

REPUBLIC OF RWANDA
Ministry of Infrastructure

**ENERGY WATER AND SANITATION
AUTHORITY (EWSA)**



**Electricity Access Rollout Programme
(EARP)**

Head Office: Avenue de l' Ihema,
P.O.Box 537, Kigali-Rwanda
Tel: (250) 598202 or 573666
E-mail: elqz@rwanda1.com
Website: www.ewsa.rw

**SUBPROJECT BRIEF FOR THE REHABILITATION OF A
30/110kV SUBSTATION AT RULINDO AND 60KM 30kV
DISTRIBUTION LINE FROM RULINDO TO BYUMBA
AND GATUNA**

September 2011

LIST OF ACRONYMS.....	4
0. BACKGROUND.....	5
I. DESCRIPTION OF THE SUBPROJECT	7
I.1. INTRODUCTION.....	7
I.2. OBJECTIVES OF THE SUBPROJECT	7
I.3. SUBPROJECT ACTIVITIES.....	8
I.4. TECHNICAL DESCRIPTION.....	8
Outdoor Switchyard 110kV.....	9
Transformer Bay 110/30 kV	9
Power transformer 110/30kV 10MVA YN0d11.....	11
Indoor Switchgear 30kV.....	11
• One (1) incoming feeder for transformer 110/30 kV	11
• Two (3) outgoing line feeders.....	11
• One (1) outgoing spare feeder	12
Details of 30kV Equipment.....	12
GENERAL.....	12
Transformer Feeder Incoming	12
Line Feeder BYUMBA.....	12
Line Feeder BASE.....	13
Line Feeder MUSASA.....	13
Spare Feeder.....	13
Control, Supervision and Protection	13
Control and Protection Panels.....	14
• One (1) Differential line for a T-off substation for four end communication	14
• One (1) micro-processor Bay Control Unit (BCU) for 110kV Transformer bay as per specification in this document.....	14
• Key-lockable selector switch for control positions LOCAL-OFF-REMOTE (may be included in BCU).....	14
• Five (5) micro-processor Bay Control Unit (BCU) for 30kV switchgears as per specification in this document.....	14
• One (1) Differential Transformer.....	14
• Set of material such as panel, wiring, terminals, etc.....	14
Voltage Regulation	14
• One (1) Digital Voltage indicator 110kV.....	15
• One (1) Digital Voltage indicator 30kV.....	15
SCADA system	15
The SCADA system is already installed in the existing substation, but is parallel type. As the new substation will be equipped with Intelligent Devices, a new RTU serial type must be supplied within this subproject. On the other hand the communication equipment will be transferred in the new substation to be adapted on the new equipments.....	15
• One (1) RTU serial type	15
• One (1) Splice box for optical fibre	15
Civil works.....	15

110 kV Outdoor Substation.....	15
Substation Building with Auxiliary Rooms.....	15
Distribution Line RULINDO-BYUMBA and GATUNA 30kV.....	16
Civil works technical requirements.....	17
II. DESCRIPTION OF THE ENVIRONMENT	25
II.1. DESCRIPTION OF THE PHYSICAL ENVIRONMENT: METEOROLOGY, HYDROGRAPHY, GEOLOGY, RELIEF AND BIODIVERSITY	25
II.2. DESCRIPTION OF THE SOCIO-ECONOMIC ENVIRONMENT.....	34
III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK.....	41
III.1. POLICIES RELEVANT TO THE SUBPROJECT.....	41
III.2. ORGANIC LAW ON ENVIRONMENTAL PROTECTION AND MANAGEMENT	49
III.3. ENVIRONMENTAL CLEARANCE PROCEDURES	52
III.4. INTERNATIONAL LEGISLATIONS RELEVANT TO THE SUBPROJECT.....	53
IV. SUBPROJECT ALTERNATIVES	57
IV.1. ANALYSIS OF ALTERNATIVES	57
IV.2. COMPARISON OF ALTERNATIVES.....	58
V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES	59
V.1. POSITIVE IMPACTS	59
Socio-economic Benefits	59
Environmental Benefits.....	60
V.2. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES.	61
V.3. SUBPROJECT DECOMMISSIONING	64

LIST OF ACRONYMS

ARAP	Abbreviated Resettlement Action Plan
EMF	Electromagnetic Fields
EA	Environmental Audit
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
IAPs	Interested and Affected Parties
IDA	International Development Association
LV	Low Voltage
MV	Medium Voltage
MININFRA	Ministry of Infrastructure
FORENWA	National Fund of the Environment in Rwanda
NDF	Nordic Development Fund
PPE	Personal Protective Equipment
PCBs	Polychlorinated biphenyls
PAPs	Subproject Affected Parties
PCU	Subproject Coordination Unit
RPF	Resettlement Policy Framework
RoW	Right Of Way
REMA	Rwanda Environment Management Authority
EARP	Electricity Access Roll-Out Program
MINIFOM	Ministry of Mines and Forests
MINELA	Ministry of Environment and Lands
KCC	Kigali City Council
EWSA	Energy, Water and Sanitation Authority

0. BACKGROUND

The Government of Rwanda, in its effort to sustain economic growth, has increased and stabilised the power production since the severe power shortages in 2004. However, infrastructure bottlenecks in the urban areas and limited access in the rural areas have emerged as a significant constraint. One of three major strategic objectives of the Economic Development and Poverty Reduction Strategy (EDPRS 2008-2012) is to expand access while also improving the quality and lowering the cost of economic infrastructure – especially transport, power, and communications. The Government of Rwanda (GoR) also exercises a strong leadership role in donor coordination and has begun to work with donors on a clearer division of labour by identifying areas of individual donor comparative advantage.

In connection with the mentioned strategy, the Government of Rwanda through Energy, Water and Sanitation Authority (EWSA) is embarked on a country-wide **Electricity Access Program** to realize the primary EDPRS target for the electricity sector of tripling access by 2012 to about 16 percent of households and at least 50 percent of identified public institutions in health, education and local administration. This will require about 160'000+ with new grid connections, and will also include efforts to reach rural consumers and service providers currently off the national grid.

In this regard, EWSA has established a new Electricity Access Scale-up Roll-out Program (EARP) as a part of its corporate structure. The program will be implemented within the framework of a Sector Wide approach (SWAp) to encompass all donors active in the sector under one common sector investment program. The overall investment envelope for the first SWAp time (2009-2013) is estimated at \$378 million, for the program period covered by the Prospectus that has been endorsed by all the Partners and key sector institutions in Rwanda, including EWSA.

The prospectus outlines the overarching spatial least cost rollout plan and priority connection targets through the medium term, the rollout strategy and the financing policy platform for the EARP. Additionally, the EARP implementation will be subject to a monitoring, evaluation and results framework as well as the oversight and accountability process of regular reviews as

agreed with the energy sector working group (SWG), chaired by Ministry of infrastructure (MININFRA) on advice from the partners.

A number of development partners so far committed to support the program including World Bank IDA, World Bank GEF/ESMAP CEIF, African Development Bank, BADEA, OFID, Saudi Funds, Netherlands, Japan, and others.

It is in this regard that Rwandan Government through its cooperation with AfDB applied for grant to undertake the rehabilitation of a 30/110kV substation at Rulindo and 30kV distribution line from Rulindo to Byumba and Gatuna which will cover about 60 kms.

I. DESCRIPTION OF THE SUBPROJECT

I.1. INTRODUCTION

This is a rural electrification subproject which is in the context of the effort of the Ministry of Infrastructure to meet the national Economic Development and Poverty Reduction Strategy (EDPRS) target to increase access to electricity on a national scale, and to supply reliable and affordable energy to Rwandan householders. This lack of electricity in some parts of rural areas caused concentration of economic activities in urban areas, causing a lot people to shift from nearby centres for green pasture.

The electricity access roll-out program aims at increasing connections, boost economic activities all over the country, direct and indirect creation of jobs and raise off-firm jobs. The ongoing EARP will enable energy sector stakeholders to connect at least 16% of the population or 350,000 customers to the grid by 2012. It is in this regard therefore that remote areas have been identified to benefit this grant.

Currently, the Rwandan transmission system is composed of 370 km 110 kV and 70 kV lines linking the southern substation Mururu II to Gikondo as well as the 70 kV line from Jabana to Rwinkavu. The transmission system has also eleven 110kV substations, and four 70kV substations that supply all Country.

According to the high energy demand the Rwandan generated electricity needs to be transmitted and distributed to the beneficiaries. It is in this line that there is a need of rehabilitating Rulindo substation and the currently existing old distribution line from Rulindo to Byumba and Gatuna.

I.2. OBJECTIVES OF THE SUBPROJECT

The purpose and objectives of this subproject are as follow:

- Reducing poverty through increase of electricity access rate by direct or indirect job creation
- Reduce CO₂ emissions from kerosene by providing clean electric energy
- Uplift living standards in the targeted areas as investors have been limited by having no electricity guarantee

- To reduce the use of charcoal which result in deforestation and end up causing soil erosion
- To create foundation for other infrastructure like ICT infrastructure and other investments that require electricity.

1.3. SUBPROJECT ACTIVITIES

The Subproject components shall consist of the rehabilitation of 30/110kV substation at Rulindo and the existing 60 km 30kV distribution line from Rulindo and Byumba and Gatuna.

The Works will consist of:

- Rehabilitation of MV and pole mounted transformer substation in along the distribution line in the subproject area
- Transportation of line building materials from Kigali to the Contractor's warehouse on site
- Storage and management of the materials in the warehouse
- Line and topographic surveys, profile calculations and calculation of structures and detailed plans for pole and cables
- Providing as built drawings of the lines.
- Arrangement and rehabilitation of existing system shut-downs and outage notifications
- Testing and commissioning of works
- Inventory of damaged items in transit

1.4. TECHNICAL DESCRIPTION

The Rulindo substation supplies the regions of Byumba, Musasa, and Base. The HV and MV equipments are in a decrepit state and non spare part cannot be found.

The rehabilitation works of this substation will be executed by constructing a new substation at the same area, but at the more appropriate location, because the existing substation is constructed very near of the swamp land that can be flooded easily. This solution will also permit the rehabilitation work execution without the prolonged electricity outages

The rehabilitation of the substation concerns the construction of the new 110kV outdoor switchyard, the replacement of the indoor MT 30kV Switchgear as well as the Protection,

Control and Command system. The existing substation is a T-off substation with one transformer bay. The new substation must be designed with three 110kV Incomer Line Bays and one 110kV Transformer bay to allow the connection of NYABARONGO II Hydro-power plant on 110kV network.

