores	196,128	211,561	177,621	170,677	0	276,416	314,110
		Salaries & Wages	1,071,868	2,451,902	4,205,703	4,676,741	4,064,520	17,200,128	20,235,445
	145,000	R & M	1,425,474	2,147,634	977,799	2,374,747	3,859,520	3,983,347	4,526,531
		Depreciation	0	0	0	0	0	0	0
		Other Generation Costs	2,236,349	2,998,783	79,406	5,288,001	1,368,560	3,012,592	3,423,401
		Sub–total	4,929,819	7,809,880	5,440,529	12,510,166	9,292,600	24,472,483	28,499,487
		Total Generation Kwh	400,798,293	835,612,000	841,335,019	779,028,060	762,219,000	795,397,000	811,307,000
Kindaruma		Lub.Oil,Water & Stores	89,595	465,812	523,844	774,462	0	160,659	182,566
		Salaries & Wages	1,707,405	2,560,813	4,082,770	4,288,484	4,126,680	4,920,262	5,591,207
	44,000	R & M	356,469	6,920,078	2,810,400	890,284	2,214,660	0	0
		Depreciation	0	0	0	0	0	0	0
		Other Generation Costs	420,305	1,272,141	2,336	1,524,469	1,682,320	1,951,669	2,217,806
		Sub–total	2,573,774	11,218,844	7,419,350	7,477,699	8,023,660	7,032,590	7,991,579
		Total Generation Kwh	102,540,797	191,273,263	223,273,221	214,063,321	216,004,000	201,274,000	206,218,000

Answer to III – 1 POWER AND ENERGY (2)

INTERCONNECTED SYSTEM PLANT OPERATION COSTS (K.SHS.) AND GROSS GENERATION (GWH)

STATION	INSTALLED CAPACITY (KW) at 1991/92		1986	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
TARDA		Lub.Oil,Water & Stores	(133,776)	315,048	372,308	454,210	0	468,659	532,568
Masinga		Salaries & Wages	685,075	1,331,656	2,823,455	2,969,867	4,266,220	7,296,490	8,584,106
	40,000	R & M	412,578	1,045,969	841,413	83,884,713	1,424,080	1,850,963	2,103,368
		Payments to TARDA	52,447,037	113,398,264	107,762,175	82,706,960	86,222,560	23,977,953	23,977,953
		Other Generation Costs	342,901	965,192	(2,944)	1,249,370	2,046,960	1,850,963	2,103,368
		Sub – total	53,753,815	117,056,129	111,796,407	171,265,120	93,959,820	35,445,028	37,301,363
		Total Generation Kwh	85,309,975	199,333,682	181,671,455	103,294,857	123,727,000	180,576,834	185,381,811
Kiambere		Lub.Oil,Water & Stores	–	–	29,070	324,779	146,014	81,990	263,688
		Salaries & Wages	–	–	1,160,406	2,377,888	755,763	3,983,111	2,563,592
	144,000	R & M	–	–	1,315,327	610,218	1,246,569	611,720	1,156,172
		Depreciation	–	–	0	0	0	0	0
		Other Generation Costs	–	–	0	1,751,059	9,871	2,112,790	1,692,410
		Sub – total	–	–	2,504,803	5,063,944	2,158,217	6,789,611	5,675,863
		Total Generation Kwh	–	–	210,587,000	794,019,476	863,000,000	962,494,490	871,643,180
KVDA		Lub.Oil,Water & Stores	–	–	–	–	–	0	0
Turkwel		Salaries & Wages	–	–	–	–	–	431,320	3,533,340
	106,000	R & M	–	–	–	–	–	83,420	815,620
		Depreciation	–	–	–	–	–	0	0
		Other Generation Costs	–	–	–	–	–	1,318,980	2,648,820
		Sub – total	–	–	–	–	–	1,833,720	6,997,780
		Total Generation Kwh	–	–	–	–	–	46,597,300	49,974,800
TOTAL HYDRO CAPACITY	598,580	TOTAL HYDRO COST	87,135,475	162,383,779	164,578,472	229,787,846	150,703,497	122,200,217	123,082,544
		TOTAL HYDRO GEN.	830,182,230	1,793,139,395	2,038,113,026	2,452,421,189	2,515,981,000	2,759,918,204	2,659,544,531

Answer to III–1 POWER AND ENERGY (2)

INTERCONNECTED SYSTEM PLANT OPERATION COSTS (K.SHS.) AND GROSS GENERATION (GWH)

STATION	INSTALLED CAPACITY (KW) at 1991/92		1986	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
KPC UEB		Generation Costs	15,125,740	28,865,224	45,081,193	45,818,911	45,263,943	60,738,239	73,481,523
Imports		Cost of Units Purchased	8,041,343	69,629,879	26,157,883	(2,265,059)	29,614,517	21,603,744	41,352,443
		Administration	62,482,220	168,287,742	63,681,583	* }	4,876,179	7,574,245	12,668,203
	30,000	Finance Charges	48,783,091	123,950,008	282,789,400	526,083,405 }	487,718,760	562,587,922	648,711,236
		Transmission costs	698,494	1,329,805	1,329,209	1,750,369	2,693,443	1,909,514	1,838,456
		Sub–Station Costs	982,318	1,027,533	2,021,936	2,594,002	912,777	7,297,681	4,717,388
		Cost of KPLC Purchases	136,113,206	393,090,191	421,061,204	573,981,628	571,079,619	661,711,345	782,769,249
		UEB IMPORTS KWH	345,552,694	716,658,000	629,973,600	568,269,300	174,261,040	135,847,500	240,472,000
GEOTHERMAL									
KPC Olkaria		Lub.Oil,Water & Stores	14,972	22,439	104,762	83,001	91,960	140,752	980
		Salaries & Wages	3,096,085	6,222,750	9,435,005	5,015,551	11,831,160	16,345,563	11,512,440
	45,000	R & M	2,501,863	7,309,004	10,760,557	9,610,201	3,012,200	9,507,864	13,355,920
		Depreciation	0	0	0	0	0	0	0
		Other Generation Costs	4,509,440	5,302,051	8,343,029	14,158,053	501,760	18,007,924	1,016,260
		TOTAL GEOTH. COST	10,122,360	18,856,244	28,643,353	28,866,806	15,437,080	44,002,103	25,885,600
		GEOTH. GEN. KWh	181,079,785	373,951,750	347,980,600	322,266,600	335,538,000	297,619,100	271,908,000
THERMAL									
KPLC									
Kipevu		Fuel	44,452,940	184,829,126	270,788,892	50,801,660	109,522,580	142,463,100	87,239,020
Steam	93,000	Lub.Oil,Water & Stores	826,120	1,665,560	3,270,460	1,469,020	(2,064,500)	6,074,040	6,261,880
Gas Turbine	33,000	Salaries & Wages	7,672,760	13,006,200	20,090,540	19,677,040	25,888,760	22,904,540	27,655,580
		R & M	3,463,200	12,387,781	25,291,940	15,162,260	14,089,500	13,586,480	21,928,420
		Depreciation	4,342,540	46,606,680	17,572,620	18,568,880	21,501,640	22,574,520	20,419,360
		Other Generation Costs	713,860	2,017,860	2,623,900	2,964,520	2,906,980	3,525,920	3,916,080
		Sub–total	61,471,420	260,513,207	339,638,352	108,643,380	171,844,960	211,128,600	167,420,340
		Total Generation Kwh	60,030,684	194,982,100	260,260,540	45,020,180	106,508,000	91,021,150	75,449,430

Answer to III–1 POWER AND ENERGY (2)

INTERCONNECTED SYSTEM PLANT OPERATION COSTS (K.SHS.) AND GROSS GENERATION (GWH)

STATION	INSTALLED CAPACITY (KW) at 1991/92		1986	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
Nairobi South									
Diesel	1,500	Fuel	1,679,594	5,962,478	7,868,705	2,886,560	3,706,120	12,755,680	10,305,580
Gas Turbine	13,500	Lub.Oil,Water & Stores	66,466	275,029	467,035	45,920	507,140	0	2,363,500
		Salaries & Wages	1,727,912	3,406,349	5,871,196	5,813,700	8,347,240	5,863,940	6,125,140
		R & M	867,704	1,323,530	2,860,140	2,142,560	2,069,360	1,192,840	3,365,720
		Depreciation	90,670	93,639	77,646	152,760	156,920	132,180	131,080
		Other Generation Costs	134,334	400,821	400,484	1,677,340	1,183,860	777,280	2,034,640
		Sub–total	4,566,680	11,461,846	17,545,206	12,718,840	15,970,640	20,721,920	24,325,660
		Total Generation Kwh	4,396,111	20,413,780	14,527,880	12,216,150	1,985,000	17,134,450	4,617,100
KPLC DIESEL									
Interconnected									
Ruiru	2,500	Fuel	534,076	1,682,948	1,233,074	1,498,980	287,680	364,180	67,140
Mbaraki	0	Lub.Oil,Water & Stores	51,151	66,563	105,747	74,520	54,400	26,540	61,460
		Salaries & Wages	343,772	768,106	1,369,562	1,389,380	1,621,140	1,573,640	2,781,060
		R & M	424,300	864,892	580,859	520,620	799,020	434,760	351,960
		Depreciation	171	320	515	5,340	5,360	4,960	5,360
		Other Generation Costs	179,984	331,788	139,674	308,540	287,960	206,880	314,000
		TOTAL INT.DIES.COST	1,533,454	3,714,617	3,429,431	3,797,380	3,055,560	2,610,960	3,580,980
		INT.DIES.GEN.KWh	485,101	1,867,650	902,370	634,930	363,000	340,630	1,647,440

Answer to III–1 (2) Current Electricity Tariff

HISTORICAL AND CURRENT METHODS OF CHARGE IN KSH/KWHr

TARIFF CATEGORY	RANGE OF UNITS CONSUMED PER MONTH	YEAR									Avg. annual growth over the last 8 years
		1985 1st July	1986	1987 1st Jan	1988 1st Jan	1989	1990 1st June	1991 1st May	1992	1993 1st April	
A0	Fixed Charge	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	35.00	
Domestic	0 – 50 KWH	0.10	0.10	0.28	0.37	0.37	0.37	0.69	0.69	0.77	
	51 –100 KWH	0.60	0.60	0.78	0.87	0.87	1.00	1.19	1.19	1.43	
240 Volts	101 – 300 KWH	0.80	0.80	0.98	1.07	1.07	1.25	1.51	1.51	1.75	
	301 – 7000 KWH	1.06	1.06	1.24	1.33	1.33	1.66	2.00	2.00	2.25	
	Average tariff	0.64	0.64	0.82	0.91	0.91	1.07	1.35	1.35	1.55	11.69%
A1	Fixed Charge	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	50.00	
Small Commercial and Industrial 240 Volts	0 – 7,000 KWHrs	0.89	0.89	1.07	1.16	1.16	1.46	1.79	1.79	2.05	10.99%
B0	Fixed Charge	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	240.00	
Irrigation 240/415 Volts	7,001 – 100,000 KWhrs	0.70	0.70	0.88	0.97	0.97	1.17	1.44	1.44	1.65	11.31%
B1	Fixed Charge	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	240.00	
Commercial	7,001 – 100,000 KWhrs	0.70	0.70	0.88	0.97	1.28	1.28	1.61	1.61	1.67	11.48%
Industrial 240/415 Volts	Cost per kVA of Demand	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	100.00	
B2	Fixed Charge	720.00	720.00	720.00	720.00	720.00	720.00	720.00	720.00	1,500.00	
Commercial/Industrial	7,001 – 100,000 KWhrs	0.66	0.66	0.84	0.93	0.93	1.23	1.57	1.57	1.60	11.70%
(HV) 11 KV/ 33 KV	Cost per kVA of Demand	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	80.00	
B3	Fixed Charge	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	7,100.00	
Commercial/Industrial	7,001 – 100,000 KWhrs	0.62	0.62	0.80	0.89	0.89	1.19	1.50	1.50	1.55	12.14%
(EHV) 66 KV/ 132 KV	Cost per kVA of Demand	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	70.00	
C1	Fixed Charge	120.00	120.00	120.00	120.00	120.00	120.00	120.00	120.00	240.00	
Commercial/Industrial	Over 100,000 KWhrs	0.64	0.64	0.82	0.91	0.91	1.19	1.48	1.48	1.59	12.05%
(LV) 415 Volts	Cost per kVA of Demand	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	100.00	
C2	Fixed Charge	720.00	720.00	720.00	720.00	720.00	720.00	720.00	720.00	1,500.00	
Commercial/Industrial	Over 100,000 KWhrs	0.60	0.60	0.78	0.87	0.87	1.15	1.43	1.43	1.57	12.78%
(HV) 11 KV/ 33 KV	Cost per kVA of Demand	45.00	45.00	45.00	45.00	45.00	45.00	45.00	45.00	80.00	
C3	Fixed Charge	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	3,280.00	7,100.00	
Commercial/Industrial	Over 100,000 KWhrs	0.56	0.56	0.74	0.83	0.83	1.10	1.37	1.37	1.51	13.20%
(EHV) 66 KV/ 132 KV	Cost per kVA of Demand	40.00	40.00	40.00	40.00	40.00	40.00	40.00	40.00	70.00	
D0	Fixed Charge	50.00	50.00	50.00	50.00	50.00	50.00	50.00	50.00	60.00	
Off–Peak 240 Volts	All units consumed	0.61	0.61	0.79	0.88	0.88	1.16	1.43	1.43	1.65	13.25%
E0 Street lighting atleast 11 Hours per day 240 Volts	Fixed Charge	65.00	65.00	65.00	65.00	65.00	65.00	65.00	65.00	130.00	
	All units consumed	0.89	0.89	1.07	1.16	1.16	1.46	1.78	1.78	2.05	10.99%

