

LAKE BASIN



DEVELOPMENT

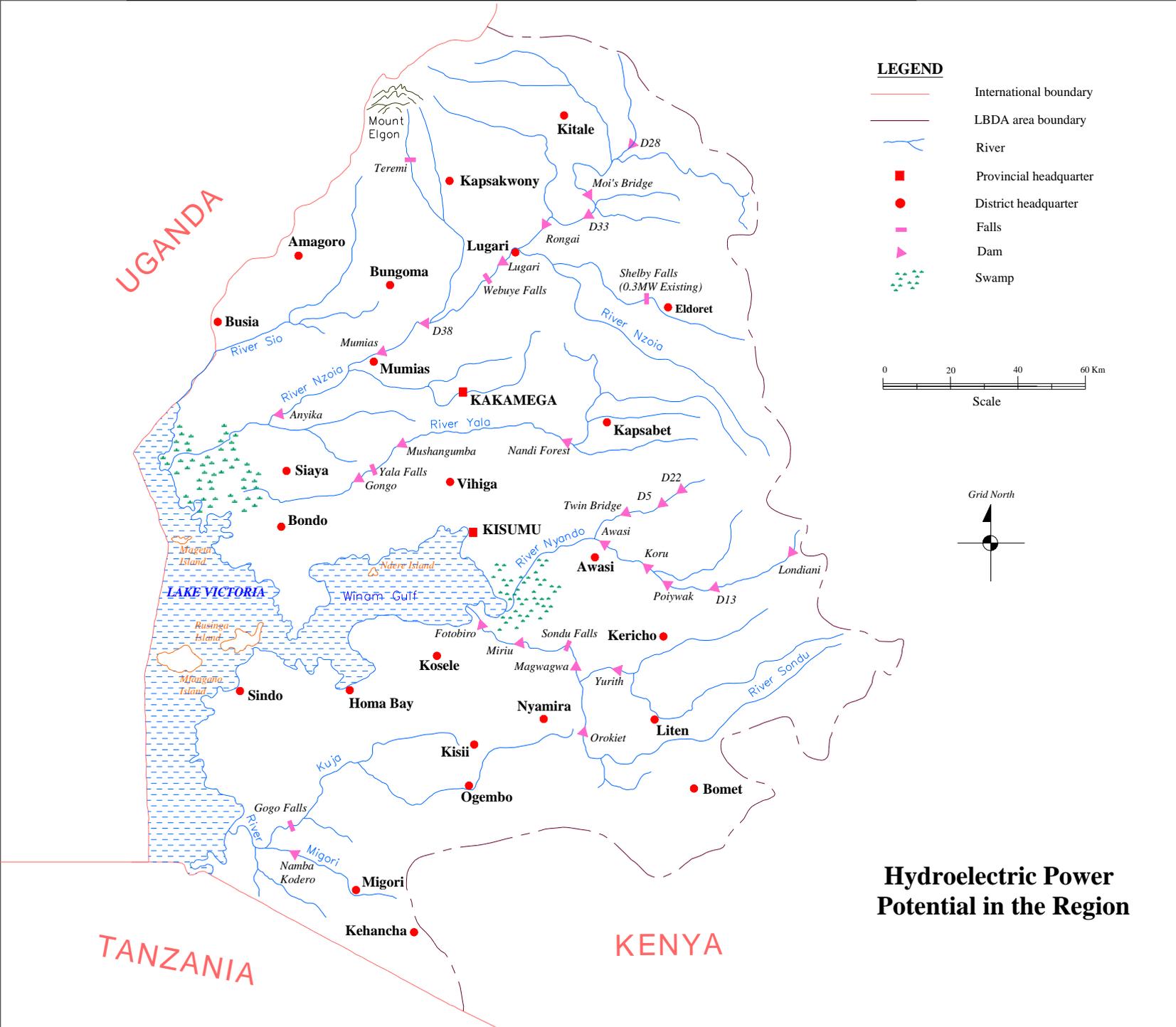
AUTHORITY

**PROPOSAL FOR A  
FEASIBILITY STUDY ON  
KUJA RIVER  
MULTIPURPOSE PROJECT**

**JUNE 2008**

**P.O. BOX 1516-40100  
KISUMU  
KENYA**

**TEL+254-057-2027227  
FAX+254-057-2027228  
Email-[lakebasin@swiftkisumu.com](mailto:lakebasin@swiftkisumu.com)**



## **PROJECT SUMMARY**

<b>COUNTRY:</b>	Republic of Kenya
<b>PROJECT TITLE:</b>	Feasibility Study and Implementation of Kuja River Multipurpose Project
<b>PROJECT LOCATION:</b>	Western Kenya in Migori District, Karungu Division
<b>EXECUTING AGENCY:</b>	Ministry of Regional Development Authorities
<b>IMPLEMENTING AGENCY:</b>	Lake Basin Development Authority
<b>PROJECT DESCRIPTION:</b>	Full feasibility study for both hydropower generation and irrigation infrastructure to produce proposals for the construction of a hydropower dam and power station including tender documents to generate up to 18 MW of electric power; and proposals for the establishment of irrigation infrastructure with a command area of up to 20,000 ha. These will include the necessary socio-economic infrastructure e.g. roads, schools, health centers, etc, to open up the area for development
<b>STAKEHOLDERS:</b>	LBDA, Local Communities along the lower Kuja River and Karungu Division, Ministries of Agriculture, Energy, Natural Resources, Water, Public Works, KenGen, and County Council of Migori District
<b>FUNDING AGENCIES:</b>	Development Partner/GoK/Local Community
<b>IMPLEMENTATION PERIOD:</b>	2 Years Feasibility Study 6 Years Hydropower Project Implementation 10 years Irrigation Project Implementation 4 Years project hand over period
<b>TOTAL COST:</b>	Kshs 254,360,000 (US\$ 4,102,580) - feasibility Study Kshs 3,100,000,000 (US\$50,000,000) - Hydropower Kshs 9,235,800,000 (US\$ 148,964,500) - Irrigation  (Kshs 62 = 1 US\$)

<b>Title</b>	<b>Kuja River Development Programme.</b>			
<b>Overall Goal</b>	<b>Poverty Alleviation</b>			
<b>Specific Objectives</b>	<ul style="list-style-type: none"> <li>• Energy for industrial Development</li> <li>• Water Supply for domestic and Animals</li> <li>• Environmental conservation</li> <li>• Irrigation development</li> </ul>			