The substation will have following important parts:

Outdoor Switchyard 110kV

Transformer Bay 110/30 kV

The 110 kV Outdoor Switchyard will be of the open air type connected on the 110kV Overhead line with four 110kV Bays. During the erection, all gantries and Steel structures must be new to allow keeping in function the old equipments during the construction of new substation. The Switchyard will be equipped with the following equipments:

- One (1) circuit-breaker, single pole, 1.250A, 31,5 kA rated short time withstand current (3s), with motor drive 110 V DC for Mukungwa Line Bay
- One (1) circuit-breaker, single pole, 1.250A, 31,5 kA rated short time withstand current (3s), with motor drive 110 V DC for Jabana Line Bay
- One (1) circuit-breaker, single pole, 1.250A, 31,5 kA rated short time withstand current (3s), with motor drive 110 V DC for Nyabarongo II Line Bay
- One (1) busbar disconnecter, outdoor, 3-pole, rotary type, 1.250 A, manually gang-operated and motor drive for Mukungwa Line Bay
- One (1) busbar disconnecter, outdoor, 3-pole, rotary type, 1.250 A, manually gang-operated and motor drive for Jabana Line Bay
- One (1) busbar disconnecter, outdoor, 3-pole, rotary type, 1.250 A, manually gang-operated and motor drive for Nyabarongo II Line Bay
- One (1) Line disconnecter, outdoor, 3-pole, rotary type, 1.250 A, manually gang-operated and motor drive for Mukungwa Line Bay
- One (1) Line disconnecter, outdoor, 3-pole, rotary type, 1.250 A, manually gang-operated and motor drive for Jabana Line Bay

- One (1) Line disconnector, outdoor, 3-pole, rotary type, 1.250 A, manually gang-operated and motor drive for Nyabarongo II Line Bay
- Three (3) lightning arresters, outdoor, 110 kV, 20 kA discharge current, with discharge counters for Mukungwa Line Bay
- Three (3) lightning arresters, outdoor, 110 kV, 20 kA discharge current, with discharge counters for Jabana Line Bay
- Three (3) lightning arresters, outdoor, 110 kV, 20 kA discharge current, with discharge counters for Nyabarongo II Line Bay
- Three (3) 110kV Voltage transformers, outdoor $\frac{110kV}{\sqrt{3}} / \frac{100V}{\sqrt{3}} / \frac{100V}{3}$ for Mukungwa Line Bay
- Three (3) 110kV Voltage transformers, outdoor $\frac{110kV}{\sqrt{3}} / \frac{100V}{\sqrt{3}} / \frac{100V}{3}$ for Jabana Line Bay
- Three (3) 110kV Voltage transformers, outdoor $\frac{110kV}{\sqrt{3}} / \frac{100V}{\sqrt{3}} / \frac{100V}{3}$ for Nyabarongo II Line Bay
- Three (3) 110kV current transformers, outdoor, 200-400/1/1/1 A for Mukungwa Line Bay
- Three (3) 110kV current transformers, outdoor, 200-400/1/1/1 A for Jabana Line Bay
- Three (3) 110kV current transformers, outdoor, 100-200/1/1/1 A for Nyabarongo II Line Bay
- One (1) power transformer 110/30kV, 10MVA YN0d11
- One (1) busbar disconnect or, outdoor, 3-pole, rotary type, 1.250 A, manually gang-operated and motor drive for Transformer Bay
- Three (3) 110kV current transformers, outdoor, 100-200/1/1/1 A for Transformer Bay
- One (1) circuit-breaker, 3-pole, 1.250A, 31,5 kA rated short time withstand current (3s), with motor drive 110 V DC for Transformer Bay

- Three (3) lightning arresters, outdoor, 110 kV, 20 kA discharge current, with discharge counters, for transformer Bay
- One (1) Earthing Transformer 30/0,4kV 160kVA
- Post insulators, outdoor,
- Terminal cubicle for all low voltage cable (command, control and protection)
- One (1) Aluminium Tubular Busbar 110kV
- Three (3) 110kV Voltage transformers, outdoor $\frac{110kV}{\sqrt{3}} / \frac{100V}{\sqrt{3}} / \frac{100V}{3}$ Busbar Voltage measurement.

The 110 kV outdoor switchyard is indicated on the single line diagram and the detailed technical specifications are indicated in this document.

Power transformer 110/30kV 10MVA YN0d11

The Power transformer to be used is 110/30kV 10MVA and YN0d11 as vector group. This vector group has been chosen to permit the Single phase or Duo phase Medium Voltage distribution for rural electrification program.

The power transformer must have the transformer earthing with Zigzag-Star as vector group to be connected on the delta side and the neuter point will be used for artificial neutral system. The earthing transformer will be used also as Auxiliary transformer for the substation. The details are indicated in the technical specification.

Indoor Switchgear 30kV

The MV switchboard shall be of the Gas Insulated GIS type, SF6 insulated, metal-enclosed and metal-clad, with vacuum circuit-breakers.

The 30 kV switchgears will be of the indoor type with rated busbar current 1.250A, short circuit capacity 25kA, rated feeder current 1.250A, composed of the following cubicles:

- One (1) incoming feeder for transformer 110/30 kV
- Two (3) outgoing line feeders

- One (1) outgoing spare feeder

Details of 30kV Equipment

GENERAL

30 kV indoor arrangement with a single busbar system with the following data:

- Rated Current Busbar 1250 A
- Rated Short Circuit Withstand Current common for all equipment 25 kA (3 sec)
- six voltage transformers $\frac{30kV}{\sqrt{3}} / \frac{110V}{\sqrt{3}} / \frac{110V}{3}$

Transformer Feeder Incoming

- One (1) three pole three position switch 1.250 A
- one (1) three pole circuit breaker 1.250 A, 25kA
- three (3) current transformers 200-400/1/1/1 A
- cable compartment for plug-in SF6/ cable sealing ends for six single core cables
- low voltage compartment with the CPU of the control and protection equipment as specified in this document
- three (3) voltage transformers $\frac{30kV}{\sqrt{3}} / \frac{110V}{\sqrt{3}} / \frac{110V}{3}$

Line Feeder BYUMBA

- One (1) three pole three position switch 1.250 A
- one (1) three pole circuit breaker 1.250 A, 25kA
- three (3) current transformers 200-400/1/1 A
- cable compartment for plug-in SF6/ cable sealing ends for three single core cables
- low voltage compartment with the CPU of control and protection equipment as specified
- three (3) voltage transformers $\frac{30kV}{\sqrt{3}} / \frac{110V}{\sqrt{3}} / \frac{110V}{3}$

Line Feeder BASE

- One (1) three pole three position switch 630 A
- one (1) three pole circuit breaker 630 A, 25kA
- three (3) current transformers 100-200/1/1 A
- cable compartment for plug-in SF6/ cable sealing ends for three single core cables
- low voltage compartment with the CPU of control and protection equipment as specified

Line Feeder MUSASA

- One (1) three pole three position switch 630 A
- one (1) three pole circuit breaker 630 A, 25kA
- three (3) current transformers 100-200/1/1 A
- cable compartment for plug-in SF6/ cable sealing ends for three single core cables
- low voltage compartment with the CPU of control and protection equipment as specified

Spare Feeder

- One (1) three pole three position switch 630 A
- one (1) three pole circuit breaker 630 A, 25kA
- three (3) current transformers 100-200/1/1 A
- cable compartment for plug-in SF6/ cable sealing ends for three single core cables
- low voltage compartment with control and protection equipment as specified

The 30 kV switchgear room shall be adapted such as to have space for at least 2 additional feeders. The details technical specifications are indicated in this document

Control, Supervision and Protection

Control and Protection Panels

One (1) combined control and protection panel for 110 kV bay and 30kV switchgear, complete with:

- One (1) Differential line for a T-off substation for four end communication
- One (1) micro-processor Bay Control Unit (BCU) for 110kV Transformer bay as per specification in this document.
- Key-lockable selector switch for control positions LOCAL-OFF-REMOTE (may be included in BCU)
- Five (5) micro-processor Bay Control Unit (BCU) for 30kV switchgears as per specification in this document.
- One (1) Differential Transformer
- Set of material such as panel, wiring, terminals, etc.

All protection relays and Bay control Units must be equipped with a communication interface using IEC 103 protocol.

Voltage Regulation

The Power transformer tap-changer will be controlled by an Automatic Voltage regulator equipped with the following equipment:

- one automatic numerical controlled voltage regulator
- one numerical controlled parallel operation control unit, if not included in the voltage regulator
- control selector switch (positions: AUTO-MANUAL-REMOTE)
- tap-change control switch for 2 push-buttons for operation of the tap changer for RAISE/LOWER
- one digital tap position indicator
- Temperature indicator with selector switch to select oil temperature and winding temperatures primary and secondary.

- Alarm unit
- Set of indication and operation lamps
- Set of material such as panel wiring, terminal etc.
- One (1) Digital Voltage indicator 110kV
- One (1) Digital Voltage indicator 30kV

The voltage regulator must be equipped with a communication interface using IEC 103 protocol

SCADA system

The SCADA system is already installed in the existing substation, but is parallel type. As the new substation will be equipped with **Intelligent Devices**, a new RTU serial type must be supplied within this subproject. On the other hand the communication equipment will be transferred in the new substation to be adapted on the new equipments.

The system must be serial type and will be composed by following equipments:

- One (1) RTU serial type
- One (1) Splice box for optical fibre

Civil works

110 kV Outdoor Substation

Foundations for switchgear and gantries shall be designed and installed on the basis of the technical data sheets and the results of the soil investigation.

Transformer foundations and firewalls shall be designed according to the actual requirements and size of the transformers. The oil-collecting pit for each transformer shall have a capacity for 120 % oil of one transformer. A water/oil evacuating system using a pump shall be installed for the oil/rain water collecting pit.

Substation Building with Auxiliary Rooms

A new substation building has to be build and designed according to the technical data sheet and his equipment to be installed. The implementation study will be submitted for approval.

Room for the medium voltage switchgear shall be provided having space for the number of feeders specified as well as space for additional feeders.

The channels for control and power cables shall be built completely separated.

The **substation** building will have the following rooms:

- Two (2) office rooms;
- One (1) meeting room;
- One (1) switchboard room;
- One (1) AC, DC **distribution** boards, battery charger
- One (1) control and command room;
- One (1) battery room;
- One (1) store room;
- One (1) combined interior bathroom and toilet room;
- One (1) exterior toilets room;
- One (1) telecommunication room;
- One (1) workshop room;

Distribution Line RULIND0-BYUMBA and GATUNA 30kV

The **distribution** line **Rulindo-Byumba** already exists, but the state is very critical. This line is **60Km** long and it is constructed using a poor material and it does not have any earthing protection wire. The number of statistics of protection trips on this line can explain how often this line is affected by the atmospheric discharges because the line is located in the region where the Kelonic level is estimated very high. For this reason the **rehabilitation** of this line is very urgent to assure a stable power supply for entire region that has now many factories and where a big and fast growth is currently observed. The **rehabilitation** of this line must be done by replacing the existing poles by towers and the Protection Earthing wire must be installed. The final technical details will be done during the technical study **phase**, but the cost is given in the estimated bill of price basing on the known cost per **Km** of **30kV distribution** line.

Civil works technical requirements

Plot arrangement of the substation RULINDO

Plot arrangement of the substation RULINDO				
Pos	Description	Unit	Minimum Values required	Minimum Values offered
	1Area, fence and access roads	-		
1.1	Preparation of the fitting out area general plan	lot	1	
1.2	Total surface of the substation's plot (50x50)	m ²	2.500	
1.3	Total surface of the occupied area for the substation (Buildings , outdoor equipment, access roads etc.....	m ²		
1.4	Earth bank with laterite soil	m ³		
1.5	Excavation of semi hard rocks	m ³		
1.6	Excavation of hard rocks	m ³		
1.7	Shouldering wall made of stones/mortar and for foundation in which the fence's poles are anchored	m ³		
1.8	Steel reinforced concrete belt in which the foundations poles are anchored as base of the fence	m ³		
1.9	Volume of the cement blocks of (40x 20 x 20)cm to realise the wall of the fence until the height of 2.20 m above the level of the belt in pos. 1.7	m ³		
1.10	Entry and exit gates 4 m with double opening	piece	2	
1.11	Guard hut made of cement blocks (3 x2,5x 2,5) m	piece	2	
1.12	Drainage for the rain water from the outdoor substation	lot	1	
1.13	Putting in place of granite gravel in the area outdoor substation	m ³		
1.14	Access roads (junction from the main road to the substation , including the access to all outdoor equipments	m ²		
1.15	Minimum admissible pressure on the ground of the outdoor	bar	1,5	

	substation			
1.16	Water supply for all needs : civil works , all buildings supply	lot	1	
	during and after the period of the erection			
	2Lighting of the outdoor substation area			
2.1	Number of simple cross lanterns	piece	12	
2.3	Total height of the lanterns above the ground	m	10	
2.4	Weight of the simple cross lanterns	kg	130	
2.6	Lantern (bolted above the concrete foundation)	type	galvanised steel	
2.7	Power cable for connexion of the lanterns	type	NXY	
2.8	Cable length NXY 4x10 mm ² CU (supply main cable)	m	1,000	
2.9	Fuse boxes to install in the lanterns	piece	18	
2.10	Sodium lamp 250 Watts	piece	28	
2.11	3x2.5mm ² supply cable for connecting the main cable to	m	60	
	the lantern and all accessories, junction accessories etc...			