Answer III-1 (1) Information and data for Power and Energy

Annual Energy Production by Source and Total Consumption

Source of Supply	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986 (Jan-Jun)	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92
Hydro (GWh)	563	785	1,053	1,288	1,040	1,362	1,377	1,458	1,471	1,660	829	1,793	2,038	2,449	2,516	2,760	2,776
Oil thermal (GWh)	376	317	252	205	333	283	260	114	174	83	59	168	208	25	96	74	75
Geothermal (GWh)	0	0	0	0	0	39	96	262	233	336	179	374	348	322	336	298	272
Interconnected Diesel (GWh)	63	20	5	1	22	1	1	0	1	2	1	5	3	2	2	0	3
Isolated Diesels (GWh)										7	4	9	10	11	12	14	16
Gas turbine (GWh)	40	11	2	1	25	0	0	0	0	4	3	17	13	1	0	4	3
Gas turbine(JBE) (GWh)	0	0	0	0	0	0	0	0	0	0	0	27	52	20	10	17	0
UEB imports (GWh)	240	272	217	160	315	194	212	179	215	215	113	211	154	112	175	134	240
Total generation	1,282	1,405	1,529	1,655	1,735	1,879	1,946	2,013	2,094	2,307	1,189	2,605	2,827	2,943	3,147	3,301	3,386
Station use(GWh)	32	28	25	22	29	29	31	29	28	27	16	28	43	27	33	33	30
Net generation(GWh)	1,250	1,377	1,504	1,633	1,706	1,850	1,915	1,984	2,066	2,280	1,173	2,577	2,784	2,916	3,114	3,268	3,356
Growth in net generation(%yr)	10.0%	10.2%	9.2%	8.6%	4.5%	8.4%	3.5%	3.6%	4.1%	10.4%	–	–	8.0%	4.7%	6.8%	5.0%	2.7%
Transmission and Distribution (T&D) losses	168	174	203	220	234	255	280	302	282	317	127	347	407	448	453	484	510
T&D losses % of net generation	13.4%	12.6%	13.5%	13.5%	13.7%	13.8%	14.6%	15.2%	13.6%	13.9%	10.8%	13.5%	14.6%	15.4%	14.5%	14.8%	15.2%
Total KPLC Sales(GWh)	1,082	1,203	1,301	1,409	1,468	1,592	1,631	1,677	1,775	1,944	1,035	2,208	2,340	2,418	2,595	2,708	2,760
Total REF sales (GWh)	–	–	–	2	4	5	7	10	15	19	12	25	36	49	67	76	85
Total Sales (GWh)	1,082	1,203	1,301	1,411	1,472	1,598	1,639	1,687	1,790	1,963	1,047	2,233	2,376	2,467	2,662	2,784	2,846
Annual Growth in Sales		11.2%	8.1%	8.5%	4.3%	8.5%	2.6%	2.9%	6.1%	9.7%		9.0%	6.4%	3.9%	7.9%	4.6%	2.2%
Maximum demand generated (MW)	207	223	256	269	290	313	317	334	349	387	400	430	461	480	520	550	566
Load factor (%)	70.3%	71.9%	68.2%	70.2%	68.1%	68.5%	70.1%	68.8%	68.3%	67.8%	68.2%	68.9%	69.7%	69.7%	68.8%	68.2%	68.0%

Source: KPLC Annual Reports

Answer to III−1 (1) Information for Power and Energy

Forecasted Power Demand based on 1992 Interim Update of the Kenya National Power Development Plan

Year	Domestic	Commercial Industrial	Off−Peak	Total KPLC	REF	Total Sales	Integrated System Sales	Generation GWh	Peak Load (MW)	Load Factor
1992/93	905.5	1,921.2	110.1	2,936.8	114.6	3,051.4	3,034.6	3,520.1	628.7	63.9%
1993/94	956.1	2,039.7	111.5	3,107.3	131.7	3,239.0	3,220.1	3,753.3	668.2	64.1%
1994/95	1,008.5	2,163.8	112.9	3,285.2	148.8	3,434.0	3,416.4	3,963.1	710.1	63.7%
1995/96	1,064.0	2,295.7	114.9	3,474.6	165.9	3,640.5	3,624.4	4,204.3	754.4	63.6%
1996/97	1,123.9	2,436.9	117.5	3,678.3	182.9	3,861.2	3,843.7	4,458.7	801.0	63.5%
1997/98	1,188.4	2,587.7	120.1	3,896.2	200.0	4,096.2	4,077.0	4,729.3	850.6	63.5%
1998/99	1,257.5	2,748.1	122.8	4,128.4	217.1	4,345.5	4,324.6	5,016.6	903.2	63.4%
1999/00	1,331.3	2,918.5	125.6	4,375.4	234.1	4,609.5	4,587.1	5,321.0	959.1	63.3%
2000/01	1,410.2	3,099.1	128.4	4,637.7	251.2	4,888.9	4,864.8	5,643.2	1,018.2	63.3%
2001/02	1,494.2	3,290.5	131.3	4,916.0	268.3	5,184.3	5,158.6	5,983.9	1,080.7	63.2%
2002/03	1,583.7	3,493.2	134.2	5,211.1	285.4	5,496.5	5,469.1	6,344.1	1,146.8	63.2%
2003/04	1,678.9	3,707.6	137.3	5,523.8	302.4	5,826.2	5,797.2	6,724.7	1,216.7	63.1%
2004/05	1,780.2	3,934.3	140.4	5,854.9	319.5	6,174.4	6,143.7	7,126.7	1,290.5	63.0%
2005/06	1,887.8	4,174.1	143.5	6,205.4	336.6	6,542.0	6,509.7	7,551.3	1,368.5	63.0%
2006/07	2,002.2	4,427.7	146.7	6,576.6	353.7	6,930.3	6,896.3	7,999.7	1,450.9	62.9%
2007/08	2,123.6	4,695.6	150.0	6,969.2	370.7	7,339.9	7,304.4	8,473.1	1,537.9	62.9%
2008/09	2,252.6	4,978.8	153.4	7,384.8	387.8	7,772.6	7,735.4	8,973.1	1,629.9	62.8%
2009/10	2,389.6	5,278.1	156.9	7,824.6	404.9	8,229.5	8,190.6	9,501.1	1,727.0	62.8%

Answer to III–1 (1) Information for Power and Energy

Sales (GWh) by Consumer Category 1980 – 1991/92

Year	A Domestic & Commercial (small)	B Commercial and industrial (medium)	C Commercial & Industrial (large)	D Off–peak	E Street lighting	Rural Electrification	TOTAL
1980	412	447	518	114	11	–	1,502
1981	438	411	615	118	11	–	1,593
1982	455	406	645	114	11	9	1,640
1983	483	415	659	109	10	11	1,687
1984	513	465	696	116	9	15	1,815
1985	545	472	798	106	9	21	1,950
1986 6 mo	292	252	437	53	4	10	1,048
1986/87	633	536	919	111	9	25	2,233
1987/88	678	555	985	110	12	36	2,376
1988/89	729	516	1,046	113	14	49	2,467
1989/90	780	554	1,130	117	14	66	2,661
1990/91	823	585	1,178	109	14	76	2,784
1991/92	877	567	1,198	104	14	85	2,845
Average Annual Growth over last 9.5 years	7.2%	3.6%	6.7%	–0.9%	2.3%	27.4%	6.0%

Source KPLC Annual Reports

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. III - 1 (1)

TABLE 5.1

HYDROELECTRIC POTENTIAL

Project	River	Installed Capacity (MW)	Firm Capacity (MW)	Gross Head (m)	Firm Energy (GW·h/yr)	Average Energy (GW·h/yr)	Capital Cost (KShx10^6)	Study Status*
Lake Victoria Drainage Basin								
Hemsted Bridge	Nzoia	60	60	553	297	307	-[2]	R
Magwagwa[1]	Sondu	95	73	185	333	438	5,818	R
Low Miriu[1]	Sondu	49	49	163	140	261	1,653	(F) Feasib
Nandi Forest[1]	Yala	50	46	552	248	255	3,123	(R)
Tana River Drainage Basin								
Karura	Tana	50	50	42	170	216	-[2]	PR
Mutonga[1]	Tana	60	41	37	202	234	2,538	PF
Low Grand Falls[1]	Tana	120	88	68	482	594	4,798	PF
High Grand Falls[1,3]	Tana	180	141	106	692	802	9,723	PF
Usueni	Tana	70	42_e	40	248	309	-[2]	PR
Adamson's Falls[1]	Tana	80	68	40	307	358	3,716	R
Kora[1]	Tana	92	69	46	342	401	4,138	R
Ndula Redevelopment	Thika	25	15_e	90	-	120	-[2]	PR
Mavoloni	Thika	40	24_e	125	-	180	-[2]	PR
Kianyonga	Mutonga	30	18_e	90	-	120	-[2]	PR

Note
e = approximate estimate

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. III - 1 (1)

Table 5.1
Hydroelectric Potential - 2

Project	River	Installed Capacity (MW)	Firm Capacity (MW)	Gross Head (m)	Firm Energy (GW·h/yr)	Average Energy (GW·h/yr)	Capital Cost ($KShx10^6$)	Study Status*
Athi River Drainage Basin								
Munyu	Athi	8	5_e	42	23	40	-[2]	R
Fourteen Falls Cascade	Athi	30	30	180	73	111	-[2]	R
Rift Valley Drainage Basin								
Sererwa[1]	Arror	60	60	1100	-	150	1,350[4]	PR
Leshota[1]	Ewaso Ngiro (S)	42	36	265	86	111	3,229	R
Oldorko[1]	Ewaso Ngiro (S)	76	69	480	149	236	3,404	R
Ewaso Ngiro River North Drainage Basin								
Crocodile Jaws	Ewaso Ngiro (N)	46	-	115	-	175	-[2]	PR
Muridjo	Ewaso Ngiro (N)	25	-	70	-	100	-[2]	PR
Kirimun	Ewaso Ngiro (N)	90	-	260	-	400	-[2]	PR

1, Advanced to generation planning studies, Sections 6 through 10.