<b>Expected Outputs</b>	18 MW Hydropower Catchment Conservation Water supply to Environs 20,000 ha Irrigated Land			
<b>Geographical Coverage</b>	<b>Karungu Division in Migori District in Nyanza province.</b>			
<b>Budget</b>	Kshs 254,360,000 (US\$ 4,102,580) - Study Kshs 3,100,000,000 (US\$ 50,000,000) - Hydropower Kshs 9,235,800,000 (US\$ 149,000,000) - Irrigation			
<b>Implementation period/Schedule</b>	Two Years study 6 Years Hydropower Project Implementation 10 years Irrigation Project Implementation 4 Years project hand over period			
<b>Source of Financing</b>	GOK Donor (Multilateral)			
<b>Project Sustainability</b>	<b>Hydropower, Water supply and Agricultural Produce.</b>			
<b>Key Assumptions</b>	Funds availability Participation from the stakeholders Good will from GOK and donors			
<b>Conclusions</b>	Creating employment opportunities in the rural areas; Stimulating Rural development in the region. Providing adequate and reliable water for domestic, agricultural & industrial use.			

## **1.0 INTRODUCTION:**

An Act of Parliament Cap 442 of 1979 established the Lake Basin Development Authority (LBDA). The prime objective of the LBDA is to plan, coordinate and implement development projects and programmes on the Kenyan side of the Lake Victoria Basin. This includes promotion of regional economic activities and mobilization of domestic resources for equitable development.

The Lake Basin region is situated between latitudes 1°16'N and 1°54' S and longitudes 33°55'E and 35°51'E. It covers an area of approximately 39,240sq km, which is about 6.9% of the total land area of Kenya. Its climate is mild with small variations in monthly average temperature between 19°C and 25°C throughout the year. Daily temperatures fluctuate more widely, ranging from 15°C to 30°C. Rainfall in this region has an annual average of about 1300mm varying from 2000mm in the highlands to 1000mm in the north, southwest and lowlands along the lakeshore. Rainfalls exhibit a bimodal pattern with long and short rainy seasons in the period of March to June and September to November respectively.