Setting and Erection

The route will be pegged on the centre-line by means of steel pins positioned every kilometre, or such smaller distance as may be required to provide intervisibility between intermediate points. Each turning point will be pegged and referenced by providing four additional steel pins, giving a means of relocating should the turning point marker be displaced or removed. Each turning point position and reference system will be recorded on a field distance. The fourth peg will be placed in any convenient location and recorded.

The error in longitudinal measurement will not exceed 0,05% between 'kilometre' pegs and the accumulated error over line route sections between turning points will not exceed 0,1%. The error in angular measure will not exceed 0,5 minutes and the error in setting out a bearing will not exceed 5 minutes of arc. Where the sections between turning points are long and the route traverses country with few reference points, a correction not exceeding 2 degrees to the route direction may be permitted.

At overhead line or telephone crossings where the line being surveyed crosses between two poles or structures, the conductor height will be assumed to be an imaginary straight line

connecting the uppermost attachment point on the two poles or structures and not the actual height of any conductors at the crossing point.

Field sketches of all power and communication line crossings will be made at the time of setting out, show the general disposition of conductors, insulators and earth wire. The pole height to the upper attachment will be measured accurately from the elevation datum. The inspection of the pegged route will be undertaken at least three days before excavations begin.

Site Preparation

The pruning or complete removal of trees where necessary along the routes of overhead **lines** will be undertaken. Where trees are to be removed, the relevant trees will be completely uprooted by means of a monkey winch or other approved methods, and stack them in a position approved by EWSA. All holes caused by such uprooting will be filled to leave the site clean and tidy. Where the branches of trees are to be pruned, such pruning will be neatly carried out in an effective and workmanlike fashion.

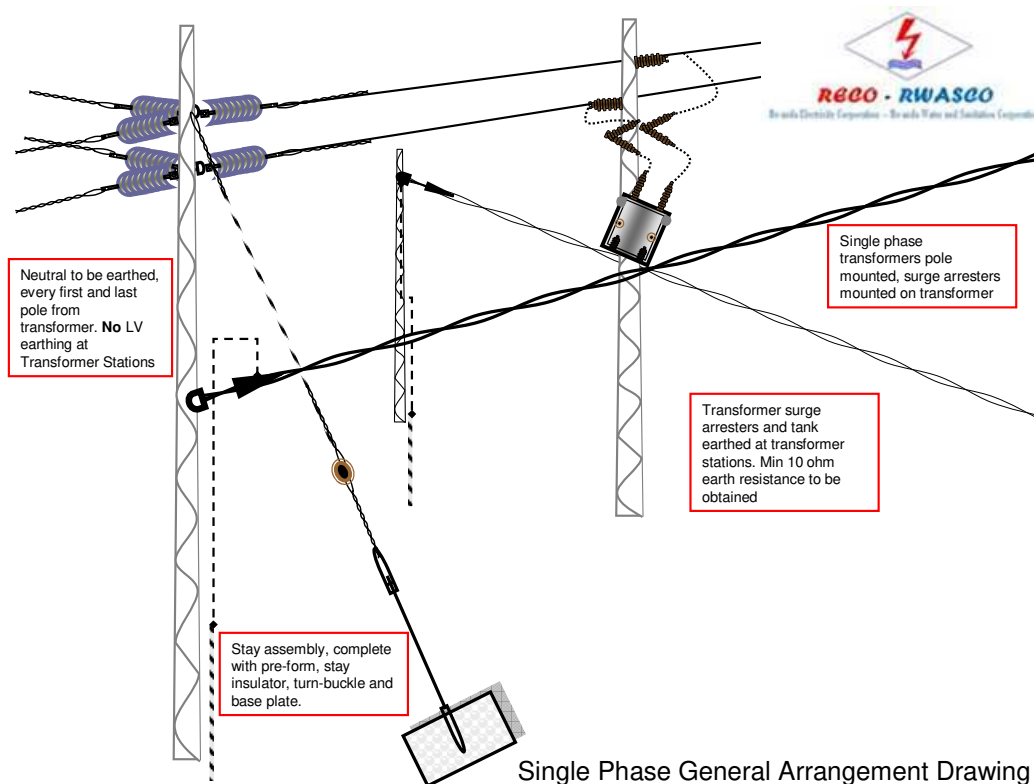
The removal of trees, except shrubs, with trunks within 5m from the nearest conductor along the routes of all **lines** will be allowed. The pruning of all tree branches, along the routes of all **lines**, in such a way that no branch will subproject through a vertical plane parallel to and 3m from the nearest conductor, on the understanding that such branches of which the highest points are below 6m above ground level need not be pruned unless it is within 3m from any pole. An area with a radius of 3m will be treated with weed killer at each pole or leg of structure.

Protection of natural vegetation

Any destruction, damage or removal of natural trees and vegetation, except where instructed or given permission to do so in cases where it is unavoidable. No trucks or plants will be allowed to run over areas not specifically set aside for this purpose. Trees protected by the Government of Rwanda will under no circumstances be uprooted or damaged in any way except with the consent of EWSA.

Construction

Prior to commence work on any property, EWSA will make sure that way leaves are in order and give the occupier of such property adequate notice of the commencement of the work.



Prior to carry out erection of the conductors or installation of earth electrodes or counterpoise along or across public roads, telegraph or telephone **lines** or across power **lines**, a requisite notice to the appropriate authorities of the date and time to perform the work. Where the local authorities and other public undertakings affected deem it necessary for the protection of the public and the assistance of traffic, to provide flagmen or watchmen or installation of warning lights, etc., the cost of such provision will be borne by the Contractor.

During the progress of the work, the following will be provided: proper fencing, watching and lighting of excavations, dumps of materials, ladders and the like and for the prevention and straying of and damage to livestock until backfilling of excavations and permanent reinstatement of fences, walls, hedges, gates and the like be completed.

All structures will be vertical within a tolerance at the structure top of 0,3% of the overall structure height, before erection of the conductors. Poles will not exhibit either twisting or bowing greater than the approved tolerances which will not exceed 2% of the mast length. After erection of the conductors the vertical tolerance of the structures will not exceed 0,5% of

the height and the cross arm transverse alignment will be square with the line to within half the width measured at the crossarm end. Proper precautions will be taken to ensure that poles are not strained or damaged in any way during erection. Suitable ladders shall be used whenever necessary during erection of the structures. All ladders will be removed when erection work is not in progress. The standard span length will be 50m to 100m and will be the span length on which all standard structure heights, assuming level ground, will be based.

Conductor Spacing and Clearances



The spacing between conductors and the clearances between clamps, jumper loops, and other live metal and structure steelwork under all specified conditions will not be less than the figures given below.

Maximum voltage for which insulation is designed, kV r.m.s. clearance phase to phase	Minimum safety clearance	Minimum clearance in meters				
		Above ground outside townships	Above ground in townships	Above roads in townships proclaimed roads outside townships railways and tramways	To communication lines , other power lines or between power lines and cradles	To buildings, poles and structures not forming part of the power lines
1,1 or less		4,9	5,5	6,1	0,6	3,0
7,2	0,15	5,0	5,5	6,2	0,7	3,0
12	0,20	5,1	5,5	6,3	0,8	3,0
24	0,32	5,2	5,5	6,4	0,9	3,0
36	0,43	5,3	5,5	6,5	1,0	3,0

Stringing

The fullest possible use will be made of the maximum conductor length in order to reduce to a minimum the number of joints. There will be no tension joints in adjacent spans or in sections between tensions structures of less than three spans. There will be no joints in spans crossing roads or in the spans immediately adjacent thereto.

The conductors, joints and clamps will be erected using approved tools and will be erected in such a manner that no bird caging, over-tensioning of individual wires or layers, or other deformation or damage to the conductor will occur. Auxiliary erection clamps or hauling devices will be of approved design and will, under erection conditions, allow no relative movement of strands or layers of the conductors. Cutting of layers of conductors will be carried out with tools designed not to damage underlying strands.

Jumpers will be cut in the centre and connected with an approved aluminium parallel groove clamp. Bimetallic clamps will be used where the take off is of copper material. Conductor ends will be sealed with an approved red-lead compound. Cropping or shearing of complete conductors will not be permitted.

Conductors will be run under partial tension and erected by means of snatch blocks of approved materials and dimensions, at every intermediate structure and by other approved means so as to reduce to a minimum contact between the conductor and the ground or other obstruction during erection. Under no circumstances may conductors be dragged along the ground. Any necessary special arrangements for running out and sagging the conductors where the route crosses buildings, gardens or other grounds over which erection cannot be carried out in the normal manner will be made. The conductors will be bound to the pin insulators with approved preformed wire ties and grips. Where reel and shackle type insulators are fitted the conductor will be bound to the insulators with approved side ties.

Insulators will be erected so as to avoid damage in any form. Pin insulators will be fully tightened on the pins before setting the insulator groove alignment and will remain tight after erection of the conductors.

The maximum tension in the conductor will not exceed 40% of the breaking tension at temperature $-5,5^{\circ}\text{C}$ and maximum wind load, and simultaneously will not exceed 18% of breaking load at average daily temperature of 35°C without wind except for sections with extra long spans where compliance with the specified maximum working tensions under the assumed maximum loading condition may necessitate a lower figure for the 35°C . C still air tensions.

Suitable dynamometers, sighting rods or other approved apparatus necessary for the proper checking of the work will be provided. Dynamometers will be tested and if necessary re-calibrated if so required by EWSA. The initial tension of the conductor during stringing will be increased by 8% of the value corresponding to the erection conditions on site to counteract non-elastic stretch of the conductor.

Standard design procedures will be used to determine the sag and tension for a specific **distribution** line. The following standards are applicable to the proposed conductors under the conditions stated.

Sag in the following conductors under the following conditions.

Safety factor	2,5
Conductor specification	SS 215
Stringing temperature	35°C wind 3.5 m/s
Maximum operating temperature	75°C
Worst Conditions	0,0kg/m ice 35 m/s wind 5°C

II. DESCRIPTION OF THE ENVIRONMENT

II.1. DESCRIPTION OF THE PHYSICAL ENVIRONMENT: METEOROLOGY, HYDROGRAPHY, GEOLOGY, RELIEF AND BIODIVERSITY

This chapter gives background information of the subproject area as a whole then narrows down to subproject specific site in terms of its location, administrative set-up, climate, settlement patterns, and the major environment attributes, which will play a crucial role in the identification of impacts and influence the overall direction in the development of the subproject.

Subproject Location

The Northern Province has Surface Area of 3293.3 km² and it is composed by 5 districts which are: Burera, Gakenke, Gicumbi, Musanze and Rulindo. It also includes 89 Sectors, 413 cells, 2740 villages, 345826 Households and population estimated to 1.6 Million.