2 Costs not available, or inconsistent with other costs quoted. See Appendix D for details.

3 High Grand Falls mutually exclusive with Mutonga plus Low Grand Falls.

4 Costs adopted from KVDA report dated September 1986.

* PR = prereconnaissance, R = reconnaissance, PF = prefeasibility, F = feasibility.

HYDROLOGY – RIVER FLOW (CUMECS)

MASINGA:

YEAR:	1988			1989			1990			1991			1992			1993		
MONTH	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL
JAN				32.39	45.75	78.14	31.91	131.84	163.75	55.02	8.37	63.39	67.96	0.00	67.96	45.64	0.00	45.64
FEB	62.24	0.00	62.24	39.14	22.78	61.92	32.74	33.46	66.20	64.01	0.00	64.01	55.63	0.00	55.63	50.93	0.68	51.61
MARCH	31.69	0.00	31.69	47.07	0.00	47.07	35.61	92.66	128.27	46.67	0.00	46.67	46.63	0.00	46.63	72.67	0.00	72.67
APRIL	67.92	0.00	67.92	22.36	55.43	77.79	25.86	267.07	292.93	47.21	0.00	47.21	26.99	0.00	26.99	61.02	0.00	61.02
MAY				14.45	156.93	171.38	31.37	219.77	251.14	43.17	40.53	83.70	29.55	0.00	29.55			
JUNE	24.70	73.86	98.56	11.25	80.54	91.79	29.35	91.68	121.03	38.41	89.47	127.88	51.92	0.00	51.92			
JULY	14.83	42.44	57.27	18.91	37.87	56.78	31.58	37.69	69.27	35.76	35.75	71.51	50.39	0.00	50.39			
AUGUST	64.73	3.69	68.42	34.45	14.14	48.59	49.03	5.65	54.68	52.24	0.00	52.24	50.92	0.00	50.92			
SEPT	18.36	29.40	47.76			0.00	57.45	0.00	57.45	60.88	0.00	60.88	55.60	0.00	55.60			
OCT	23.58	26.29	49.87	41.29	8.29	49.58	55.03	0.00	55.03	51.58	0.00	51.58	42.44	0.00	42.44			
NOV	36.15	69.06	105.22	32.07	121.08	153.15	42.53	2.81	45.34	52.25	0.00	52.25	35.71	0.00	35.71			
DEC	30.85	63.74	94.59			0.00			0.00	49.41	0.00	49.41	36.89	0.00	36.89			

KAMBURU:

YEAR:	1988			1989			1990			1991			1992			1993		
MONTH	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL
JAN				67.77	28.70	96.47	61.72	146.59	208.31	79.26	0.00	79.26	65.72	0.00	65.72	66.15	0.00	66.15
FEB	75.26	0.00	75.26	66.09	0.00	66.09	71.22	2.83	74.05	69.93	0.00	69.93	68.40	0.00	68.40	75.61	0.00	75.61
MARCH	54.78	0.00	54.78	59.01	1.03	60.04	53.52	115.79	169.31	68.34	0.00	68.34	60.45	0.00	60.45	82.44	0.00	82.44
APRIL	66.93	57.22	124.15	65.66	45.01	110.69	54.10	323.55	377.65	72.69	0.00	72.69	51.17	0.00	51.17	71.04	0.00	71.04
MAY				64.66	177.15	241.83	54.59	255.98	310.57	71.96	83.65	155.61	66.02	0.00	66.02			
JUNE	75.39	53.73	129.12	62.83	59.30	122.13	57.77	90.34	148.11	71.32	87.84	159.16	72.67	0.00	72.67			
JULY	67.97	10.04	78.01	66.09	4.54	70.63	74.11	6.98	81.09	75.43	7.01	82.44	67.68	0.00	67.68			
AUGUST	71.25	2.34	73.59	67.67	0.00	67.67	68.42	0.00	68.42	72.47	0.00	72.47	64.79	0.00	64.79			
SEPT	67.64	0.00	67.64			0.00	65.13	0.00	65.13	70.79	0.00	70.79	67.86	0.00	67.86			
OCT	66.29	0.00	66.29	70.34	4.33	74.67	69.67	0.00	69.67	66.05	0.00	66.05	72.75	0.00	72.75			
NOV	76.53	90.96	167.49	74.76	130.62	205.38	76.84	1.56	78.40	65.80	0.00	65.80	97.80	0.00	97.80			
DEC	70.23	55.84	126.07			0.00			0.00	60.45	0.00	60.45	55.00	0.00	55.00			

GITARU:

YEAR:	1988			1989			1990			1991			1992			1993		
MONTH	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL	GENERATION	SPILLAGE	TOTAL
JAN				71.89	35.70	107.59	68.69	163.74	232.43	55.46	41.16	96.62	73.06	0.00	73.06	71.03	0.00	71.03
FEB	77.32	0.00	77.32	70.39	0.00	70.39	75.38	1.43	76.81	73.15	2.38	75.53	72.66	0.00	72.66	83.13	1.99	85.12
MARCH	61.22	0.00	61.22	62.52	3.46	65.98	79.21	110.17	189.38	73.49	0.00	73.49	66.02	0.00	66.02	90.66	0.00	90.66
APRIL	70.85	115.02	185.87	70.01	53.30	123.31	60.55	379.71	440.26	73.51	0.00	73.51	53.89	0.00	53.89	78.81	0.00	78.81
MAY				73.05	175.39	248.44	74.52	310.14	384.66	79.92	100.23	180.15	71.58	0.00	71.58			
JUNE	75.41	79.31	154.72	72.28	65.01	137.29	75.04	123.34	198.38	78.06	124.43	202.49	79.83	0.00	79.83			
JULY	63.83	21.47	85.30	71.63	3.99	75.62	73.88	20.32	94.20	80.58	16.90	97.58	75.61	0.00	75.61			
AUGUST	74.24	0.00	74.24	69.16	0.00	69.16	75.67	0.00	75.67	81.94	0.00	81.94	73.07	0.00	73.07			
SEPT	72.69	0.00	72.69			0.00	72.58	0.97	73.55	79.92	0.00	79.92	75.02	0.00	75.02			
OCT	74.40	0.00	74.40	75.22	4.22	79.44	76.03	0.00	76.03	77.50	0.00	77.50	64.27	0.00	64.27			
NOV	76.81	107.44	186.25	70.30	171.03	241.33	75.46	13.98	89.46	75.46	0.00	75.46	66.32	0.00	66.32			
DEC	72.86	84.57	157.43			0.00			0.00	71.24	0.00	71.24	63.47	0.00	63.47			

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. III - 1 (1)

KINDARUMA:

YEAR: MONTH	1988 GENERATION	1988 SPILLAGE	1988 TOTAL	1989 GENERATION	1989 SPILLAGE	1989 TOTAL	1990 GENERATION	1990 SPILLAGE	1990 TOTAL	1991 GENERATION	1991 SPILLAGE	1991 TOTAL	1992 GENERATION	1992 SPILLAGE	1992 TOTAL	1993 GENERATION	1993 SPILLAGE	1993 TOTAL
JAN				80.70	13.63	94.53	78.03	108.95	186.98	81.00	1.98	82.98	70.44	0.00	70.44	68.16	0.00	68.16
FEB	77.19	0.00	77.19	66.29	3.11	69.40	50.66	16.28	66.94	65.76	6.43	72.19	66.67	2.22	68.89	61.15	0.78	61.93
MARCH	62.16	0.00	62.16	64.15	1.39	65.54	81.23	76.75	157.98	69.88	0.00	69.88	62.76	0.00	62.76	86.22	0.00	86.22
APRIL	67.92	60.26	128.18	66.62	45.55	112.17	72.06	317.42	389.48	71.76	0.00	71.76	49.55	0.00	49.55	75.30	0.00	75.30
MAY				61.83	157.35	219.18	71.02	234.53	305.55	84.93	67.95	152.88	67.31	0.00	67.31			
JUNE	82.12	53.11	135.23	80.76	44.49	125.25	82.86	121.58	204.44	83.71	88.12	171.83	73.91	0.00	73.91			
JULY	73.15	11.20	84.35	71.63	3.99	75.62	66.61	11.71	78.32	86.25	4.89	91.14	72.15	0.00	72.15			
AUGUST	68.23	7.04	75.27	69.33	0.15	69.48	49.35	30.43	79.78	74.55	0.00	74.55	69.61	0.00	69.61			
SEPT	70.39	0.80	71.19			0.00	52.75	19.10	71.85	76.54	0.00	76.54	60.86	0.00	60.86			
OCT	72.11	0.00	72.11	76.25	2.32	78.57	58.85	19.06	77.91	74.80	0.00	74.80	81.56	0.00	81.56			
NOV	87.83	67.71	155.54	82.69	126.75	209.44	65.78	17.79	83.57	68.63	2.23	70.86	65.95	0.00	65.95			
DEC	82.39	54.83	137.22			0.00			0.00	66.66	0.74	67.40	62.81	0.00	62.81			

KIAMBERE:

YEAR: MONTH	1988 GENERATION	1988 SPILLAGE	1988 TOTAL	1989 GENERATION	1989 SPILLAGE	1989 TOTAL	1990 GENERATION	1990 SPILLAGE	1990 TOTAL	1991 GENERATION	1991 SPILLAGE	1991 TOTAL	1992 GENERATION	1992 SPILLAGE	1992 TOTAL	1993 GENERATION	1993 SPILLAGE	1993 TOTAL
JAN				68.68	43.93	112.61	82.28	146.98	229.26	89.75	4.61	94.36	80.18	0.00	80.18	77.94	0.00	77.94
FEB	16.85	0.00		69.77	2.67	72.44	85.09	7.25	92.34	91.21	0.00	91.21	85.69	0.00	85.69	87.27	0.00	87.27
MARCH	58.62	28.00	86.62	70.70	0.00	70.70	85.32	87.37	172.69	87.98	0.00	87.98	82.01	0.00	82.01	95.32	0.00	95.32
APRIL	40.48	89.31	129.79	17.90	54.27	72.17	82.22	339.49	421.71	82.68	0.00	82.68	56.53	0.00	56.53	86.18	0.00	86.18
MAY				70.76	178.55	249.31												
JUNE	48.75	102.92	151.67	72.11	65.16	137.27	79.13	98.99	178.12	80.70	104.26	184.96	70.27	0.00	70.27			
JULY	74.19	19.71	93.90	71.87	7.31	79.18	82.16	7.99	90.15	81.96	15.77	97.73	72.24	0.00	72.24			
AUGUST				69.33	0.15	69.48	84.52	0.00	84.52	85.28	0.00	85.28	76.77	0.00	76.77			
SEPT	67.46	0.13	67.59			0.00	83.04	0.00	83.04	83.43	0.00	83.43	77.79	0.00	77.79			
OCT	67.78	16.41	84.19	58.15	21.85	80.00	83.67	0.00	83.67	84.29	0.00	84.29	79.23	0.00	79.23			
NOV	71.57	114.35	185.92	71.69	165.78	237.47	87.99	0.00	87.99	85.33	0.00	85.33	84.20	0.00	84.20			
DEC	67.25	100.54	167.79			0.00			0.00	75.58	0.00	75.58	73.94	0.00	73.94			

MASINGA HYDRO POWER OPERATION STATISTICS 1988–1993

INSTALLED GENERATION CAPACITY 2x20MW

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES NO. III - 1 (1)

ENERGY GENERATED (GWh)