About 11.2 million people occupy the Lake Basin region, which is about 40% of the country's total population (1999 population census). The region consists of Nyanza and Western Provinces and some parts of the Rift Valley Province. Certain areas in the region are among the most densely populated in the country. This has led to an economic pressure being exerted on the high and medium potential lands in the region.

Six major rivers and many small ones, most of which are seasonal drain the basin into Lake Victoria. The Major Rivers are Sio, Nzoia, Yala, Nyando, Sondu and Kuja. The Kuja River Multipurpose Project is proposed on the Kuja River.

## **2.0 PROBLEM STATEMENT**

Although the LBDA region is endowed with rich water resources, abundance land and readily available labour, the region however suffers from poor and unreliable rainfall distribution and flood hazards, which alternate unpredictably so that stable food production cannot be realized without the use of irrigation and drainage

The region has continued to suffer from inadequate power supply, which would otherwise promote accelerated industrial development especially in the rural areas. Kenya's current electricity generation capacity is inadequate, with demand regularly exceeding supply during peak periods. This normally leads to rationing. From September 1998 to early 2001, the country went through severe power rationing due to a prolonged drought, which negatively affected the performance of the economy. Electricity demand has been growing at an average of 6% per annum. This reflects the requirements for developing other power services to deliver adequate supplies to the large urban centres, fast growing towns and small urban centres in rural areas. The rural electrification programme is an important element of the regional development policy, as it will stimulate industrial and agricultural development as well as to promote general welfare in the rural areas.

### **3.0 BACKGROUND INFORMATION**

#### **3.1 The agricultural sector**

The agricultural sector dominance in the economy has remained strong as reflected by its share in the national economy, job creation, food security, and linkages with other sectors including in industrial development. In 2006, the sector directly contributed 23.6.0% to the Gross Domestic Product (GDP); slightly lower than a high of 25.2% recorded in 2003; attributed to a gradual shift in the country's economic mix towards other sectors including services and manufacturing. This is the scenario envisaged where focus shifts towards commercialization of agriculture as expected in a modernizing economy.

A further 27% of GDP is realized through linkages with manufacturing, distribution and other service related sectors. Moreover, it is estimated that 45% of government revenue is derived from agriculture, while the sector contributes over 75% of industrial raw materials and 60.0% of the export earnings apart from being the largest employer in the economy, accounting for over 60% of the total employment.

In the past five years, the Government has embraced broad-based growth and development strategies in the agricultural sector to address food security and hunger, unemployment, poverty and enhance national equity through the Economic Recovery Strategy for Wealth and Employment Creation (ERS 2003-2007). Accordingly the sector recovery thrust has centered on the Strategy for Revitalizing Agriculture (SRA) launched in March 2004 and provides the necessary policies needed to transform the sector to effectively provide food and nutritional security, increased incomes and gainful employment, promotion of farmers' productivity and lowering of the cost of agricultural inputs.

It is envisaged that the economic expansion will be consolidated further through the Vision 2030, which succeed the ERS. The Vision identifies agriculture as a key driver of the economy for realization of the targeted GDP growth rates and also accelerates achievement of the Millennium Development Goals (MDGs). The sector is therefore expected to open new frontiers especially in productivity, agro-processing, value addition and agribusiness development. Furthermore, agricultural growth catalyses growth in other sectors, with an estimated growth multiplier of 1.23 in the non-agricultural sector.

#### **3.2 Energy Sector**

Energy is an important input in a country's development process since it provides the stimulus, drive and momentum for socio-economic development due to its hidden multiplier effect. Therefore the supply of adequate and affordable energy for growth and development is the central theme of the Government's Energy Policy encapsulated in *Sessional Paper No.4 of 2004 on Energy*.

The per capita energy consumption in Kenya in 2005 was 95.5 kgs of oil equivalent (koe), which is way below the levels expected of a fast growing modern economy. For a country to make the transition from subsistence to a fast growing modern economy, the minimum per capita consumption of commercial energy is expected to be at least 300 koe. Energy consumption in Kenya therefore needs to increase at least three-fold just to attain this threshold. Households account for the largest share of primary energy consumption (73.1%); small-scale industries 10%; and the balance is accounted for by the large commercial and industrial sub-sectors.