The subproject area concerns the two districts of Rulindo and Gicumbi which are described below

RULINDO DISTRICT

Rulindo District is one of the 30 Districts of Rwanda. It is located in the Northern Province. It covers an area of 567 km² and has a population of about 261,018 inhabitants according to the census of 2002 . The district is divided into 17 administrative areas resulting from the last administrative reform in January 2006 that merged some of the administrative sectors of the former district of Rulindo which are Buliza, Shyorongi, Nyamugali, and Kinihira Kisaro.

In its current configuration, it is limited to the West by Gakenke district, South by the Southern province and Kigali City, East by the district of Gicumbi and North by the districts of Gicumbi and Burera.

Natural features

Rulindo district is characterized overall by a rugged terrain with hills, subject to massive erosion. It consists of massive chains separated by valleys more or less reduced. Despite this mountainous dominance, the district has some valleys, including Cyohoha Rukeri valleys with

very important tea plantations, Nyarubuga Bahimba valleys where various crops are grown and Rugezi marsh which contains water that moves to Burera lake, which in turn feeds Ntaruka falls.

Rulindo District has a temperate climate, characterized by a succession of rainy seasons and droughts. In general, the dry season occurs in case of a non climate disruption, from June to August and January to February. The rainy season from September to December and March to May. **Rulindo** district has considerable water resources from local sources and rivers flowing in the valleys and which provides water even during the dry season and has yet untapped in the context of increasing local production.

The major rivers that flow within the district are: Base, Bahimba, Mulindi, Cyonyonyo, Cyohoha, and Rukeri and Muzanza. They are great cliffs overhanging and poorly developed. It is only during the rainy seasons, especially the months February to May, they overflow their banks to flood the crops grown in the lowlands around them. This water which, in principle, should be a high potential for development potential, has become an obstacle which requires adequate measures to protect the environment.

Due to the dominance of steep slopes, the soil in **Rulindo** District is predominantly lateritic. In the lowlands and marshes, the soil is mainly clay soil and alluvium, the basement of the former sector of Masoro is rich in deposits of cassiterite, while other areas are rich in gravel quarries and sands. These resources are an economic potential of the district once developed.

The geographical position of the District.

The District lies between 29.86 and 29.98 degrees eastern longitude and 1.61 and 1.91 degrees southern latitude. Its altitudinal floors stretch between 1400 meters along the Nyabarongo in the West and Nyabugogo in the East. This altitude climbs to over 2000 meters on the tops of Bumbogo and Buberuka occupying the south and north of the country. It is from these three elements (longitude, latitude, altitudinal floor) that this climate has replaced the equatorial climate normally applicable to these regions.

The position of the District in the Country.

Inside Rwanda, **Rulindo** District is in the Northern Province, central northern Rwanda. It covers an area of 567 **km**² and has a population of about 252,000 inhabitants according to the 2002 census. The District is divided into 17 administrative areas resulting from the last administrative reform in January 2006 that merges some of the administrative sectors of the former Districts **Rulindo** which are: Buliza, Shyorongi, Nyamugali, and Kinihira Kisaro. In its current configuration, it is limited to the west by Gakenke District, south by the Southern Province and Kigali City, east by the Districts Gicumbi and north by the Districts and Gicumbi and Burera.

District in the Province.

Rulindo District is one of five districts that make up the Northern Province: Burera, Gakenke, Gicumbi, Musanze and **Rulindo**. In this Province, the District of **Rulindo** occupies the Southern and Central Province. It can be a link that can be taken as a belt conversion between different districts that make up the Province.

The agro-bio-climatic

The natural vegetation has disappeared under the pressure of human population. Hence natural areas have been replaced by agro-bio-climatic regions. According to the classification of MINAGRI mapping, the district is composed of two agro-bio-climatic: the region called the central region in the south and east of the District and the agro-bio-region known as the high lands of Buberuka in the north and west, which extends in the districts and Gicumbi and Burera in the north and northwest. These regions were determined from some key parameters are: climate, soils, topography and vegetation.

Climate.

The climatic parameters:

The climate is observed from two parameters: temperature and precipitation. Available observations allow us to describe and present their implication on poverty of the people in the following.

Temperature.

While rainfall is fairly well observed through several **stations**, it is not the same temperatures for which approximations done. In a first approach, we observe that for the whole country, there is a contrast between its geographical position and temperature. It is located at about 2 degrees south of the equator and one would expect at a temperature warmer than it is.

Instead of an expected equatorial temperature, there are temperatures in temperate regions. The most characteristic elements of this phenomenon is due to its elevation in general. And the highlands of the district are cooler in the country. Average temperatures will range between 15 ° C and 18 ° C throughout the year. This has implications for agriculture. There is thus a potential for some crops (maize, wheat, potatoes,) and a virtual exclusion of others that require more heat.

As the population tends to generalize the crop throughout the country, the potential output is uncertain. The temperature becomes a limiting factor as it could be a potential in the production if the agricultural specialization was strictly observed. If this specialization was well observed, the potential production determined by the climate would increase the volume of crops and thus promote exchanges between people of different regions. In planning ahead, it will be important to determine with sufficient accuracy plants suitable for each region to exploit the benefits of the climate through temperature levels.

Precipitation.

The following table shows the monthly precipitation height in millimetres. There are two **stations** in the district for the observations of rainfall; **Rulindo** and Rutongo, which worked respectively for 54 and 33 years. Annual data are averages of about 1243.3 mm (height)

The level of calculated mean monthly precipitation of 54 years at **Rulindo** and 33 years at Rutongo shows that there are two seasons of heavy rains (February to May and October-December) and two seasons when rainfall decreases sharply (from June to September and December -January). As in the rest of Rwanda, the agricultural year which begins in September with the rains and know four seasons: one rainy season that extends from September to December with a peak in November, the first dry season between December and

February, a second rainy season between February and June followed by a second dry season extends from June to August

In general, the district is well watered by referring to the total annual rainfall. The average of the two stations is 1243.3mm. Taking the average as that which applies throughout the district, this means that it falls on average 1.23 m³ of water over 1m² of land in the district. As the district covers some 567 km², it would fall 697 million m³ of water throughout the district. For an estimated population of 251,266 inhabitants, this represents approximately 2774 m³ of water available per capita per year or 7.6 m³ of water per day per capita. As seen, this is a significant potential that is very poorly exploited both as drinking water and as water for agriculture. So there is enough to satisfy the needs of agriculture and drinking water for everyone and all year round.

On the contrary, this potential is now considered a bottleneck. It creates a lot of nuisances. It takes everything in its path and the marshes are flooded during rainy seasons. When it does not rain, especially during the long dry season, the fields remain uncultivated because farmers can not sow or plant as they have lost their moisture. The perceived problem there is a problem of management of this potential. Rational management of this water would make it beneficial for the people of the region.

The effects of climate on soil conservation.

The effects of climate on soil conservation are generally expressed also by the rainfall. The other elements of climate such as temperature play very poorly on soil conservation in the district. Indeed, there is today, soils in the highlands of Rwanda are generally washed out where systems of soil conservation have not been developed. This is the case in the district that is the subject of description.

The effects of climate on agricultural production.

Here as elsewhere, the effects of climate on agricultural production is carried out negatively in two ways. The first is a gradual decline in production because of soil conservation is uncertain. Then the result of the production is below what it should be the result of conduct of the population in agricultural practices. People speculate agricultural practices and unsuitable to

the climate of a part or all of the district. This applies to the persistence of the banana in the high altitude areas where it can not bear the temperature that prevails there.

But the climate of the district that brings inconveniences. It is also a potential of the district. Indeed, it allows specialization of the district in speculation of some crops and promote an improvement in trade between different districts first, then among the countries of the region.

At district level, there would be a staging of cultures from the **banks** of the river of Nyabugogo in the region of Bwanacyambwe to the high peaks of the mountains of Bumbogo and Buberuka. Wheat, or passion fruit, tea, very suitable for cultivation in the region are becoming usual crop of people in the district.

Relief

The relief of the district is dominated by two parallel steep parallel: Bumbogo in the south and Buberuka in the north. They are oriented east to west. In between, there are two notched holes where two rivers flow (Bahimba and Base) separated by a third steep with minor importance and related to the Northeast of the district to of Buberuka cliffs. To the east there is development of high plateau of Buliza. All this is as a disturbed region collapsing from east to west in the centre and bordered to the south and north by great cliffs.

Hydrography.

Hydrography is the description of all the running water of a region. It concerns mainly the surface water. This data is in principle an important potential for development. Water is used to support life for people, animals and plants. But this potential can become a bottleneck if not properly managed, especially in a mountain region as **Rulindo** district where steep slopes predominate. We describe the four aspects: the rivers, drinking water, water for agriculture and water for energy.

Natural forests.

The natural forest has completely disappeared from the district. The vegetation on the type of district is anthropogenic.

GICUMBI DISTRICT

Location and geographic data.

Gicumbi district is one of five (5) districts of the Northern Province. It is located in the East of this province. Gicumbi district includes large parts of the old districts of Rwamiko, Rebero, Rushaki, Bungwe, Kisaro and the City of **Byumba**. Its area is 829 **km²**. The district includes 21 sectors, 109 cells and 630 villages. The district lays due-north of Kigali, straddling the major road from Kigali to Kampala. It is a hilly district.

The district includes the following limits:

- North: From West to East, the district of Gicumbi respectively bounded by the Burera district, Rwandan-Ugandan border and the district of Nyagatare.
- In the East: From North to South, the district of Gicumbi is limited by the districts of Nyagatare, Gatsibo and Rwamagana.
- In the South: from East to West, the district of Gicumbi has the border with Rwamagana and Gasabo districts
- To the West: from South to North, the district is limited by Gasabo, **Rulindo** and Burera districts.

Relief.

The relief of Gicumbi district is very rugged with steep slopes where the altitude culminates at 2500 meters. The valleys are deep and narrow. To the East, there are rather plains with altitudes ranging between 1 500 and 1 800 meters. To the South, Muhazi Lake has an altitude of 1500 meters and is the border between the two districts of Rwamagana and Gasabo

Hydrography.

The major rivers in the district are: Mwange, Mulindi; Muturiwa, Walufu and Bulimba. Gicumbi district has also a few water supplies scattered here and there and likely to provide hydro-electrical power. The flow of these rivers and supply systems varies seasonally. Despite this abundance of water sources, the district's population suffers from drinking water shortage, since most of these sources are in the lowlands (valleys) while the population prefers to live in the slopes and hilltops. Thus, conveyance of water by gravity is not possible and the installation of the pumps is expensive. Gicumbi district shares Lake Muhazi with other districts

namely Gasabo, Gatsibo and Rwamagana.

The whole river system of the district of Gicumbi belongs to the Nile Basin. The density of the network is important in the West, the regime is torrential and rivers are often cut off from falls or rapids that can produce electrical energy. Several rivers and streams can have flooding during the rainy season and abruptly fall during the dry season, hence the difficulty to know exactly their flows.

Gicumbi district has one lake; Muhazi. It has a large marsh with plenty of water. Exploitation for agricultural purposes is prohibited so as not to deplete water of Burera and Ruhondo districts. Despite all this rich hydro potential, the district of Gicumbi lacks drinking water. People live in the tops of the hills yet the water sources are in the shallow valleys. Because of the very rugged terrain, the piped water by gravity is rare. Water supply by pumping is very expensive and difficult to maintain.

Agro-climatic zones.