MONTH	1988	1989	1990	1991	1992	1993
JAN	19.06	10.48	10.32	17.80	21.99	14.76
FEB	16.04	11.44	9.57	18.71	16.84	14.88
MAR	8.73	15.23	11.52	15.75	15.08	21.29
APR	8.33	7.00	8.10	17.43	8.45	19.10
MAY	6.73	4.67	10.15	13.96	9.56	
JUN	7.73	3.52	9.19	10.02	16.25	
JUL	4.80	6.12	10.34	11.57	16.30	
AUG	11.48	11.47	15.86	16.90	16.47	
SEP	5.76	14.51	17.98	19.17	17.47	
OCT	7.63	13.36	17.80	16.69	13.73	
NOV	11.32	10.04	13.26	16.36	11.17	
DEC	9.98	9.98	11.77	15.98	11.93	
TOTAL/YR	98.52	107.33	135.53	172.53	153.25	

MAX RESERVOIR LEVEL IN METRES

MONTH	1988	1989	1990	1991	1992	1993
JAN	1049.05	1056.88	1057.34	1056.73	1053.22	1055.23
FEB	1046.57	1056.71	1056.74	1056.12	1051.24	1056.55
MAR	1043.65	1056.07	1057.12	1054.98	1049.38	1056.47
APR	1053.16	1057.21	1057.48	1054.27	1048.27	1055.68
MAY	1057.14	1057.23	1057.35	1057.16	1052.85	
JUN	1056.98	1056.99	1057.10	1057.11	1053.23	
JUL	1056.77	1056.77	1056.77	1056.82	1053.09	
AUG	1056.73	1056.67	1056.63	1056.47	1052.64	
SEP	1056.74	1056.54	1056.32	1056.01	1051.73	
OCT	1056.74	1056.93	1055.21	1054.95	1050.31	
NOV	1057.00	1057.31	1056.54	1054.25	1051.48	
DEC	1056.94	1057.29	1056.90	1053.99	1053.43	

MIN RESERVOIR LEVEL IN METRES

MONTH	1988	1989	1990	1991	1992	1993
JAN	1046.57	1056.66	1056.76	1056.13	1051.32	1053.43
FEB	1043.65	1056.48	1056.63	1054.98	1049.38	1055.12
MAR	1042.74	1056.07	1056.65	1054.00	1047.23	1055.68
APR	1042.72	1056.21	1056.91	1053.73	1047.13	1055.12
MAY	1053.16	1056.99	1057.11	1054.02	1047.99	
JUN	1056.74	1056.75	1056.76	1056.80	1052.80	
JUL	1056.69	1056.66	1056.63	1056.47	1052.62	
AUG	1056.48	1056.51	1056.33	1056.01	1051.73	
SEP	1056.54	1056.23	1055.52	1054.93	1050.31	
OCT	1056.61	1056.28	1054.82	1054.27	1049.63	
NOV	1056.69	1056.83	1055.21	1053.88	1049.75	
DEC	1056.73	1056.85	1056.53	1053.22	1051.43	

RESERVOIR LEVEL AT END OF MONTH

MONTH	1988	1989	1990	1991	1992	1993
JAN	1056.68	1046.57	1056.76	1056.13	1051.32	1055.23
FEB	1056.48	1043.65	1056.66	1054.98	1049.38	1056.47
MAR	1056.21	1042.74	1056.91	1054.25	1047.23	1055.68
APR	1057.07	1053.54	1057.27	1054.02	1048.27	1055.18
MAY	1056.99	1056.98		1057.13	1052.85	
JUN	1056.75	1056.73	1056.76	1056.82	1053.06	
JUL	1056.67	1056.73	1056.63	1056.47	1052.62	
AUG	1056.50	1056.54	1056.32	1056.01	1051.73	
SEP	1056.31	1056.69	1055.52	1054.93	1050.31	
OCT	1056.93	1056.74	1055.21	1054.26	1049.75	
NOV	1057.29	1056.84	1056.53	1053.99	1051.45	
DEC	1056.99	1056.88		1053.22	1053.43	

KAMBURU HYDRO POWER STATION OPERATION STATISTICS 1988 -- 1993

INSTALLED GENERATION CAPACITY 2x31.4MW

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES NO. III - 1 (1)

ENERGY GENERATED (GWh)

MONTH	1988	1989	1990	1991	1992	1993
JAN	37.36500	34.70400	31.63500	40.60100	33.66000	33.87500
FEB	36.05500	30.57000	32.86600	32.36200	32.77000	34.96700
MAR	28.05400	30.22100	27.40250	35.02100	30.95700	38.13200
APR	33.17200	32.55600	26.82403	33.98400	25.36100	35.20900
MAY	36.56100	33.12100	27.97200	36.87000	33.80900	
JUN	37.36400	31.15100	28.64400	35.36300	36.01400	
JUL	34.80700	33.91300	36.76100	38.63100	34.65900	
AUG	33.15000	34.65300	35.06000	37.11600	33.17900	
SEP	33.52100	30.78100	32.29800	36.25400	33.63000	
OCT	33.94700	36.02500	35.68200	33.82000	37.25300	
NOV	37.92700	37.05200	38.10500	32.61000	48.47100	
DEC	37.50300	34.26700	38.76200	30.96000	28.16500	
TOTAL/YR	399.01400	399.01400	392.01153	423.59200	407.93000	

MAX RESEVOIR LEVEL IN METRES

MONTH	1988	1989	1990	1991	1992	1993
JAN	1005.91	1006.46	1006.48	1006.34	1005.80	1006.01
FEB	1005.80	1006.43	1006.48	1005.98	1005.90	1006.28
MAR	1005.95	1006.47	1006.51	1006.40	1005.51	1006.01
APR	1006.81	1006.71	1006.46	1005.49	1005.92	1006.06
MAY	1005.16	1006.34	1006.45	1006.49	1006.48	
JUN	1006.44	1006.45	1006.50	1006.48	1005.79	
JUL	1006.50	1006.46	1006.46	1006.49	1005.70	
AUG	1006.51	1006.23	1006.23	1006.18	1005.67	
SEP	1006.26	1006.01	1005.91	1006.81	1005.76	
OCT	1006.30	1006.36	1006.37	1003.66	1005.59	
NOV	1006.54	1006.40	1006.47	1002.89	1001.59	
DEC	1006.43	1006.41	1006.50	1003.62	1004.79	

MIN RESEVOIR LEVEL IN METRES

MONTH	1988	1989	1990	1991	1992	1993
JAN	1004.65	1006.05	1006.03	1005.38	1003.30	1003.75
FEB	1005.03	1005.76	1006.14	1005.98	1005.03	1005.09
MAR	1001.94	1006.01	1006.25	1004.81	1005.16	1005.34
APR	1001.98	1005.75	1006.00	1003.99	1004.83	1004.91
MAY	1004.06	1000.21	1006.00	1005.36	1002.21	
JUN	1005.07	1006.23	1006.17	1006.05	1005.38	
JUL	1006.29	1006.16	1006.15	1005.92	1005.42	
AUG	1006.11	1005.49	1005.73	1005.01	1005.27	
SEP	1005.23	1005.17	1005.65	1003.81	1005.42	
OCT	1005.17	1005.47	1005.50	1001.91	1001.08	
NOV	1006.24	1006.14	1005.98	1002.11	1000.94	
DEC	1006.43	1006.00	1006.30	1002.23	1001.26	

RESERVOIR LEVEL AT END OF MONTH

MONTH	1988	1989	1990	1991	1992	1993
JAN	1006.06	1005.80	1006.27	1005.76	1005.80	1005.87
FEB	1006.31	1005.03	1006.20	1006.44	1005.51	1005.62
MAR	1005.88	1001.98	1006.36	1004.56	1005.26	1005.52
APR	1006.00	1003.96	1006.27	1005.49	1005.72	1005.57
MAY	1006.18	1005.16		1006.07	1005.30	
JUN	1006.41	1006.41	1006.30	1006.42	1005.55	
JUL	1006.17	1006.31	1006.23	1006.15	1005.47	
AUG	1005.68	1006.26	1005.77	1004.75	1005.52	
SEP	1005.96	1006.13	1005.69	1003.68	1005.55	
OCT		1006.12	1006.23	1002.10	1001.08	
NOV	1006.31	1006.27	1006.16	1002.68	1001.43	
DEC	1006.06	1006.18		1003.41	1003.86	

GITARU HYDRO POWER STATION OPERATION STATISTICS 1988 – 1993

INSTALLED GENERATION CAPACITY 2x72.5MW

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES

NO. III - 1 (1)

ENERGY GENERATED (GWh)

MONTH	1988	1989	1990	1991	1992	1993
JAN	73.72	66.85	63.77	51.58	67.95	66.06
FEB	67.27	59.10	63.22	61.45	63.21	69.83
MAR	56.94	58.14	73.67	68.35	61.39	76.16
APR	63.74	63.01	64.49	66.08	48.50	70.93
MAY	67.77	67.94	69.30	74.32	66.57	
JUN	67.87	65.05	67.54	70.26	71.85	
JUL	59.37	66.62	68.71	75.04	70.32	
AUG	66.26	64.32	70.56	76.21	67.96	
SEP	65.42	58.73	65.32	74.33	67.52	
OCT	69.19	69.95	70.71	72.00	78.37	
NOV	70.93	63.27	67.04	67.90	61.49	
DEC	67.76	47.13	59.27	66.25	59.03	
TOTAL/YR	750.11	750.11	803.60	823.77	784.15	

MAX RESERVOIR LEVEL IN METRES

MONTH	1988	1989	1990	1991	1992	1993
JAN	922.85	924.50	924.50	924.45	924.50	923.95
FEB	923.80	924.40	924.50	924.50	924.30	924.50
MAR	924.10	924.55	924.55	923.70	923.70	924.10
APR	924.40	924.00	924.40	922.75	923.80	924.15
MAY	922.85	924.50	924.50	924.55	923.80	
JUN	923.95	924.50	924.50	924.50	924.40	
JUL	924.45	924.50	924.65	924.50	924.15	
AUG	924.60	924.75	924.40	924.45	923.95	
SEP	924.40	923.95	924.60	924.55	924.05	
OCT	924.50	924.45	924.15	924.30	924.35	
NOV	924.50	924.50	924.50	924.30	923.85	
DEC	924.75	924.50	924.00	924.45	923.00	

MIN RESERVOIR LEVEL IN METRES

MONTH	1988	1989	1990	1991	1992	1993
JAN	920.10	924.00	924.00	922.70	921.70	921.50
FEB	919.45	923.65	923.30	922.70	921.55	923.30
MAR	922.15	922.95	922.55	922.20	921.40	922.85
APR	921.30	922.20	923.60	921.30	921.00	922.75
MAY	921.80	923.95	923.90	921.20	920.70	
JUN	922.35	923.95	923.90	923.95	922.80	
JUL	923.40	924.05	923.80	923.75	922.50	
AUG	923.35	923.03	923.20	923.00	923.35	
SEP	923.35	922.40	923.20	923.40	923.25	
OCT	921.05	923.35	923.15	922.80	922.80	
NOV	921.00	924.00	923.25	922.70	922.55	
DEC	924.05	922.40	923.30	922.40	919.45	

RESERVOIR LEVEL AT END OF MONTH (metres)

MONTH	1988	1989	1990	1991	1992	1993
JAN			*	923.05	921.70	923.75
FEB			*	922.75	923.30	923.45
MAR			*	921.60	921.45	923.25
APR			*	921.20	923.30	922.75
MAY			*	924.10	923.15	
JUN			*	924.05	923.50	
JUL			*	924.10	923.55	
AUG			*	923.55	923.35	
SEP			923.55	923.90	923.35	
OCT			923.85	923.45	923.50	
NOV			924.05	924.10	922.95	
DEC				922.40	922.65	

NOTE Records for water level not kept before September 1990 as storage was considered insignificant

KINDARUMA HYDRO POWER STATION OPERATION STATISTICS FROM 1989 - 1993

INSTALLED GENERATION CAPACITY 2x22MW

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES

NO. III - 1 (1)

ENERGY GENERATED (GWh)