Between 2003 and 2007, electricity demand increased for all consumer categories while the system peak demand increased from 786 MW to 987 MW. Electricity consumption rose from 3,801 GWh to 5,065 GWh – a growth rate of 6%. The current consumption of 121 kWh per capita is considered to be extremely low; as is the national access rate at about 15%, which is below the benchmark 32% for developing economies. The access rate is, however, expected to increase as a result of the current policy of accelerated rural electrification.

A small amount of hydro-power is currently generated at Gogo Falls in Kuja River through a low gravity dam of masonry construction with a maximum height of 12 m and a crest length of 159 m.. The dam has ogee-shaped cross section and is provided with two distinct spillways; a primary spillway 61 m in length with crest elevation 1221.34 m and a secondary spillway 98 m in length with crest elevation 1222.86 m. The construction of this dam was completed in 1956, with an installed capacity of 2 x 1000 KW, which is connected to the national grid. However, current power generation is limited to 400 KW from one generating set, the other set is out of order.

#### **4.0 PREVIOUS STUDIES**

Lotti & Associati and Viginter Consultants have analyzed the Kuja River development potential under two separate studies namely: UNDP's "Lake Basin River Catchment Development: River Profile Studies" and the "Kuja River Basin Study" respectively. According to these studies, the existing hydro-power production at the Gogo Falls can be upgraded to 1.8 MW by repairing the damaged parts (packing box). However, the height of the dam cannot easily be increased because the right bank has a very gradual slope. Installation of a third set is not recommended because the right abutment of the dam was damaged by floods and was only partially repaired in 1980 with castings and gabions. Therefore, the rehabilitation of the Gogo Falls has been rejected because the full potential of the Kuja River will not be realized under this option.

Lotti & Associati (River Profile Studies) indicated that up to 2000 Ha of land in the Lower Kuja Basin could be irrigated without construction of the Gogo Dam. This would require tractor mounted, motor pumps for drawing water from the river into the fields for surface irrigation. However, with the construction of 50M height dam with a live storage capacity of 675m<sup>3</sup> of water and a firm flow of 15.8 m<sup>3</sup>/s the area that can be put under irrigation can be increased up to 16850 Ha. The dam would also support a hydropower installation of 18 MW.

It is envisaged that an earth-fill embankment dam or a concrete gravity dam with a central overflow spillway would be constructed immediately downstream of the existing concrete overflow weir. The cost of the full feasibility study for both hydropower generation and irrigation infrastructure is estimated at about Kshs 254,360,000.

The construction of the dam and hydropower component of the project was estimated to cost Kshs 3,100,000,000 and the benefit-cost ratio if operated for power only was calculated at 0.72. The possible utilization of the regulated flows for downstream irrigation and the economics of a multipurpose development project were not carried out.

The two studies referred to above conclude that the project is technically feasible and economically viable. The consultants recommended further investigations for establishing firm figures of cost and benefits. The Lake Basin Development Authority proposes that a full feasibility study be undertaken, including detailed designs for optimum Multipurpose Project Development of the Kuja River flows.

## 5.0 PROJECT LOCALITY

### 5.1 Geographic Area

Kenya's Lake Victoria basin can be broadly divided into highlands to the east and lowlands to the west along the shores of Lake Victoria. The highlands vary in altitude from 1,800 meters to 3,000 meters above sea level. The project area lies approximately at 1,220 meters above sea level in an area of a gentle undulating topography to the west of the highlands. The Project site is located in Karungu Division in Migori District approximately 170 Km south of Kisumu and 30 Km from Migori town. A tarmac road links Migori to Kisumu while the Migori-Karungu road has an all weather good murram surface.

### 5.2 Climate

The climate of the Lake Victoria basin is tropical type but is very much influenced by the lake and altitude. The lowlands are generally warm while the highlands are cooler. The mean temperature ranges from a minimum of 14.18°C in the highlands areas in the east to a maximum of 30.34°C near the lakeshore. The temperature of the project area lies within the latter range.

### 5.3 Rainfall

Rainfall in the region is well distributed with an annual average of 1500 mm to 1600 mm, varying from 2000 mm in the highlands to 1000 mm in the lowlands. Two periods March to May and November to December are characterized as Long and Short rainy seasons respectively, but there is no remarkable dry month. It is however pointed out that over the years variation of annual rainfall is considerably large. In the project area there is poor rainfall considerably lower than the highland areas.