According to the classification of agro bioclimatic Rwanda (Agricultural Agenda 2003, soil map), the district of Gicumbi belongs to three agro-climatic zones:

- In its north-south axis, from Kaniga sector to Rutare sector, the district is in the area of the highlands of Buberuka characterized by a very hectic terrain, a succession of steep hills separated by valleys, a high altitude varying from 1 800 to 2650 meters, rainfall varies from 1 200 to 1 564 mm, an average annual temperature of 15-16 ° C and land degraded by rain erosion.
- In the East South axis, from Bwisige sector to Bukura sector there is the zone of plateau in the Est, characterized by a relief of less tormented interfluves of Muhazi-Nyabugogo basin, an altitude ranging between 1 500 and 1 600 meters, an average annual rainfall of about 1000 mm and an average temperature of about 23 ° C.
- And finally, in its western part, covering a big part of Mutete and Rutare sector is the area of the Central Plateau characterized by an interim relief, an altitude from 1 600 to 1 800 meters, an average annual rainfall of 1000 to 1 100 mm and an average temperature of about 20 ° C.

Climate.

The climate of the district of Gicumbi alternates between dry and rainy seasons with winds from the tropics and the monsoon from the Indian Ocean and Lake Victoria. The area of the eastern district enjoys a temperate climate with an equatorial average annual temperature of 20 ° C. In the region of high altitude, the annual average temperature average oscillates between 11 ° C and 15 ° C. Towards the altitudes of 2000 meters, the climate is cold and wet.

In general, rainfall is abundant but irregular, sometimes improvised during the dry season. There are often major landslides during the long rainy season. In the mountainous area in the western part of Gicumbi district, the rainfall exceeds 1200 mm per year whereas the average is 950 mm per year in the East

Soils.

Overall, the soils of the of Gicumbi district are kaoli soils which are dominated by shales, the mica and quartz. They are acidic (pH around 5) and have a high content of clay, well developed topsoil and an acceptable level of exchangeable bases.

- The group of kaolin dominates quartz and shales with a high content of clay;
- Soils derived from shales in fine silt with high water retention;

The ferric-soils rest on a lateritic layer of varying thickness from which agricultural value depends on the state of conservation of the humus layer which is often very low, their vocation is often forestry and pastoral;

- The ferric-soils and litho-soils on quartz rich in gravel and stones
- The very stony soils on quartz for the sole purpose of forestry;
- Organic soils of valleys with high agricultural potential but with very indispensable drainage,

In all kaoli-soils, the ferric-soils have the high potential fertility provided that anti-erosion measures required by the very rugged terrain, save their humus layer. In general, soil productivity of Gicumbi decreases year by year due to rainfall erosion caused by terrain and as a result of the overexploitation of land due to population pressure and lack of organic manure.

II.2. DESCRIPTION OF THE SOCIO-ECONOMIC ENVIRONMENT

RULINDO DISTRICT

Socioeconomic situation of RULINDO District

Almost the entire population of the district of Rulindo lives of agriculture, although practiced in archaic manner. Food crops found in the area are mainly: beans, sweet potato, cassava, sorghum, corn, peas and wheat. It has also vegetable crops such as tomatoes, cabbages, carrots and eggplants. The passion fruit is the main fruit crop available in the district. Two cash crops are found in the district area: tea and coffee.

As elsewhere in the country, livestock was decimated during the war and the genocide of 1994. Despite the efforts undertaken by some stakeholders to develop again the livestock, the public always evokes the lack of livestock as being closely linked to the reduction of agro-pastoral production. Veterinary clinics are under-equipped and lack of means of transport, technicians in place are unable to cover the full extent of their area of assignment.

Different sectors of the district have literacy centres, nursery schools, primary schools, training centres for youth (CFJ), high schools and a higher institute in Tumba. Most learning centres are in poor conditions and shows a lack of equipment, some of them are to be rehabilitated and / or be extended or construct new ones.

Rulindo district currently has one hospital, 15 health centres (an estimate of over 17,000 inhabitants per health centre), 6 doctors and 141 nurses. The lack of medical personnel in all health facilities and even, sometimes inadequate and the lack of housing has hindered performance in terms of health services in the district.

The problem of water shortage in the district of Rulindo remains crucial. The population of this district has difficulties in accessing to clean water due to the insufficient number and position of topographic sources and water supply in such a way that the majority of people travel more than 4 km in search of water. Statistics show that for a total of 467 sources, only 131 are in good condition, 336 are to be rehabilitated and the district still needs to build 171 over 5 years.

The district of **Rulindo** is very poorly supplied with electrical energy, as only 0.2% of households are connected to the grid. Firewood is used in most households to meet their needs resulting in continued deforestation.

Commercial activities in **Rulindo** district do register enough progress in recent days. They mainly concern the flow of food products with a few items available in shops located in various trading centres of the district. Covered Markets have started to settle in the area and it is an asset for the promotion of trade in the local environment.

Transport infrastructure and communication.

The roads, their condition and density.

The most commonly used communication in the district is the road. The district has access to 39.3 km of asphalt road with 29.3 km crossing between Nyarugenge district to the east and Gakenke district to the west. The remaining 10 km are the limit with the district of Gasabo. It is also crisscrossed by 67 km of on asphalt roads considered national, 350.5 km considered as regional and 1038.5 km of local network roads. This gives an average of 2.6 km per km². However, the majority of these roads are made up of local roads which form 69.5% of total roads.

The roads are in poor conditions as they represent over 80% of all roads. This is due to the fact that only 2.6% are paved and the rest not asphalted.

Telephone services and ICT.

Telephone services and ICT are very insecure in the district. Apart from a few mobile phones whose numbers are difficult to define, there are few telephones in the district. However, it should be noted where there is currently an adequate network of MTN Rwandacell and TIGO whose phones are the most commonly used in rural areas, since they do not require pulling wires to access communication.

GICUMBI DISTRICT

Population of Gicumbi district

The total population in Gicumbi is 362 331 inhabitants with 172 144, or 47% are men and 190 187, or 53% are women. The density is 437 inhabitants per km².

Areas of human development.

Health

As elsewhere in Rwanda, the public health system is based on primary health care strategy. The geographical **distribution** of health facilities is satisfactory with an average of health center per sector.

In the community of Gicumbi district, we find a ratio of a doctor and 15.4 paramedics per 100 000 people against 1.8 doctors and paramedical 17.9 100 000 people at the national level, as elsewhere in Rwanda, much of the personnel (50.7%) are concentrated in the city and qualifications of the staff do not always match the needs of service. The formal private sector in health is still not widespread, except for some concentrated medical offices, especially in cities

The traditional medicine (Tradi-practitioners, traditional birth attendants, etc.) occupies a large part in the health region. But everything remains to be redefined because often many confuse them with the charlatans who watch as looking for their own profits.

Furthermore, as foreign aid has declined significantly recently in Rwanda from \$ 20 million between 1994 and 1999 to less than \$ 10 million in 1999-2000 (Vision 2020) and the Rwandan government in financing health, has increased from 2.2% of the national budget in 1997 to 4.1% in 2000, rates are still very low compared to WHO recommendations (12% of the national budget) while the rate Inflation stabilized at 2.1%. (MINECOFIN, Department of Statistics, July 2001.)

The first causes of morbidity are respectively malaria, the parasites, skin diseases, trauma, malnutrition and problems gynecological - obstetric. The abortions are prominent among the reasons for hospitalization for gynecological problem Gicumbi district. The rate of assisted deliveries is only 38.6%. All health facilities have inadequate staffing in both quality and quantity. All health facilities have now integrated the system of mutual health organizations in their activities, but membership rates vary from one formation to another, ranging from 60 to 89.5%. The average rate was 74.5% in April 2007. (Gicumbi district report, 2007).

Habitat

The habitat is a serious problem for the district of Gicumbi. In general, it is dispersed and further complicates the difficult access of the population to basic social services (health care,

drinking water, electricity, education,) and the development of communication. This mode of dispersed settlement has another drawback that is the excessive fragmentation of land and miniaturization of family farms, making these economically unviable. The population seems to understand all these constraints and remains open to the consolidation of a coherent policy will specifically be identified and serviced (sanitation, water and sanitation, education, electricity, roads, pharmacies, markets, etc). In the urban area of **Byumba**, the protocols of urbanization have not been met; the urban habitat is disorganized.

Water and sanitation

The hydraulic network of the district of Gicumbi is dense. The area has high altitude sources including the capture and conveyance by gravity can serve many families. There are also shallow sources that can be improved to feed the population. Overall the lack of access to clean water is still outstanding; the average access for the entire district is 1.582m away.

Economic Development Sector.

Agriculture

Agriculture in the district of Gicumbi occupies over 90% of the population. The agricultural production system is characterized by the family farm, and remains farming for substance. This agriculture is dominated by food crops (beans, maize, sorghum, small weight, potato, wheat, vegetables, passion fruit, sweet potatoes, cassava, banana, soybeans, etc..) and two industrial crops namely coffee and tea. Agricultural tools available are practically limited to the hoe and the machete.

Breeding

In general, the district of Gicumbi we notice the lack of modern livestock infrastructure. As for improved pastures, the only area that stands out is Manyagiro sector in which vulnerable families received an improved cow an arithmetic mean of 60 acres of forage.

Two veterinary clinics and 42 races for the entire district which seems very inadequate to the development of this sub-sector. Concessions for intensification inputs are very rare, and when they exist, they are rather empty.

Beekeeping.

Beekeeping is partially exploited using traditional techniques. The hives are mostly of wood (i.e. traditional) and are not well designed in a way that sometimes the swarms of bees often

die during periods of rain. The productivity is still low.

Afforestation

A commendable effort has been made but there is not enough because the forest area of the district represents 5%, while the objectives of MINAGRI / MINIRENA is 30%. Hence, 5% of the existing, private sector proportion is 76%, allowing one to hope definite improvement in the near future.

Infrastructure

Gicumbi district has a range of infrastructure in relatively good conditions which scattered throughout the district and administrative localities as detailed below:

- Existence of the urban center (City of Byumba)
- Existence of administrative infrastructures
- Existence of the national electric lines (via Ntaruka) and foreign (via Kabare)
- International asphalt road that joins Kigali and Gatuna
- Existence of the inter-district and inter sectoral roads
- Telephonic network existing (stationary and portable)
- Existence of the farming agglomerations (imidugudu)

Education

Gicumbi district the following education levels for formal: the nine year basic education, secondary education, professional education, university education and functional elimination of illiteracy.

The district of Gicumbi currently has 148 nursery schools, 90 nine year basic education schools including 3 that are privately owned, 27 secondary schools including 6 which are privately owned, 6 Youth Training centres commonly known as CFJ of which 1 only is publicly owned, 173 Centres for illiteracy elimination and 2 Institutes of higher learning: Polytechnic institute of Byumba (IPB) and Higher Institute of Health of Byumba.

Land and housing

The process of distributing land begins with preparing agglomerates because it was discovered that the essential infrastructure that can bring economic and social development must be brought to agglomerates so that people can get attracted to live there.

According to MINALOC program, people should live in well arranged villages, because of that Gicumbi district prepared at least one village in each sector so that it can be used as exemplary to others and this village should be having all the essential socio-economic infrastructure.

Gicumbi does not have a good town plan. The settlement, up to now, is still dispersed, the biggest number of the houses is not well constructed and they are dispersed on the slopes of the hills. It is a very small number of people that are living in agglomerates.

This dispersed kind of settlement does not allow many people to easily get access to essential socio-economic infrastructure. And it also does not favor agriculture because it is not easy to cultivate or graze on scattered pieces of land. It does not allow access to land for agriculture and the problem of the cultivable land is very crucial in this district.