MONTH	1988	1989	1990	1991	1992	1993
JAN	19.25	20.01	19.35	20.09	17.47	16.90
FEB	17.91	14.84	11.34	14.73	15.47	18.18
MAR	15.42	15.90	20.14	17.33	15.56	19.31
APR	16.30	15.98	17.29	17.01	11.89	18.07
MAY	18.25	15.33	17.61	21.06	16.69	
JUN	19.71	19.38	19.88	20.09	17.74	
JUL	18.14	18.70	16.51	21.47	17.89	
AUG	18.16	17.19	12.24	19.39	17.26	
SEP	16.89	15.84	12.46	18.98	14.61	
OCT	17.88	18.91	14.59	18.55	20.23	
NOV	21.08	19.84	15.77	16.47	15.83	
DEC	20.43	19.86	19.17	16.53	15.58	
TOTAL/YR	219.43	211.78	177.00	221.70	196.22	

MAX RESERVOIR LEVEL (METRES)

MONTH	1988	1989	1990	1991	1992	1993
JAN	780.80	781.05	780.60	781.00	780.70	780.20
FEB	781.00	781.20	781.05	781.05	781.10	780.90
MAR	781.05	781.10	781.05	781.00	780.05	780.05
APR	781.30	781.05	781.05	780.90	780.10	780.60
MAY	781.05	781.05	780.95	781.00	779.85	
JUN	781.05	781.05	781.05	781.05	780.60	
JUL	781.10	781.05	781.00	781.05	780.40	
AUG	781.00	781.10	780.75	781.05	780.35	
SEP	781.05	780.95	780.95	780.60	781.10	
OCT	780.25	781.05	781.15	780.60	780.25	
NOV	781.05	781.05	781.10	781.05	780.20	
DEC	781.10	781.05	781.05	781.05	780.25	

MIN RESERVOIR LEVEL (METRES)

MONTH	1988	1989	1990	1991	1992	1993
JAN	778.30	778.70	778.60	775.75	778.30	778.20
FEB	777.80	779.50	DRAINED	778.95	778.35	778.70
MAR	779.50	777.70	777.90	777.70	777.60	778.25
APR	777.85	779.00	778.10	778.20	778.00	777.65
MAY	779.30	779.80	779.00	778.55	777.70	
JUN	778.70	778.80	DRAINED	778.00	777.80	
JUL	778.45	778.80	DRAINED	778.70	778.45	
AUG	777.30	779.60	779.00	778.45	778.70	
SEP	778.45	779.05	778.45	780.20	777.00	
OCT	778.10	779.75	779.25	778.10	777.70	
NOV	779.30	779.05	778.05	778.25	778.65	
DEC	778.75	778.00	778.00	778.15	778.50	

RESERVOIR LEVEL AT END OF MONTH

MONTH	1989	1990	1991	1992	1993
JAN		*	780.10	779.40	779.70
FEB		*	780.55	779.20	779.10
MAR		*	779.00	778.35	779.50
APR		*	779.60	779.75	779.10
MAY		*	779.30	779.05	
JUN		*	779.70	778.90	
JUL		*	780.10	779.15	
AUG		*	779.55	779.60	
SEP		780.05	780.05	780.90	
OCT		780.95	778.75	779.15	
NOV		778.70	779.65	779.50	
DEC			779.50	778.90	

* STORAGE NOT SIGNIFICANT

KIAMBERE HYDRO POWER STATION OPERATION STATISTICS FROM 1988 – 1993

INSTALLED GENERATION CAPACITY 2X72MW

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES

NO. III - 1 (1)

ENERGY GENERATED (GWH)

MONTH	1988	1989	1990	1991	1992	1993
JAN	2.96	66.36	79.05	86.72	77.48	75.31
FEB	15.23	60.89	74.26	79.60	77.46	76.16
MAR	56.64	68.31	82.44	85.02	79.24	83.19
APR	37.85	64.58	76.88	81.72	52.86	80.58
MAY	47.75	68.36	78.47	76.12	42.24	
JUN	45.58	67.42	73.99	75.46	65.71	
JUL	71.68	65.99	79.38	79.19	69.80	
AUG	65.93	69.13	81.67	82.40	74.18	
SEP	63.08	60.93	77.65	80.81	72.74	
OCT	65.49	56.19	80.84	81.44	76.55	
NOV	66.92	67.03	82.28	79.79	78.74	
DEC	64.98	67.03	76.04	73.03	71.45	
TOTAL/YR	604.09	782.24	942.95	961.29	838.44	

MAX RESERVOIR LEVEL (METRES)

MONTH	1988	1989	1990	1991	1992	1993
JAN	700.34	700.51	701.06	700.19	698.40	699.35
FEB	700.37	700.18	700.34	699.61	697.78	699.97
MAR	700.21	699.90	700.69	697.92	696.25	699.63
APR	701.51	700.98	701.17	696.65	694.23	699.39
MAY	700.71	700.80	700.94	700.78	697.92	
JUN	700.54	700.52	700.63	700.79	698.93	
JUL	700.31	700.46	700.28	700.26	699.31	
AUG	699.58	700.13	699.94	700.01	699.45	
SEP	700.07	700.17	699.25	699.80	699.30	
OCT	700.19	700.44	698.91	699.72	699.56	
NOV	700.76	700.87	698.52	699.11	699.88	
DEC	700.75	700.87	700.43	698.45	699.62	

MIN RESERVOIR LEVEL (METRES)

MONTH	1988	1989	1990	1991	1992	1993
JAN	700.23	699.72	700.19	699.60	697.31	697.70
FEB	700.10	699.00	699.25	697.98	696.25	699.35
MAR	699.51	699.36	699.32	696.64	694.09	699.13
APR	700.03	699.50	700.22	695.03	693.75	698.20
MAY	700.23	700.37	700.51	694.20	694.18	
JUN	700.71	700.11	700.12	699.96	697.87	
JUL	699.16	699.68	699.82	699.87	698.88	
AUG	699.21	699.83	699.20	699.73	698.92	
SEP	698.88	699.53	698.17	699.27	698.61	
OCT	699.50	699.82	697.61	699.11	698.63	
NOV	699.31	700.31	697.40	698.52	698.72	
DEC	700.15	700.31	698.46	697.33	698.70	

RESERVOIR LEVEL AT END OF MONTH

MONTH	1989	1990	1991	1992	1993
JAN		700.18	699.60	697.73	699.35
FEB		699.34	697.98	696.25	699.63
MAR		700.40	696.49	694.09	699.27
APR		700.75	695.17	694.19	698.74
MAY			700.78	697.85	
JUN		700.28	700.10	698.93	
JUL		699.87	699.95	699.31	
AUG		699.20	699.79	698.97	
SEP		698.19	699.49	698.62	
OCT		697.65	699.12	699.30	
NOV		698.52	698.52	698.75	
DEC			698.40	698.79	

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. III - 1 (2)

BYELAWS OF THE KENYA POWER AND LIGHTING COMPANY LIMITED

Prescribing the methods of charge and the prices to be paid by Ordinary Consumers for electrical energy consumed by them and providing for the variation of such methods of charge and prices from time to time.

The Kenya Power and Lighting Company Limited with the approval of the Minister has, under the powers conferred by Section 149 of the Electric Power Act, made the following Byelaws:-

PART I

GENERAL

1. The Byelaws may be cited as the Methods of Charge (KPLC) 1991(No.2) Byelaws and shall come into force on 1.1.1992 and apply to all bills raised based on meter readings taken on or after that date.

2. In these Byelaws, unless the context otherwise requires, the following words and expressions shall have the following meanings:-

"Act" shall mean the Electric Power Act (Cap.314) and any Act Or Acts amending or replacing the same.

"Company" shall mean The Kenya Power and Lighting Company Limited.

"Contract" shall mean the agreement made by an ordinary consumer with the Company for a supply of electrical energy, in force on the date of commencement of these Byelaws and shall include any agreement made thereafter in substitution therefor pursuant to the provisions of any Byelaws made by the Company under the provisions of Section 149 of the Act.

"Demand" shall mean the maximum demand drawn by the ordinary consumer in each meter reading period.

"Fixed Charge" shall mean the charge to be made per meter reading period in addition to those charges accruing in respect of units and when applicable, demand supplied.

"Interconnected System" shall mean those works inclusive of power stations, transmission and distribution lines electrically interconnected forming the main supply grid in the Republic.

"Isolated System" shall mean those works of the licensee electrically and physically separate from the interconnected system.

"KVA" shall mean one Kilovolt ampere of demand.

"Licensee" shall mean The Kenya Power and Lighting Company

Limited.

"Meter" shall include kilowatt hour meters, maximum demand indicators, rhythmatic relays, time switches and any other equipment installed by the Company at the consumer's terminals.

"Meter reading period" shall mean the period of time elapsing between any two consecutive readings of the meter and/or maximum demand indicator installed by the Company but with the exception of their first and last period; each such period of time shall be as near to thirty days as possible.

"Power factor" shall mean the decimal fraction obtained by dividing the maximum demand in kilowatts by the maximum demand in kilovolt amperes and shall be ascertained by suitable apparatus installed by the Company.

"The Rules" shall mean the Electric Power Rules and any Rule or Rules amending or replacing the same.

"Unit" shall mean one kilowatt hour (kwh).

Other expressions to which meanings are assigned in the Act have the same meanings in these Byelaws unless the context otherwise requires.

3. Every consumer shall pay for all electrical energy supplied to him by the Company at the price or prices provided for in Byelaw 4 hereof and in accordance with the Methods of Charge determined by the Company or inserted in the contract or according to such method or methods as may from time to time be substituted therefore.

4. The prices to be paid by an ordinary consumer for electrical energy consumed by him shall be calculated in accordance with the provisions of these Byelaws, and shall be those promulgated by the Company from time to time pursuant to the provisions of Section 73 of the Act.

5. (a) In the event of the supply of electrical energy to the installation of any ordinary consumer having a power factor of less than 0.90, then the Company may give to such ordinary consumer thirty days notice in writing (quoting the provision of this Byelaw) requiring him to improve the Power factor of his installation to or in excess of 0.90. If the ordinary consumer fails to comply with such notice as aforesaid, then and in any such case, the Company shall be at liberty until such time as the power factor of such ordinary consumer's installation is, or is in excess of 0.90 to impose a surcharge as follows:-

i) for consumers charged under Methods A and E the payment for electrical energy consumed in each meter reading period (exclusive of Government Tax and Fuel oil cost adjustment) will be increased by 1 per cent for each complete 1 per cent by which the power factor is below 0.90.

ii) for consumers charged under Method B and C - the payment for electrical energy consumed and chargeable KVA of demand in each meter reading period (exclusive of Government Tax and Fuel oil cost adjustment) will be increased by 1 per cent for each complete 1 per cent by which the Power factor is below 0.90.

iii) for consumers charged under Method D - the payment for electrical energy in each meter reading period (exclusive of Government Tax and Fuel oil cost adjustment) will be increased by 2 per cent for each complete 1 per cent by which the Power factor is below 0.90.

(b) Any apparatus installed by the Company for the purpose of ascertaining the power factor of any ordinary consumer's installation or of any part thereof shall be installed and maintained at the sole expense of the Company.

6. (a) All prices for electrical energy specified in Part II of these Byelaws shall be liable but subject to approval by the Minister for Energy and irrespective of the method of generation to a fuel-oil cost adjustment which shall be calculated in accordance with the following:-

Fuel Oil cost adjustment in cents/unit calculated to the nearest one-tenth of one cent

$$= \frac{F}{I-L}\left[\frac{\sum Ci\ Gi\ Si}{G} - e_b\right] \times 100$$

where

Ci - Actual price in Shs/kg paid by the Company for fuel oil at Kipevu, gas turbine fuel at Kipevu, and at Nairobi South, heavy diesel oil at Nairobi South and at different isolated power stations, as the case may be.

Gi - Units generated during the calendar month immediately preceeding each meter reading period at Kipevu thermal station, Nairobi south and Kipevu gas turbines, and all diesel power

stations on the interconnected and isolated systems as the case may be.