### 5.4 Hydrology

The Kuja-Migori River has a total catchment area of about 6,900km<sup>2</sup>. The Kuja Branch is characterized as a river with ample flow replenished by abundant rainfall in its sub-catchment of about 3,000km<sup>2</sup> and has a mean annual flow of over 1000 million m<sup>3</sup> at the stream gauge IKBIA located near Gogo Falls.

#### River Flows at IKBIA (1964-1983)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	OCT	NOV	DEC	MEAN
Maximum	59.3	67.1	80.3	186.5	350.0	111.1	65.6	30.0	56.1	78.5	479.0	228.8	149.3
Minimum	1.0	0.8	0.7	6.2	22.7	9.5	4.8	3.3	2.9	4.7	2.3	1.6	5.0
Mean	11.8	10.6	17.0	53.7	94.3	38.6	18.7	13.4	23.6	23.7	46.5	31.3	31.9

### 5.5 Population

The LBDA area has a population of some 12 million people, which accounts for over 42% of the Kenya's total population. This implies that land resources in this area are already becoming a limited factor for further development and production activities will stay at a subsistence level. The population of Karungu Division where the project is located is 27,901<sup>1</sup> people. The Division is 138.8Km<sup>2</sup> and is well populated with an average density of 201 people per square kilometer.

<sup>1</sup> 1999 Population Census Report

## **5.6 Socio-Economic Conditions**

Major food crops in the LBDA Area include maize, sorghum, millet, rice, potatoes, cassava, beans and groundnuts, whilst dominant cash crops are coffee, tea, sugarcane, cotton and sisal. Small-scale farmers under rainfed conditions grow most food crops, except rice, which is planted mainly in pilot schemes, with little application of fertilizers. Most of the farmers live at subsistence level. Karungu Division does not receive sufficient rains and therefore it grows drought resistant crops such as sorghum, cassava and groundnuts.

## **6.0 OBJECTIVES:**

Under the Rural Electrification programme, the main objective of the Government is to provide electricity to as many parts of the country as possible and reduce the demand on wood-fuel and kerosene for lighting. The objectives of this project are:

- (i) To increase the supply of energy in the region
- (ii) To lessen the country's dependency on imported energy
- (iii) To harness the energy resources of the region
- (iv) To create employment opportunities
- (v) To stimulate industrial development in the region, and
- (vi) To contribute to agricultural development of the region through irrigation.
- (vii) To alleviate poverty in the region

## **7.0 SCOPE OF WORK**

The Kuja River has the potential of generating about 10 MW to 18 MW and irrigating a gross area of 20,000 ha. The scope of Work comprises the feasibility study and implementation of both the hydropower and irrigation development. Hydropower and Irrigation development will commence after detailed designs

### **7.1 Feasibility Study**

- Phase I: Exploratory and Planning
- Phase II: Feasibility Studies
- Phase III: Project Preparation, Design and Tender Documentation

### **7.2 Hydropower generation**

- Phase I: Detailed design
- Phase II: Land acquisition
- Phase III: Construction

### **7.3 Irrigation development**

- Phase I: Detailed design
- Phase II: Community sensitization
- Phase III: Construction

**: Feasibility Study Schedule (Months)**

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			
<b>Phase I- INCEPTION</b>																										
Inception Report	—————																									
Client/Financier Comments			—																							
<b>Phase II – FEASIBILITY STUDIES</b>																										
Interim Report				—————																						
Client/Financier Comments									—																	
Draft Feasibility Report				.....					—————																	
Client/Financier Comments																	—									
Final Feasibility Report																		—————								
<b>Phase III – TENDER DESIGN AND TENDER DOCUMENTATION</b>																										
Draft Tender Documentation																	.....		—————							
Client Comments																							—			
Final Tender Documentation																							—————			

**Implementation Schedule (Years)**

Year		1	2	3	4	5	6	7	8	9	10	11	12
Kuja River Hydro-power project	Detailed design	—————											
	Land acquisition			—————									
	Construction				—————								
Kuja Basin Irrigation	Detailed design	—————											
	Community sensitization		.....										
	Construction phase I			—————									
Project Hand Over	Hydropower											—————	