In addition, dwelling houses are built in poor quality and nondurable materials. Most of these materials, in almost the whole district are made out of mud bricks with straw roofing.

Industry

The industrial sector is almost non-existent in Gicumbi district due to lack of essential infrastructure like electricity, water, and roads. However, a few processing units of agricultural products are in place with an aim of increasing the value of certain products like coffee that represent a considerable economic potential for the district.

The art and craft industry is usually practiced at the level of associations and individuals. The major artisanal activities are masonry, shoe making, carpentry, pottery, brick making, joinery, hair dressing, weaving, watch, radio and bicycle repairing.

The low capacity of organization and management of craftsmen, lack of raw materials, insufficient incomes, weak purchasing power, difficult in accessing foreign markets as well as

not having quality products that can compete on the international market are some of many factors which contribute to the lethargy of the arts and crafts industry.

There is need to encourage foreign investors to invest in the district especially in the agricultural sector due to the soil fertility in the district and abundance of cheap labour. There is also need to encourage the population to use modern methods of technology in order to increase their productivity and hence improve their standards of living.

Tourism

The tourism sector in the district can be a source of employment to a big number of people. It is not yet well developed in the district in spite of its potential to create jobs and generate income. Yet the tourist attractions are available in the district whereby we find high mountains that offer beautiful panoramic views of the volcanoes.

There are also several Hotels like Hotel Urumuli , restaurants and bars that can accommodate tourists. Although they are not many but plans are being put in place to build more and encourage investors to invest in this sector. There are also five centres of welcome at Rwesero, Karambo, Rukomo, pastoral Centre, and at the EER Diocese in **Byumba**.

Trade

Gicumbi district's trade is mostly practiced through shops, small bars, restaurants, and some other two small hotels. There are some markets amongst which some are well constructed others still operating from places that are not roofed in such a way that traders have to endure the rain and the sun that bothers them a lot and spoils their merchandise.

There are even micro finance lending institutions and savings cooperatives that help people to access financial facilities.

The district indulges in trade with the other districts that it shares the borders with especially in agricultural products. The district built and rehabilitated some markets and this helped greatly in improving trade within the district. Trade in the district is improving as more people participate in it.

There is need, however, for well constructed markets so that traders can practice their trade better and trade would be generally improved in the district. The district is encouraging investors to invest in trade because there are profits especially in the agricultural sector.

III. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

III.1. POLICIES RELEVANT TO THE SUBPROJECT

A. Energy Policy

The national policy goal is to meet the energy challenges and needs of the Rwandan population for economic and social development in an environmentally sound and sustainable manner.

Since 1994, the energy sector as well as the overall economy has gone through structural modifications, where the role of the Government has changed, markets have been liberalised and private sector initiatives encouraged. Hence, the energy policy document has to take into account structural changes in the economy and political transformations at national and international levels.

The national policy objective for the development of the energy sector is to provide an input in the development process by establishing an efficient energy production, procurement, transportation, **distribution**, and end-user systems in an environmentally sound manner.

The Energy Policy, therefore, focuses on market mechanisms and means to reach the objective, and achieve an efficient energy sector with a balance between national and commercial interests.

An interactive and participatory process between government, other stakeholders and relevant groups has been necessary as part of the formulation process in order to incorporate views of market actors and energy consumers to address the complex nature of the sector.

Specifically, the energy policy takes into consideration the need to:

- (a) Have affordable and reliable energy supplies country wide;

- (b) Reform the market for energy services and establishes an adequate institutional framework, which facilitates investment, expansion of services, efficient pricing mechanisms and other financial incentives;
- (c) Enhance the development and utilisation of indigenous and renewable energy sources and technologies,
- (d) Adequately take into account environmental considerations for all energy activities,
- (e) Increase energy efficiency and conservation in all sectors; and
- (f) Increase energy education and build gender-balanced capacity in energy planning, implementation and monitoring.

Domestic energy demand has grown rapidly due to population growth and the increase in economic activities especially during the last ten years

The vision of the energy sector is to effectively contribute to the growth of the national economy and thereby improve the standard of living for the entire nation in a sustainable and environmentally sound manner. The mission of the energy sector is to create conditions for the provision of safe, reliable, efficient, cost-effective and environmentally appropriate energy services to all sectors on a sustainable basis. By fulfilling its vision and mission, the energy sector will contribute to social economic development, and in the long-term framework, poverty reduction.

The national energy policy objectives are to ensure availability of reliable and affordable energy supplies and their use in a rational and sustainable manner in order to support national development goals. The national energy policy, therefore, aims to establish an efficient energy production, procurement, transportation, **distribution** and end-use systems in an environmentally sound and sustainable manner.

Short and medium term priority policy actions

The priority for Rwanda is to implement sub**projects** now, to overcome the current electricity crisis, to prevent the next electricity crisis, to tackle proactively the wood crisis, to begin to provide greater access to modern energy and to reduce reliance on petroleum products due to the oil price crisis. Without implementation further capacity building and studies will have no value.

The management and institutional capacity has to continue to progress if these subprojects are to be delivered effectively and efficiently. This will require further external support and guidance.

Several policy actions will be implemented in order to achieve the broad and specific objectives of this energy policy. Strategic financial interventions required to move forward the policy priority actions are indicated alongside the proposed actions.

Below are the priority policy actions:

- Meet the crisis of blackouts caused by delayed investment and drought
- Provide economic power by developing the use of Lake Kivu methane, and by bringing on line more hydro power.
- Enhance overall electrical infrastructure to meet demand growth and supply quality needs – generation, transmission and major distribution construction and rehabilitation.
- Deliver a programme of rural electrification on the basis of enhanced distribution networks, micro hydro, and solar power.
- Implement a wood and charcoal efficiency and substitution strategy to counter the deforestation crisis.
- Continue steady progress to a viable electricity and gas sector, consistent with meeting social needs.
- Commence utilisation of Kivu gas for other than power generation.

B. Land Policy

Apart from a few scattered land regulations, most of which date back to the colonial period, Rwanda has never had a proper land policy, a situation that enhances the existing duality between the very restrictive written law and the widely practised customary law, giving rise to insecurity, instability and precariousness of land tenure.

The Rwandan Government, therefore, found it compelling and necessary to establish a national land policy that would guarantee a safe and stable form of land tenure, and bring about a rational and planned use of land while ensuring sound land management and an efficient land administration.

The following are the main obstacles that hinder the efficient management of land in Rwanda, necessitating the establishment of a national land policy that would guide the essential land reforms:

- Strong pressure on the already spatially limited land resources by a rapidly growing population;
- Domination of the agricultural sector which lacks any specialization in terms of human resources and equipment, and lack of alternative concrete and realistic options that would reduce the pressure on land resource;
- A land tenure system dominated by customary law which favours land fragmentation, a practice which reduces further the size of the family farms which are already below the threshold of the average surface area that is economically viable;
- A considerable number of landless persons who have to be resettled at all costs;
- Scattered farming plots that are difficult to manage due to the scattered mode of human settlement;
- Lack of a reliable land registration system that would guarantee the security of land tenure;
- Weak and inadequate existing methods of land-use planning and land improvement (outline of land potential, land use and land development; reliable methods of soil and water conservation);
- Disorderly and fraudulent land transactions, necessitating the establishment of regulations that would enable the authorities to give to the land a recognised market value that brings considerable profit to the Government Treasury;
- Unplanned use of marshlands which, in spite of their good agricultural soil, cannot be wholly recovered for agricultural purposes, in view of the following factors:
 - Abundance of water which is necessary as a useful water reservoir;
 - The soil make-up, which does not lend itself easily to the current cultivation methods;
 - The biotic environment and biodiversity which should be protected at all costs;
 - The obvious poor coordination among various institutions which use with land to support their activities;

Currently, the land tenure system in Rwanda operates in a dual legal system: On one hand, there is: the customary law, which governs almost all the rural land and promotes the excessive parcelling out of plots through the successive father-to-son inheritance system. And

on the other, there is the written law, which mostly governs land in urban districts and some rural lands managed by churches and other natural and legal persons. This law confers several land tenure rights to individuals such as land tenancy, long term lease and title deeds (particularly in towns).

On the whole, Rwanda's land tenure system requires comprehensive reforms, from the elaboration of a national land policy to the establishment of a land law and land code, which will guide the judicious use and management of the land resource for the economy to be able to take off in such a way that our country is freed from the grips of poverty.

In the perspective of the harmonious and sustainable development, the overall objective of the national land policy of Rwanda is to establish a land tenure system that guarantees tenure security for all Rwandans and give guidance to the necessary land reforms with a view to good management and rational use of national land resources.

In Rwanda, there are currently two modes of land acquisition, namely acquisition according to customary law or conceptions, and acquisition according to the rules of the written law.

According to custom, land ownership is held by whoever occupies the land first. This rule has always been respected in our society. However, in modern times, land acquisition by occupation has become obsolete since all vacant land belongs to the State. Likewise, the provisions of the decree-law No. 09/76 of 4th March 1976, article 1, stipulate that 'all land not held under the written law and affected or not by customary law or land occupation belongs to the State'.

Customarily, land rights are passed on from father to son through inheritance. Girls are excluded from inheritance of the family land from the father. Concerning inheritance rights of widows, the custom merely gives them the right to use the land that belonged to their deceased husbands.

In its original customary conception, land was owned collectively. Any disposal of land was therefore inconceivable, since such land was considered as family property that belonged to the ancestors, as well as to present and future generations.

With the introduction of the subdivision of land into individual plots due to successive inheritance procedures, each family owner of a plot of land was considered as the real owner

of the plot, having the right to dispose of it as it wishes. However, Article 2 of the decree-law No. 09/76 of 4th March 1976 stipulates that nobody may sell off his land rights except with the written authorization of the Minister of Lands upon the recommendation of the Municipal Council where the land is located.

In actual fact, ownership through prescription originates from the written law since traditionally, title deeds were unheard of. Rwandans consider that once a right has been acquired or recognized, even customarily, it is indefeasible. This is why the many existing landless people, not having received any new land, continue to feel cheated and left out because they have no right over the land which they owned customarily over 30 years ago, since the law has fixed the time limit of acquisition by prescription to 10 years.

Tenancy contracts of plots for building purposes for a 3-year period in urban areas. Long lease contracts of land for agricultural purposes for a period of 15 years or more in rural areas. Free assignment contracts in both rural and urban areas to natural or legal persons for social activities with real impact on the welfare of the people. Sale contracts and title deeds for plots that are built in urban areas. This is a system of land tenure by urban residents who first lease plots with the contractual obligation of developing them. The Ministry of Lands delivers the title deeds after confirming that the plots have been developed. Right of access: mode of land acquisition which is common for public institutions.

Apart from the above-mentioned different modes of land acquisition and land ownership, there is the case of the landless people who live in rural areas and who must live from farming. These are mostly the refugees of 1959 who were forced into exile for political reasons and left their land behind. These same refugees have now returned to their country and find themselves landless. They cannot claim back their previously owned land which has been occupied by other Rwandans who remained in the country, because the Arusha Peace Accords fixed the time limit for acquisition by prescription to 10 years.

C. Land Law

This organic law n° 08/2005 of 14/07/2005, determines the use and management of land in Rwanda. It also institutes the principles that are respected on land legal rights accepted on any land in the country as well as all other appendages whether natural or artificial.

Land is part of the public domain of all Rwandans; ancestors, present and future generations. With exceptions of the rights given to people, the state has supreme powers to manage all the national land, and this is done in public interest aimed at sustainable, economic development and social welfare, in accordance with procedures provided for by law. In that regard, it is the state that guarantees the right to own and use the land. The state also has rights to expropriation due to public interest, settlement and general land management through procedures provided by law and prior to appropriate compensation.