Si - Specific fuel consumption in kg/unit generated for thermal, gas turbine and diesel plant namely:

Kipevu thermal power station	0.37kg/unit generated
Gas Turbine Plant	0.38kg/unit generated
Diesel Plant in interconnected system	0.33kg/unit generated
Diesel Plant in isolated system	0.34kg/unit generated

G = Total of all units generated and purchased during the calendar month immediately preceeding each meter reading period, including all hydro stations, isolated stations and import from U.E.B.

e_b = Base fuel cost in Shs/unit generated, incorporated in the per unit charges in [illegible] per unit generated.

L = Units used on works and losses in transmission and distribution = 0.15.

F = Economic factor which shall be unity or such other figure as the Minister may from time to time determine.

(b) The Company shall publish not later than the 13th day of each month a notice in the Kenya Gazette showing the variation if any from the previous month in prices paid by it for fuel as detailed under Ci above. The notice will also show the amount of the fuel oil cost adjustment to be applied to all unit charges as specified in Part II of these Bylaws for all meter reading periods commencing during the month of publication of the said notice. The value of the economic factor F and variation in the amount of fuel oil cost adjustment from the previous month will also be shown.

7. The Company shall determine the pressure at which a supply of electrical energy shall be provided to any ordinary consumer's supply terminals and this pressure shall be maintained by the company subject to the permissible variations as provided for in the Act and/or Rules.

8. Every ordinary consumer shall if required by the Company pay to it in addition to the charges specified in Part II of these Byelaws, a fixed charge at a rate not exceeding shillings 4.25 per KVA per meter reading period of nameplate KVA continuous rating in respect of all electric welding plant, as adjusted by any power factor equipment in use.

PART II

METHODS OF CHARGE FOR ELECTRICAL ENERGY SUPPLIED BY THE LICENSEE

9. The methods of charge to be applied by the Company for supplies of electrical energy from the interconnected system as also from the isolated systems, in each meter reading period shall be as detailed below:-

METHOD A_0 Applicable to ordinary domestic consumers whose consumption does not exceed 7,000 units per meter reading period.

a) a fixed charge of Shs.35.00*

b) i) Cents 77 per unit for the first 50 units consumed.

ii) Cents 143 per unit for the next 50 units consumed.

iii) Cents 175 per unit for the next 200 units consumed.

iv) Cents 225 per unit for all additional units consumed upto 7,000 units.

* If Method A_0 is used in conjunction with Method D_0 at the same supply terminals, then the combined fixed charge for both Methods of Charge will be Shs.70.00

METHOD A_1 Applicable to ordinary small non-domestic consumers whose consumption does not exceed 7,000 units per meter reading period.

a) A fixed charge of Shs.50.00*

b) Cents 205 per unit for all units consumed.

* If Method A_1 is used in conjunction with Method D_0 at the same supply terminals, then the combined fixed charge for both Methods of Charge will be Shs.75.00.

METHOD B Applicable to ordinary consumers whose consumption exceeds 7,000 units but does not exceed 100,000 units per meter reading period.

METHOD B_0 For supplies provided and metered by the Company to the irrigation pumping loads at a pressure of 240 volts single-phase two wire or 415 volts three-phase four-wire:-

a) a fixed charge of Shs.240.00

b) cents 165 per unit consumed.

METHOD B_1 For supplies provided and metered by the Company at a pressure of 240 volts single-phase two wire or 415 volts three-phase four-wire:-

a) A fixed charge of Shs.240.00

b) Cents 167 per unit consumed.

c) Shs.100.00 per KVA of demand.

METHOD B_2 For supplies provided and metered by the Company at a pressure of 11,000 or 33,000 volts:-

a) a fixed charge of Shs.1,500.00

b) Cents 160 per unit consumed

c) Shs.80.00 per KVA of demand

METHOD B_3 For supplies provided and metered by the Company at a pressure of 66,000 or 132,000 volts:-

a) a fixed charge of Shs.7,100.00

b) Cents 155 per unit consumed

c) Shs.70.00 per KVA of demand.

METHOD C Applicable to ordinary consumers whose consumption exceeds 100,000 units per meter reading period.

METHOD C_1 For supplies provided and metered by the Company at a pressure of 415 volts three-phase four wire:-

a) A fixed charge of Shs.240.00

b) Cents 159 per unit consumed

c) Shs. 100.00 per KVA of demand.

METHOD C_2 For supplies provided and metered by the Company at a pressure of 11,000 or 33,000 volts:-

a) A fixed charge of Shs.1,500.00

b) Cents 157 per unit consumed

c) Shs.80.00 per KVA demand

METHOD C_3 For supplies provided and metered by the Company at a pressure of 66,000 or 132,000 volts:-

a) a fixed charge of Shs.7,100.00

b) Cents 151 per unit consumed

c) Shs.70.00 per KVA of demand.

The demand charged will be that recorded during the periods from 08.00 to 22.00 hours on Mondays to Fridays inclusive.

METHOD D_0 Interruptible off-peak supplies of electrical energy to ordinary consumers.

a) a fixed charge of Shs.60.00*

b) Cents 165 per unit consumed.

* If Method D_0 is used in conjunction with Method A_0 at the same supply terminals, then the combined fixed charge for both Methods of Charge will be Shs.70.00.

* If Method D_0 is used in conjunction with Method A_1 at the same supply terminals, then the combined fixed charge for both Methods of Charge will be Shs.75.00.

Note 1 The electrical energy which will be supplied and charged under this method of charge shall be available at all times other than during peak periods which shall be such periods of high demand as may occur during each day not exceeding sixteen hours in the aggregate and during which the supply of electrical energy may be restricted, the time or times of such restriction and the duration thereof being controlled by the Company at its sole discretion.

Note 2 This method of charge is only available for installations so arranged to the Company's satisfaction, that they cannot be operated on any other method of charge and also where there is no duplication of the off-peak circuits by other electrical circuits unrestricted as to time of use so enabling the supply on another method of charge to be used for a similar function.

REPUBLIC OF KENYA

THE ELECTRIC POWER ACT (CHAPTER 314)

Pursuant to section 72 and 149 of The Electric Power Act I hereby approve the Methods of Charge and the Methods of Charge (KPLC) Byelaws attached hereto to come into force on the 1st. April., 1993.

Approved.....

HON. JOHN M. KYALO, M.P.
MINISTER FOR ENERGY

Dated at Nairobi this 22nd day of February., 1993.

Pursuant to the above approval the Methods of Charge (KPLC) 1991(No.2) Byelaws are made this 22nd day of February., 1993.

S. K. GICHURU
MANAGING DIRECTOR
THE KENYA POWER & LIGHTING COMPANY LIMITED

Note 3 The Company will provide and maintain apparatus upto a maximum capacity of 15 amperes, single phase, to control the period of availability of the supply and will take all reasonable steps to ensure the reliability thereof, but shall not be responsible for any loss, damage or injury which may result from any maloperation of this control equipment.

METHOD E Applicable to public and local authorities for supplies of electrical energy for public lamps (Street Lighting).

a) a fixed charge of Shs.130.00 per supply terminal.

b) Cents 205 per unit consumed.

Supplies under this method of charge shall be available for a minimum period of 11 hours per night for public lamps and for no other purpose.

The attention of public and local authorities taking supplies on this tariff is drawn to the fact that where public lamps are fitted on the [illegible], switchwire and associated equipment must be carried out by the Company, and will be charged for on the basis of net costs of materials, labour and transport plus 25%.

PART III

AMENDMENT OR REVOCATION OF BYELAWS

10. The Company shall be at liberty at any time or times to alter the Methods of Charge to be applied in any area of supply by altering or revoking any of the Byelaws hereinbefore contained pursuant to the powers and provisions contained in Section 149 of the Act and by substituting other Byelaws therefor, and every contract shall be deemed to be varied accordingly with effect from the date prescribed by sub-section (5) of section 149 of the Act.

11. The Methods of Charge (KPLC) Byelaws 1991 are hereby revoked with effect from 1st April 1993. 1st April 1993

N O T E

IN ADDITION TO THE ABOVE CHARGES THE CONSUMER SHALL PAY ANY TAXES OR DUTIES IMPOSED FROM TIME TO TIME BY THE GOVERNMENT. AT THE PRESENT VAT IS CHARGED AT 5% OF THE TAXABLE VALUE OF ELECTRICAL ENERGY CONSUMED WITH AN EXEMPTION OF THE FIRST 200 UNITS UNDER DOMESTIC CONSUMPTION.

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES

NO. II - 2 (3)

MERU: SUMMARY OF THE MAIN DATA FROM EVAPORATION STATIONS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
Number: 90.37.160 (108) MARIMANTI METEOROLOGICAL STATION 1965-1989													
Mean	179.4	189.3	217.3	179.5	172.3	172.6	186.7	210.6	245.6	252.5	170.0	151.4	2327.2
% of Annual	8	8	9	8	7	7	8	9	11	11	7	7	100
No. of Obs.	23	24	24	23	25	24	25	24	22	22	21	21	
Maximum	241.6	249.4	261.4	248.9	258.3	249.4	221.0	240.5	302.5	327.4	203.5	176.0	
Minimum	120.4	103.9	135.4	132.1	132.3	130.3	149.9	170.4	168.1	187.2	143.5	119.9	
Std. Dev.	31.2	37.4	36.5	33.0	30.8	25.9	20.8	20.2	29.7	34.2	17.7	15.5	
Var. Coeff.	0.17	0.20	0.17	0.18	0.18	0.15	0.11	0.10	0.12	0.14	0.10	0.10	
Number: 165 MAUA POLICE STATION 1988-1989													
Mean	100.0	99.0	116.0	95.5	106.5	102.0	90.5	117.0	114.0	128.0	90.0	94.0	1252.5
% of Annual	8	8	9	8	9	8	7	9	9	10	7	8	100
No. of Obs.	1	1	1	2	2	2	2	1	2	1	1	1	
Maximum	100.0	99.0	116.0	96.0	109.0	103.0	92.0	117.0	122.0	128.0	90.0	94.0	
Minimum	100.0	99.0	116.0	95.0	104.0	101.0	89.0	117.0	106.0	128.0	90.0	94.0	
Std. Dev.	0.0	0.0	0.0	0.5	2.5	1.0	1.5	0.0	8.0	0.0	0.0	0.0	0.0
Var. Coeff.	0.0	0.0	0.0	0.3	6.3	1.0	2.3	0.0	64.0	0.0	0.0	0.0	0.0
Number: 43 MERU WATER SUPPLY 1952-1976													
Mean	124.1	130.6	141.4	122.5	121.3	104.9	100.6	106.3	137.5	150.6	111.9	109.6	1461.2
% of Annual	8	9	10	8	8	7	7	7	9	10	8	7	100
No. of Obs.	22	23	23	22	22	21	22	22	23	24	21	23	
Maximum	169.4	187.5	185.2	162.3	252.2	205.5	138.2	138.4	169.7	207.5	221.7	141.7	
Minimum	95.3	94.5	99.8	82.8	79.8	73.4	57.9	75.9	103.9	120.9	68.6	86.1	
Std. Dev.	16.6	19.7	18.3	20.7	37.3	28.1	20.8	15.2	16.6	19.3	30.0	15.3	
Var. Coeff.	0.13	0.15	0.13	0.17	0.31	0.27	0.21	0.14	0.12	0.13	0.27	0.14	
Number: 5 TANA GRAND FALLS 1948-1964													
Mean	197.4	219.6	232.4	183.5	203.9	212.2	221.1	238.8	250.1	252.5	188.0	159.6	2559.1
% of Annual	8	9	9	7	8	8	9	9	10	10	7	6	100
No. of Obs.	12	13	14	14	14	16	15	15	15	14	13	13	
Maximum	297.7	293.1	311.2	236.0	296.2	309.9	269.2	305.8	298.2	316.2	272.8	244.3	
Minimum	112.3	165.1	152.1	114.6	133.4	150.9	172.2	167.1	165.6	171.5	129.0	121.2	
Std. Dev.	59.2	36.3	48.1	31.7	44.2	46.3	32.3	38.4	42.0	41.4	39.3	34.6	
Var. Coeff.	0.30	0.17	0.21	0.17	0.22	0.22	0.15	0.16	0.17	0.16	0.21	0.22	