This organic law protects equally the rights over the land acquired from custom and the rights acquired from written law. With regard to law, owners of land acquired from custom are all persons who inherited the land from their parents, those who acquired it from competent authorities or those who acquired it through any other means recognized by national custom whether purchase, gift, exchange and sharing.

A land can be categorized urban and rural land (which is confined within boundaries of towns and municipalities established by law), individual land (composed of the land acquired through custom, written law which excludes public land or district, town, municipality and the City of Kigali land, the one acquired from competent authorities, purchased land, gift, exchange and sharing and state land (which makes up the public domain consists of all the land meant to be used by public or land reserved for organs of state services as well as national land reserved for environmental protection;

1° Land containing lakes and rivers as listed by an order of the Minister having water in his or her attributions;

2° Shores of lakes and rivers up to the length determined by an order of the Minister having environment in his or her attributions starting from the furthest line reached by water depending on successive floods. This is not concerned with exceptional floods;

3° Land occupied by springs and wells determined in accordance with an order of the Minister having water in his or her attributions;

4° National land reserved for environmental conservation composed of natural forests, national parks, reserved swamps, public gardens and tourist sites ;

5° State roads and their boundaries which were listed by the order of the Minister having infrastructure in his or her attributions;

6° Land and buildings the administration reserved for public activities or the land used by public administration organs).

Under this law, registration of land a person owns is obligatory. An employee called the Land Officer who directs the land bureau, shall keep land registers and issues certificates approving ownership of land.

Regarding land issues, he or she holds the power of the public notary and in regard to administration; he or she is supervised by administration of town, municipality or district in which the land he or she is responsible to register is located.

Without prejudice to laws related to human settlement, general land organization and use, the landowner shall enjoy full rights to exploit his or her land in accordance with the existing laws and regulations. However, the laws stipulates that the landowner has no right over minerals and any other wealth underground; they belong to the State but the landowner is allowed before others to enjoy rights of their exploitation upon his or her request and if he or she is capable.

Besides the rights that are enjoyed by the land owners, there some obligations that have to be full filled; unless it is considered to be necessary, the landlord shall not act against other people's rights.

In that regard he or she shall not:

- 1° refuse passage to his or her neighbors leading to their homes when there is not any other way;
- 2° blocking water that is naturally flowing through his or her land from other persons' land above his or hers;
- 3° refuse other people to draw water from a well found on his or her land unless he or she can prove that such a well has been dug or built by him or her.

The law envisages penalties in case of non compliance of the obligations of the land owners. There exist Administrative penalties (requisition of degraded and the unexploited land, forceful confiscation of degraded and unexploited land, repossession of requisitioned land) and penal sanctions (payment of cash as fines).

III.2. ORGANIC LAW ON ENVIRONMENTAL PROTECTION AND MANAGEMENT

The law sets out the general legal framework for environment protection and management in Rwanda. It also constitutes environment as a one of the priority concerns of the Government of Rwanda. Under the fundamental principle on national environmental protection policy develops national strategies, plans and programs, aiming at ensuring the conservation and use of sustainable environmental resources.

The law gives right to every natural or legal person in Rwanda to live in a healthy and balanced environment. They also have the obligation to contribute individually or collectively to safeguard country's natural, historical and socio-cultural heritage.

The framework of the law on the protection and management of natural resources centres on avoiding and reducing the disastrous consequences on environment. It measures result from an environmental evaluation of policies, programs and subprojects, aimed at preventing the consequences of such activities.

The principle of sustainability of environment and equity among generation emphasizes human beings at the core of sustainable development. They therefore, have a right to a healthy and productive life in harmony with nature. They must so as to equitably meet the needs of the present and future generation.

The protection and management of environment is currently registered in the environmental organic law that has been published in the official Rwanda newspaper in April 8th 2005.

Under the article 65 put, Rwanda Environment Management Authority (REMA) is the institution charged with the responsibility of ensuring environmental protection by demanding for EIA studies to be undertaken before subprojects are executed.

The present organic law has the following objectives:

- To protect human and natural environment;

- To establish fundamental principles of management and protection of environment against all forms of degradation so as to develop natural resources and to fight all kinds of pollutions and nuisances;
- To improve the living conditions of the population while preserving ecosystems and available resources;
- To ensure sustainable environment and resources as well as rational and sustainable use of resources, taking into account the equality between the present and future generations;
- To guarantee to all Rwandans an economically viable, ecologically rational and socially acceptable development;
- To establish the precaution principle in order to reduce the negative effects on Environment and ensure the rehabilitation of degraded areas.

Chapter IV of the Organic Law Article 67 clearly calls for the need to subject subprojects to mandatory Environmental Impact Assessment.

Article 3: States that every person has the duty to protect safeguard and promote environment. The States shall protect, conserve and manage the environment.

Article 67: Further specifies that every subproject shall be subjected to environmental impact assessment prior to its commencement. It shall be the same for programs, plans and policies likely to affect the environment. Specific details of subprojects referred to in this Article shall be spelt out by the order of the Minister in charge of environment.

Article 68:

The Environmental Impact Assessment (EIA) shall include at least the following:

- A brief description of the subproject and its variants.
- Analysis of direct and indirect foreseeable consequences on the environment.
- Analysis of the initial state of the environment.
- Measures envisaged reducing, preventing or compensating for the consequences.
- Reasons for the choice.
- A summary of requisitions from clause 1 to 5 of this article;
- A definition of the evaluation and monitoring methods used regularly and environmental indicators before (initial state), during and after implementation of

- the subproject or, as the case may be, at the final evaluation stage of the subproject;
- A financial evaluation of measures recommended preventing, reducing or compensating for the negative effects of the subproject on the environment and measures for regular monitoring and control of relevant environmental indicators.

Article 69:

States that the analysis and approval of environmental impact assessments is done by the Rwanda Environmental Protection Authority or any other person given a written authorisation. The subproject promoter shall pay a levy which shall be assessed from the amount invested or to be invested, excluding the amount of operating cost. The assessment of this levy shall be fixed by law establishing the National Fund for the Environment. The impact study shall be done at the expense and under the responsibility of the promoter.

The Organic Law also puts in place the National Fund of the Environment in Rwanda (FONERWA). The composition, the working and the assignments of these institutions will be determined by particular laws.

The article 66 of the Organic Law on the environment specifies that it has created, to the level of the Provinces, of the City of Kigali, of the Districts, the Cities, the Sectors and the Cells, Committees responsible for the conservation and the protection of the environment. The composition, the working and the assignments of these committees will be determined by Decree of the prime minister.

Title IV of Article 67 of the Organic Law requires that the execution of Policies, Plans and Subprojects must be subject to mandatory EIA studies to identify the potential adverse impacts they could have on the environment.

Further to this through the Ministerial Decree, a list of all the subproject that must be subjected to mandatory EIA has been put in place under article 30 of the Organic Law which stipulates that works of public or private construction as roads, dams etc must be subjected to EIA studies.

Article 69 of the Organic Law further specifies that the EIA studies undertaken must be submitted to REMA for approval and the studies must be undertaken at the proponent's expense.

III.3. ENVIRONMENTAL CLEARANCE PROCEDURES

REMA has now developed the EIA regulations which provide a guideline and requirements for EIA in Rwanda. According to these new regulations Sub Article 1 makes it mandatory for all the subprojects listed under schedule I to be subjected to a full scale EIA. The Sub Article further states that :

Sub Article 1) No environmental authorization shall be granted by the Authority for any subproject in Schedule I to these Regulations if no environmental impact assessment has been submitted to the Authority in accordance with the provisions of these Regulations.

Sub Article 2) states that any subproject listed under Impact Level III of Schedule I to these Regulations shall require a full environmental impact assessment by the preparation of an environmental impact report, unless the Authority refuses permission. The expansion of distribution network in Kigali City that involves construction of substation and electrical lines is in this category and thus must be subjected to full scale EIA.

Public Hearing Process

Article 47: The Authority shall on receipt of the developer's environmental impact report, arrange for a public hearing to take place within twenty (20) working days from the first day of public notification, at which relevant Lead Agencies, local governments, civil societies and concerned members of the public may comment on the environmental impact report and express views on impact of the proposed development. The Authority shall cover all costs incidental to the public hearing.

Article 48: All subprojects classified under Impact Level III shall be subjected to a public hearing prior to the decision-making process.

III.4. INTERNATIONAL LEGISLATIONS RELEVANT TO THE SUBPROJECT

Rwanda is a signatory to a number of conventions on sustainable development and is a member of various bilateral and multilateral organizations. Some of the relevant development partners in this subproject are the World Bank and a number of United Nations agencies.

World Bank Environment and Social Safeguards Policy

World Bank Operational Policies (OP) and Bank Procedures (BP) Environmental Assessment - BP4.01 and OP 4.01 (January 1999) all of which require environmental assessment of subprojects proposed for World Bank financing to help ensure that they are environmentally sound and sustainable.

The World Bank provides guidance on EIA requirements through the Environmental Assessment Sourcebook (World Bank 1994) which includes sectoral guidelines. The World Bank EIA process is implemented through a set of Operational Policies/Directives whose primary objective is to ensure that Bank operations do not cause adverse impacts and that they “do no harm”. These safeguard policies are grouped into Environment, Rural Development, Social Development and International Law.

The following safeguard policies have been considered in this EIA.

Environment

OP/BP 4.01 Environmental Assessment (January 1999)

Environmental Assessment is one of the 10 safeguard policies of the World Bank. The World Bank Environment and Social Safeguard Policy aims at improving decision making, to ensure that subproject options under consideration are sound and sustainable, and that potentially affected people have been properly consulted.

The World Bank's environmental assessment policy and recommended processing are described in Operational Policy (OP)/Bank Procedure (BP) 4.01. The World Bank system assigns a subproject to one of three subproject categories, as defined below:

Category A: An EIA is normally required because the subproject may have diverse significant impacts (subprojects in this category are forestry, large industrial plants, irrigation and

drainage, mineral development (including oil and gas), pipelines (oil, gas, and water), resettlement, rural roads, tourism, urban development, large transmission lines, etc.).

Category B: A limited environmental analysis is appropriate, as the subproject may have specific environmental impacts. Subprojects in this category include agro-industries (small scale), aquaculture & marine culture, small industries, mini-hydropower station, public facilities (hospitals, schools, housing complexes, rural electrification, telecommunications, small-scale tourism, rural water supply, etc.

Category C: Environmental analysis is normally unnecessary, as the subproject is unlikely to have significant environmental impacts. Subprojects in this category include education, family planning, nutrition, institutional development, technical assistance, etc.

OP/BP 4.04 Natural Habitats (June 2001)

Supports the conservation of natural habitats and the maintenance of ecological functions as a basis for sustainable development. The Bank does not support subprojects that involve the significant conversion or degradation of critical natural habitats.

Rural Development

OP 4.36 Forests (November 2002)

Aims to reduce deforestation and enhance, through sustainable economic development, the environmental and social contribution of forests. The Bank does not support subprojects which involve significant conversion or degradation of critical forest areas or related critical natural habitats.

Social Development

OP/BP 4.11 Physical Cultural Resource (July 2006)

Cultural property is defined to include both remains left by previous human inhabitants (e.g. middens, shrines) and unique natural environmental features such as canyons and waterfalls. The Bank does not support subprojects that will significantly damage non-replicable cultural property and assists only those subprojects that are sited or designed so as to prevent such damage.