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES

NO. II - 2 (3)

MERU: SUMMARY OF THE MAIN DATA FROM RAINFALL STATIONS

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	No. of Raindays
Number: 90.37.034 CHUKA CHIEF'S OFFICE													1939-1985	
Mean	49.3	38.8	127.8	384.9	166.8	18.2	28.6	26.5	27.4	201.9	328.7	116.0	1515.0	98
% of Annual	3	3	8	25	11	1	2	2	2	13	22	8	100	
No. of Obs.	40	43	43	43	42	42	43	43	42	42	42	41		33
Maximum	343.6	257.2	324.7	661.3	412.2	63.0	286.8	99.3	160.4	937.0	938.5	319.0	2793.7	
Minimum	0.0	0.0	4.3	29.0	12.2	0.0	0.0	0.0	0.0	10.0	79.5	11.9	702.6	
Std. Dev.	63.9	54.4	96.6	149.1	100.9	17.7	46.9	24.2	33.3	175.7	152.4	77.4	432.8	
Var. Coeff.	1.29	1.40	0.76	0.39	0.61	0.97	1.64	0.91	1.21	0.87	0.46	0.67	0.29	
Number: 90.37.102 MARIMBA LIVESTOCK FARM													1949-1985	
Mean	75.5	76.2	181.8	438.8	232.3	19.1	15.1	22.1	37.7	342.8	463.1	202.5	2107.0	115
% of Annual	4	4	9	21	11	1	1	1	2	16	22	10	100	
No. of Obs.	37	37	37	37	37	37	37	37	37	37	37	37		31
Maximum	356.3	366.7	565.7	707.1	603.3	81.5	113.5	108.6	145.8	1448	958.9	573.7	3896.9	
Minimum	0.0	0.0	11.5	161.1	36.8	0.0	0.0	0.0	0.0	11.7	201.7	30.7	1168.9	
Std. Dev.	72.9	81.0	154.2	144.8	121.7	19.6	20.7	19.0	34.8	237.1	167.8	133.2	546.2	
Var. Coeff.	0.97	1.06	0.85	0.33	0.52	1.03	1.37	0.86	0.92	0.69	0.36	0.66	0.26	
Number: 90.38.006 THARAKA DISPENSARY-KITUI													1952-1986	
Mean	30.5	18.7	70.7	202.6	53.8	3.6	0.0	3.1	4.5	55.3	187.4	82.4	712.7	33
% of Annual	4	3	10	28	8	1	0	0	1	8	26	12	100	
No. of Obs.	34	35	34	35	35	35	35	34	34	35	33	34		23
Maximum	173.1	197.2	358.2	1107	276.9	46.4	1.3	52.8	80.4	351.3	1008	354.3	2538.7	
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	218.8	
Std. Dev.	47.6	39.4	87.8	182.2	64.9	9.4	0.2	10.6	15.8	73.9	187.8	77.6	461.5	
Var. Coeff.	1.56	2.10	1.24	0.90	1.21	2.60	5.83	3.45	3.51	1.34	1.00	0.94	0.65	

STATION NAME MARIMA[illegible]

LATITUDE 00° 09'S LONGITUDE 37° 5' E

STATION NUMBER ALTITUDE 1925 FEET 587 METRES

MONTH	ATMOSPHERIC PRESSURE		TEMPERATURE (1971 - 80)									RELATIVE HUMIDITY			RAINFALL (1971 - 80)			
			MEANS			EXTREMES		DRY BULB		DEW POINT								
	0600 GMT	1200 GMT	MAX.	MIN.	RANGE	HIGHEST	LOWEST	0600 GMT	1200 GMT	0600 GMT	1200 GMT	0300 GMT	0600 GMT	1200 GMT	MEAN	HIGHEST	LOWEST	MAX. 24 HOUR FALL
	mb.	mb.	°C	°C	°C	°C	°C	°C	°C	°C	°C	%	%	%	mm	mm	mm	mm
January			31.9	18.4	13.5	36.9	13.9	24.9	31.0	19.3	20.9		75	52	50	165	0	118.2
February			33.8	19.8	14.0	37.4	12.6	25.0	32.7	19.3	20.0		72	49	21	75	1	33.4
March			34.6	20.9	13.7	38.2	17.0	25.8	33.4	19.7	19.2		71	46	68	185	8	87.6
April			33.1	21.4	11.7	37.8	17.4	25.6	31.9	20.8	21.9		75	59	272	381	10	117.1
May			32.2	20.8	11.4	39.5	17.0	25.0	30.8	19.8	20.7		74	54	112	215	2	129.2
June			31.7	19.2	12.5	35.6	14.5	24.5	30.9	17.5	18.5		64	46	7	26	0	24.5
July			31.0	19.4	11.6	35.5	14.5	23.7	29.9	16.3	17.0		64	44	4	9	1	7.4
August			31.3	19.5	11.8	35.2	15.5	23.9	30.2	15.4	16.3		60	40	4	7	1	5.1
September			33.2	20.0	13.2	36.6	14.6	25.1	32.1	16.2	17.3		57	41	11	21	1	21.0
October			34.2	21.1	13.1	36.9	17.2	25.7	32.9	18.2	18.4		64	42	70	244	6	122.4
November			30.0	20.3	9.7	36.6	16.4	24.4	29.9	20.8	21.5		81	59	223	425	13	91.3
December			30.9	18.9	12.0	35.1	14.1	24.1	29.9	20.3	21.7		80	61	5	151	3	110.3
Year			32.3	20.0	12.3	39.5	12.6	24.8	31.3	18.7	19.5		70	49	847	1201	545	129.2

MONTH	NUMBER OF DAYS OF		DAILY SUNSHINE			DAILY RADIATION (1971 - 80) INSTRUMENT 'GB'			MONTHLY EVAPORATION (1971 - 80) PAN TYPE 'A'			CLOUD AMOUNT				DAILY WIND RUN 1971-80	WIND SPEED		CALMS		VISIBILITY			
												TOTAL		LOW							FOG		MIST, HAZE	
	RAIN	THUNDER	MEAN	MAX. MEAN	MIN. MEAN	MEAN	MAX. MEAN	MIN. MEAN	MEAN	HIGHEST	LOWEST	0600 GMT	1200 GMT	0600 GMT	1200 GMT		0600 GMT	1200 GMT	0600 GMT	1200 GMT	0600 GMT	1200 GMT	0600 GMT	1200 GMT
	≥1mm	days	hours	hours	hours	langleys	langleys	langleys	mm	mm	mm	oktas	oktas	oktas	oktas	miles	knots	knots	days	days	days	days	days	days
January	4					462	533	414	159	200	122					53.3								
February	3					481	548	421	177	212	100					68.0								
March	4					487	532	439	225	276	162					69.8								
April	12					498	544	464	181	239	125					55.5								
May	6					479	522	455	166	192	142					56.4								
June	2					409	449	374	168	211	144					67.1								
July	2					365	404	317	180	211	148					84.9								
August	1					393	480	337	208	249	171					100.6								
September	1					450	482	417	242	280	206					111.3								
October	4					477	509	433	254	320	195					103.1								
November	12					469	528	431	173	207	139					55.0								
December	6					455	507	417	154	176	124					50.8								
Year	57					452	481	426	2287	2561	1795					73.0								

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES NO. II - 2 (3)

STATION NAME MERKA [illegible] STATION

STATION NUMBER [illegible]

LATITUDE 0° 05'N LONGITUDE 37° 39'E

ALTITUDE 5100 FEET 1552 METRES

MONTH	ATMOSPHERIC PRESSURE (1975 - 80)		TEMPERATURE (1975 - 80)									RELATIVE HUMIDITY (1975 - 80)			RAINFALL (1975 - 80)			
			MEANS			EXTREMES		DRY BULB		DEW POINT								
	0600 GMT	1200 GMT	MAX.	MIN.	RANGE	HIGHEST	LOWEST	0600 GMT	1200 GMT	0600 GMT	1200 GMT	0300 GMT	0600 GMT	1200 GMT	MEAN	HIGHEST	LOWEST	MAX. 24 HOUR FALL
	mb.	mb.	°C	°C	°C	°C	°C	°C	°C	°C	°C	%	%	%	mm	mm	mm	mm
January			23.4	11.4	12.0	26.0	6.4	18.3	22.1	14.4	14.3	92	79	67	80	263	11	75.6
February			24.7	11.9	12.8	28.3	6.9	18.7	23.8	14.8	14.7	91	78	50	39	75	0	28.7
March			25.7	13.0	12.7	29.8	9.2	19.4	24.6	15.1	14.3	91	78	55	126	526	5	91.3
April			24.1	14.3	9.8	28.6	10.6	19.3	23.1	16.0	16.2	95	81	67	282	481	122	102.2
May			22.8	13.7	9.1	25.5	8.9	18.5	22.0	15.4	16.4	95	83	71	86	133	19	54.4
June			22.1	12.0	10.1	25.2	7.0	16.9	21.5	13.4	14.1	94	81	63	5	3	0	6.3
July			21.5	11.9	9.6	24.6	7.5	15.7	20.6	12.7	12.4	95	84	61	10	7	1	7.5
August			22.1	12.0	10.1	26.2	8.5	15.5	21.1	12.3	11.9	93	83	56	8	12	5	6.1
September			24.4	12.3	12.1	28.7	7.8	16.8	23.7	12.9	11.8	93	78	49	16	28	2	19.9
October			25.1	13.5	11.6	30.0	9.0	18.1	24.2	14.3	11.9	93	79	49	140	241	79	105.5
November			22.8	13.1	9.7	25.7	9.2	18.4	21.6	15.2	15.5	96	83	71	328	607	158	93.0
December			22.7	12.0	10.7	25.7	8.0	18.4	21.6	15.1	16.1	95	81	73	139	259	23	90.1
Year			23.4	12.6	10.8	30.0	6.4	17.8	22.5	14.3	14.1	94	81	61	1259	1905	870	105.5

MONTH	NUMBER OF DAYS OF		DAILY SUNSHINE 1975 - 80			DAILY RADIATION (1977 - 79) INSTRUMENT [illegible]			MONTHLY EVAPORATION (1976-77, 79-80) PAN TYPE 'A'			CLOUD AMOUNT (1975-80)				DAILY WIND RUN 1975-80	WIND SPEED 1975-80		CALMS 1975-80		VISIBILITY (1975-80)			
												TOTAL		LOW							FOG		MIST, HAZE	
	RAIN	THUNDER	MEAN	MAX. MEAN	MIN. MEAN	MEAN	MAX. MEAN	MIN. MEAN	MEAN	HIGHEST	LOWEST	0600 GMT	1200 GMT	0600 GMT	1200 GMT		0600 GMT	1200 GMT	0600 GMT	1200 GMT	0600 GMT	1200 GMT	0600 GMT	1200 GMT
	≥1mm	days	hours	hours	hours	langleys	langleys	langleys	mm	mm	mm	oktas	oktas	oktas	oktas	miles	knots	knots	days	days	days	days	days	days
January	7	6	8.1	9.7	5.8	379	400	357	120	137	97	5.7	5.8	3.8	4.7	66.8	5	8	1	0	3	1	0	0
February	6	7	8.6	10.1	7.1	432	452	410	129	149	104	5.5	5.8	4.2	4.7	67.7	5	8	2	0	2	1	0	0
March	8	8	8.3	9.2	5.5	429	481	375	157	178	144	6.0	6.3	4.5	5.2	63.5	5	8	1	1	3	1	0	0
April	17	11	7.5	9.1	6.4	384	415	360	134	150	119	6.5	6.7	4.0	5.5	53.6	6	8	2	0	3	0	0	0
May	10	5	8.1	9.2	7.1	382	397	369	117	127	111	5.8	6.2	4.3	5.5	62.9	7	9	1	0	7	2	0	0
June	3	1	7.5	9.4	6.5	365	380	342	115	131	103	5.8	5.8	4.8	4.7	58.1	7	10	1	0	5	1	0	0
July	3	2	6.1	7.6	5.6	315	348	294	115	137	93	6.5	6.5	5.2	5.2	62.1	7	11	1	0	8	1	0	2
August	3	1	6.5	8.3	5.1	366	405	328	133	157	110	6.5	6.2	5.5	4.5	75.2	7	10	0	0	7	2	0	1
September	4	3	7.7	8.7	6.8	431	443	417	148	173	134	5.7	4.8	5.3	3.7	82.7	7	11	0	0	4	1	0	1
October	9	2	7.9	8.8	5.9	426	451	392	170	187	146	6.0	5.6	4.6	4.4	75.3	7	9	1	0	4	0	0	0
November	17	8	6.4	8.0	4.7	361	385	314	110	131	84	6.3	6.6	4.6	5.4	50.9	5	7	1	1	3	0	0	0
December	12	7	7.0	8.9	4.7	335	342	327	111	122	95	5.3	6.3	4.1	5.4	50.8	5	7	3	1	3	1	0	0
Year	99	61	7.5	8.3	6.4	384	404	366	1559	1719	1449	6.0	6.1	4.6	4.9	64.1	6	9	14	3	52	11	0	4

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. II - 2 (3)

STATUS OF GRAND FALLS, MUTONGA AND KATHITA RIVER GAUGING STATIONS

Grand Falls (4F13)

This was established in 1963 to replace station No.4F1 (upstream) which operated from 1948-1962.

Water level observations are said to be continuing although the available records are upto July 1992.

The station has no existing water level recorder since 1985. The previous recorder suffered from frequent malfunctioning and siltation of the intake pipes/stilling well.

Flow measurements were carried out upto 1981 using a cableway/cablecar. The cableway/car is in very poor state and requires replacement with new equipment.

The 15km or so access track to this station is in very bad condition and require rehabilitation and maintenance for effective operation of the station.

Mutonga (4EA7)

The station was established in 1966 to replace station No. 4EA5 (upstream) which operated from 1956-1963.

Water level observations are said to be continuing although records in the file are upto May 1992.

A new Seba water level recorder was installed by TARDA in 1992 to replace the previous recorder which was not functioning well since 1986.

Flow measurements were done by boat and only upto 1.01m river stage. Gauging by boat at higher stages is said to be very risky due to the presence of rapids in the river.

Lack of flood and silt records is said to be mainly due to lack of infrastructure and equipment e.g

- nearby bridge
- bridge crane
- cableway
- sediment sampler

and transport and also due to budgetary constraints.

Kathita (4F19)

This station was established in 1966 to replace station No.4F2 (upstream) which operated from 1948-1960

Water level observations are said to be continuing although records are upto July 1992.

There is no existing water level recorder at this station since 1985. The previous recorder was damaged by vandals.

Flow measurements are done by either wading (upto 0.90m river stage) or by boat upto 1.50m.

Like Mutonga, flood and silt records have not been carried out due to lack of infrastructure and equipment e.g

- nearby bridge
- bridge crane
- cableway
- sediment sampler

and transport and also due to budgetary constraints.

AVAILABLE RECORDS

Tana Grand Falls

Gauging Station No.4F1 (Manual Station)

Water levels:	1948 - 1961
Flow measurements:	1948 - 1962 (45No)
Silt records:	1948 - 1956 (338 No)

Gauging Station No.4F13 (Recorder Station)

Water levels:	(a) Manual: 1963 - July 1992
	(b) Recorder: 1966 - March 1985
Flow measurements:	1962 - 1981 (96No)
Silt records:	May 1964 (4No)
	1979 - 1981 (9No)

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. II - 2 (3)

Mutonga River

Gauging Station No.4EA5 (Manual Station)

Water levels:	1956 - 1962
Flow measurements:	1957 - 1963 (10No)
Silt records:	None

Gauging Station No.4EA7 (Recorder Station)

Water levels:	(a) Manual: 1966 - May 1992 (b) Recorder:1966 - July 1986
Flow measurements:	1966 - 1967 (11 No) 1977 (2 No) 1979 - 1981 (11 No) 1992 (1 No)
Silt records:	1979 - 1981 (6 No)

Kathita River

Gauging Station No. 4F2 (Manual Station)

Water levels:	1948 - 1960
Flow measurements:	1946 - 1960 (24No)
Silt records:	1948 - 1958 (31 No)

Gauging Station No.4F19 (Recorder Station)

Water levels	(a) Manual: 1966 - July 1992 (b) Recorder: 1966 - March 1985
Flow measurements:	1966 - 1990(98 No)
Silt records:	1979 - 1982(25 No)

ATTACHED DATA OF ANSWERS TO QUESTIONNAIRES NO. III - 2 (7)

1. GROUND SURVEY AND MAPPING

MAP SCALE	CONTOUR INTERVAL (m)	AREA HECTARE	RATE PER HECTARE KSH.
1:10,000	5.00	37150.00	57.00
1:10,000	1.00	22000.00	85.00
1:2,500	2.00	12850.00	115.00

2. SEISIMIC WORK

FIELD WORK, PROVISION OF SEISIMIC EXPLOSIVES AND GEOPHYSICAL TEAM FOR 25 DAYS @ KSH 46,500 PER DAY

3. DRILLING (PER M)

a) SOIL DRILLING AND SAMPLING (up to 5m) @ KSh 7,704

b) CORE DRILLING:

Depth (m)	Rate in KSh
50–75	4264.00
75–100	4555.00
100–150	4651.00
150–200	4938.00
200–250	5034.00
250–300	5274.00

4. PERMEABILITY TEST BORE HOLE
@ Ksh 4,810

5. TEST PITTING:
a) In class 1 material
@ KSh 1,341

b) In soft material

Depth (m)	Rate in KSh
0–1	3641.00
1–2	4547.00
2–3.5	5451.00

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. III - 2 (8)

SECTION 3 PART 2

GENERAL REQUIREMENTS

CONTRACTUAL REQUIREMENTS

2.1 STANDARDS

Unless another standard is specifically mentioned in this Specification, all materials used and provided under this contract, and all design calculations and tests, must be in accordance with the Regulations issued under the relevant local statutory authorities and, where not covered by such Regulations must be in accordance with the latest amendments of the Standards of the International Electrotechnical Commission or British Standards where specified and in particular the standards listed in each section.

Supplier's who do not normally manufacture to IEC or BSI Standards may offer equipment in accordance with other recognised National Standards provided that they draw attention to any essential differences between their Standards and IEC/BSI Standards, and subject to the satisfaction of the Employer that the quality, finish and performance of the equipment complying with such standards shall be comparable to that complying with IEC or BS.

For pressure vessels, design shall comply with the appropriate British Standard Specification and also to accord with the Regulations issued under the relevant local statutory authorities.

2.2 COMPLIANCE WITH SPECIFICATION

Notwithstanding any descriptions, drawings or illustrations which may have been submitted with the Tender, all details other than those shown on the Schedule of Departures will be deemed to be in accordance with the Specification and the standard specifications and codes referred to therein.

No departures from the Specification except those shown on the Schedule of Departures and approved by the Employer, shall be made without the written approval of the Engineer.

2.3 GENERAL DESIGN OF EQUIPMENT

In complying with the requirements of the Specification, design shall conform to the best current engineering practice. Each component part of the Plant shall be to the maker's standard design provided that this design is in general accordance with the Specification.

The essence of design should be simplicity and reliability in order to give long continuous service with high economy and low maintenance costs. Particular attention should be paid to internal and external access in order to facilitate inspection, cleaning and maintenance.

omissions discovered. If any further information is required, the date by which it is requested shall be demonstrably reasonable.

Any drawings initially issued by the Engineer with a suffix P1, P2, etc. are preliminary and merely for the Contractor's information to indicate the Engineer's current approach to the particular item or problem. They are for initial planning purposes but do not form part of the Contract. Proposal sketches may be issued from time to time and will be designated as such. Unless otherwise instructed they will similarly be for information, comment and discussion only.

Drawings issued with Revision 0 and with a signature in the appropriate block are the first issue of a working drawing and form part of the Contract, together with subsequent revisions which will be numbered 1, 2, etc. Each working drawing shall be deemed to be an instruction in writing to carry out the work shown on that drawing.

References to drawings within the specification, unless noted otherwise, relate to the working drawings.

1.4.4.3 Details Relevant To Electro-Mechanical Plant

Any details which are shown for electro-mechanical Plant foundations etc. in the Tender Drawings are only indicative of their nature and will vary depending on the selection of the electro-mechanical Plant Contractors and their requirements for this particular installation. Some working drawings and details for works closely related to the mechanical and electrical Plant will, therefore, not be finalised until some time after the award of the Plant Contracts and subsequent receipt of details of the equipment to be installed by the Plant Contractors. It is, therefore, to be expected that these matters will be discussed in some detail for each work heading at the time when the first detailed programme, as required by the Conditions of Contract, is produced by the Contractor for this Contract.

1.4.5 Amendments and Additions To Specification

At any time during the progress of the Contract, the Engineer may revise or amend any part of the Specification by notice in writing to the Contractor and substitute another to suit a particular need. The Engineer may issue additional specifications for items of work not covered by the clauses of this Specification. All such revisions, amendments and additions to the Specification shall be deemed to be incorporated in the Contract from the date of receipt by the Contractor.

1.4.6 Standards

Where the Specification refers to British Standards (BS) or British Codes of Practice (CP) to indicate the standard of work required, goods and procedures meeting other authoritative standards, which the Engineer agrees will ensure an equal or higher quality than the British Standards, may also be accepted. At the time of tender, tenderers must indicate any proposals which they may have in this respect in the relevant Schedule provided.

For the purposes of tendering, the latest version of the relevant standard applicable at the start of the Tender Period shall apply.

ATTACHED DATA OF ANSWERS
TO QUESTIONNAIRES
NO. III - 2 (8)

SECTION ONE

FIRE DETECTION AND ALARMS

1. GENERAL CONSIDERATIONS

1.1 Introduction

A manual and automatic fire detection and alarm system shall be provided, with detection devices selected to suit particular risks, and with control and indication systems designed to provide operational and fire brigade staff with sufficient information to identify and respond correctly to any fire detected.

1.2 Design Standards and Codes

Unless otherwise indicated elsewhere in this specification the fire alarm facilities shall comply with the following standards:

British Standards (BS)
National Fire Protection Association (NFPA)
Other internationally recognised standards, subject to approval by the Engineer

Standards relevant to specific systems are stipulated in the following sections.

Equipment may be proposed in accordance with other relevant published standards: copies of these standards must be submitted for approval by the Engineer at time of tender.

1.3 Designation of Fire Safety Equipment

Every principal item of fire safety equipment shall be marked by means of an embossed metal label not less than 150 mm x 100 mm, showing white or light coloured characters on a red background, displaying the following information:-

(a) The words "Fire Safety Equipment" in English.

(b) The words "Fire Safety Zone" in English followed by the zone number.

(c) An alpha-numeric code denoting the type of equipment.

(d) A serial number associated with a register of fire safety equipment.

1.4 Environmental Considerations

All equipment, materials and installation shall be suitable for the environmental conditions of the site.

H_2S likely to be present around the site in concentrations of some 5-10ppm. Concentrations above 0.3 ppm are unacceptable for exposed copper conductors, and concentrations down to 0.1 ppm have adverse effect on silver-plated connectors and