OP 4.10 Indigenous Peoples (July 2005)

Indigenous peoples in particular geographical areas are identified by having: a close attachment to ancestral territories and to the natural resources in these areas; self-identification and identification by others as members of a distinct cultural group; an indigenous language, often different from the natural language; presence of customary social and political institutions; and primarily subsistence-oriented production.

The Bank's objective is to ensure that indigenous peoples do not suffer adverse effects from Bank financed subprojects and that they receive culturally compatible social and economic benefits. Effectively the World Bank requires a subproject to develop a program for addressing issues based on the informed participation of the indigenous people themselves. Any subproject that affects indigenous peoples is expected to include components or provisions that incorporate an "Indigenous Peoples Development Plan".

OP/BP 4.12 Involuntary Resettlement (December 2001)

Details involuntary resettlement, emphasizing the severe economic, social and environmental risks, if unmitigated. It ensures that the population displaced by a subproject receives benefits from it and also covers those with usufruct or customary rights to land or other resources taken for the subproject. The Operational Policy is specifically inclusive, ensuring that all those affected both directly and indirectly by subproject developments are compensated as part of the subproject. Affected population, include those with income derived from informal sector and non-farm activities, and from common property resources. The absence of legal title does not limit rights to compensation.

The World Bank's Policy objectives urge that involuntary resettlement be avoided whenever possible. If unavoidable, displaced persons need to:

- Share in subproject benefits,
- Participate in planning and implementation of resettlement programs, and
- Be assisted in their efforts to improve their livelihoods or standard of livings or at least to restore them, in real terms, to pre-displacement levels or levels prevailing prior to the beginning of subproject implementation, whichever is higher.

OP 17.50 Disclosures

This Policy details the Banks requirements for making operational information available to the public. The Bank reaffirms its recognition and endorsement of the fundamental importance of transparency and accountability to the development process. In addition, timely dissemination of information to local groups affected by the subprojects and programs supported by the Bank, including nongovernmental organizations, is essential for the effective implementation and sustainability of subprojects.

Rwanda has ratified the following international conventions and protocols pertaining to the environment and which are of relevance to the Subproject:

- United Nations Framework Convention on Climate Change, 1992
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal adopted on 22 March 1989
- Bamako Convention on the Ban of the Import Into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa, adopted 30 January 1991
- Convention on Biological Diversity, 5 June 1992
- Convention on the Protection of World Cultural and Natural Heritage ratified 1997.
- Convention on the Means of Prohibiting and Preventing the Elicit, Import, Export and Transfer of Ownership of Cultural property ratified 2003.
- Ramsar (wetlands) Convention

IV. SUBPROJECT ALTERNATIVES

This chapter describe and examine the various alternatives available for the sub-subproject. Alternatives examined during the study included site and route alternatives, on-grid electrification, and finally a No Subproject alternative was also assessed to determine the impact of this No Subproject Scenario.

IV.1. ANALYSIS OF ALTERNATIVES

A. Alternative Routes

An analysis of alternative routes was undertaken through mapping and involvement of all the stakeholders in this selection process. At the end of this process, alternative routes and location of the substation were selected among the possible ones, based on the following general sitting criteria (which are related to economic and environmental values):

1. Proximity of existing lines;
2. Avoidance of restricted zones ;
3. Distance from zones of landscape value;
4. Distance from mountain edges, preference for valley routings;
5. Distance from residential areas;
6. Route with constant slope;
7. Minimisation of infrastructure crossing (e.g. roads, other power lines, etc.).

B. On-Grid Electrification

Provide on-grid electrification. This is the alternative that is proposed by this subproject. Through this all target beneficiaries will be provided with electricity from the existing grid system. The subproject is expected to significantly reduce demand for firewood, as this is the primary source of heating and lighting in these communities. This alternative will contribute positively to improving the lives of the target communities through reduced exposure to smoke, improvement of existing electricity infrastructures, improvement in living conditions, increased communication via use of mobiles and opportunities for seeking alternative livelihood options. Local government institutions will also benefit through reduced time and money spent on

sourcing firewood from local communities, as well as increase in accessibility to information through various media sources, internet and improved communication.

C. No Subproject Alternative

A No Subproject alternative would primarily mean that the status quo will be maintained and in a sense the environmental impacts (adverse) will not occur if the existing old distribution lines. However the positive benefits will be forgone in terms of providing more access to electricity to the populace of the subproject area which would have in turn spurred and contributed to economic growth.

IV.2. COMPARISON OF ALTERNATIVES

The second alternative “providing improved on-grid electrification for the proposed beneficiaries” is the most feasible in the country, the positive environmental benefits, and most importantly because this is what the local communities prefer. The third alternative of “no-build” is not feasible because electricity is included as a measure of development in a village and therefore is always given high priority in the list of developmental activities for any district Development Plan. While there will be no environmental cost from this alternative, with increasing population it is expected that the demand for fuel wood will increase each year, putting very heavy pressure on the already dwindling forest resource.

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The subproject being a national development agenda in the energy sector has immense benefits that could save the country losses in terms of power rationing and frequent outages. However poor planning of the subproject could also affect the environment that supports a significant number of Rwandese through the subproject potential hazards that the subproject could pose to the public, pollution of water resources and atmospheric resources.

V.1. POSITIVE IMPACTS

Positive impacts of these subproject are various and diverse in nature. They range from employment opportunities, to wealth creation, industrialization, improvement in service delivery to technology transfer and capacity building.

Socio-economic Benefits

The positive impacts are numerous and wide-ranging. The benefits of the subproject for domestic supply and use in small-scale businesses and in access to electric power for schools and public services are evident. In the rehabilitation phase there will be temporary employment opportunities for local contractors and those who will be employed or supply services and provisions for workers and to contractors. Within the respective subproject areas there will be opportunities for petty trading and small business service provision along the power line routes.

Significant social benefit will come through employment generation and safer more efficient operation of key services, through provision of electricity access to the villages along the existing distribution lines served by the subproject and the substation. Potential beneficiary enterprises affected by and contributing to regional socio-economic transformation will be small industries and other agricultural processing businesses which need electricity.

The long-term direct positive impact is therefore in access to reliable new electricity supplies, which will lead to better provision and easier management of goods and services, and enable new facilities for processing and storage. There will be better availability and supply of safe and

clean water (which needs pumping); data management with computers is made possible and communication facilities like internet will be increased, as also charging for mobile phones; also, electric lighting adds to security at night and enables extended opportunities for work and study.

Electricity access increase would support overall investment in education and strengthen the ongoing effort of capacity building to overcome critical constraints in the implementation of development programmes. Essential to this effort would be power supply to health facilities for the installation of cold storage facilities for the safe transportation and storage of vaccinations and other vital medications.

As a consequence the quality of life and extent of economic opportunity will be changed for the better. Social and environmental costs associated with the use of firewood and others means of lighting will be reduced and there may be a more limited requirement for firewood cutting and collection.

On employment the subproject expects to employ local casual and skilled labor on-site. This is exclusive of indirectly employed people who will provide support and related services including those trading in foodstuff for the workers on site and construction personnel during the site preparation phase of the subproject. At this point, the number of women workers or those directly affected by the subproject who could be employed is unknown but EARP will advise that this group of persons be given priority.

Environmental Benefits

Increased distribution of electricity to the subproject area population will ease the pressure on the use of fuel wood that is rampant in the area and in effect would help to conserve the fragile and diminishing forest cover of the country by providing an alternative source of energy.

V.2. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES.

The table below presents the anticipated environmental impacts, corresponding mitigation measures related to the pre-construction, construction and operation phases of subprojects. Mitigation measures for pre-construction and operation phases shall be implemented by EWSA/EARP while those for construction phase shall be implemented by contractors.

Impact Description	Mitigation Measures	EARP Subcomponent Type
Preconstruction		
Land acquisition for substation construction, overhead line installation and upgrading of urban/rural grid and loss of income due to acquisition of agricultural land and plantation forests.	Resettlement Plans (RP) detailing compensation schemes, grievance mechanisms, monitoring and evaluation plan, and institutional arrangements will be prepared and implemented consistent with GOV and ADB requirements.	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines
Land acquisition will require relocation of some households.	Prior to any site works, EWSA and MININFRA shall undertake compensation and relocation in coordination with affected families and local authorities.	Construction/Rehabilitation of Conventional substations
Disturbance to agricultural land uses through permanent and temporary land acquisition	Carry-out detailed design of ROW and towers in a way that minimizes disturbance to agricultural land. Utilize tower designs that minimize ROW width and land use impacts. Adjust power line span length to avoid specific tower pad impacts. As far as practical, schedule construction works to take place after crop harvesting	Construction/Rehabilitation of Conventional substations
Safety risks due to presence of UXO	EWSA/EARP shall engage qualified organizations to remove UXOs prior to site works.	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines
Lack of consultations with local authorities on route selection	During FS and detailed design, EWSA/EARP and MININFRA shall coordinate with local authorities regarding selection of suitable alignments for transmission and distribution lines to ensure minimal impacts to affected communities.	Construction of Medium and low voltage overhead transmission lines
Construction		
Vegetation clearing for construction of new conventional substations and provision of buffer zones for high voltage lines	EWSA/EARP shall coordinate with affected families and local authorities for compensation of trees lost following Government/AfDB policies Contractors shall confine vegetation clearing within required area, unnecessary cutting of trees shall be prohibited As much as possible, contractors shall undertake vegetation clearing through manual methods. Use of herbicides shall be prohibited. Contractors shall replant disturbed sites	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines
Increased exploitation of forest products	Workers shall be prohibited from hunting and gathering other forest products	Construction of Medium and low voltage overhead transmission lines
Direct discharge of construction run-off	Run-off and drainage control shall be provided in	Construction/Rehabilitation

may cause siltation of watercourses. Improper storage and disposal of excavation spoils, wastes and other construction materials could adversely affect water quality and flow regime.	<p>construction areas to avoid siltation of nearby watercourses.</p> <p>Sediment laden construction water will be discharged into settling ponds prior to final discharge, if practical.</p> <p>Earth, stones and solid wastes will be Properly stockpiled and disposed of so that these do not block canals, rivers and creeks in the vicinity of the subproject sites.</p>	<p>of Conventional substations</p> <p>Construction of Medium and low voltage overhead transmission lines</p> <p>Installation of GIS Facilities</p>
Flooding of adjacent areas	Proper drainage shall be installed to avoid flooding of surrounding properties.	Construction/Rehabilitation of Conventional substations
Improper storage and handling of fuel, lubricant and other hazardous substances could contaminate soil and water.	Fuel and other hazardous substances shall be stored in roofed, concrete-lined and bunded areas.	<p>Construction/Rehabilitation of Conventional substations</p> <p>Installation of GIS Facilities</p>
Oil leaks during replacement of old transformers.	<p>Prior to replacement, old transformers shall be carefully checked to ensure that there are no oil leaks.</p> <p>In case oil leaks occur, abatement and clean up measures shall be immediately implemented by the contractor to avoid contamination of soil and water resources.</p> <p>Handling, storage, transport and disposal of old transformers shall be undertaken following national and local regulations. Required permits shall be secured by the contractor.</p>	Construction/Rehabilitation of Conventional substations
Elevated noise and dust emission levels may be experienced by nearby households and other sensitive receptors.	<p>The following measures will be implemented to minimize impacts to local communities during construction:</p> <ul style="list-style-type: none"> - Provision of cover on haul trucks transporting filling materials, gravel, excavated soil and other construction materials, access roads shall be regularly cleaned to keep these free from debris - Water spraying on exposed areas near residential and commercial areas to suppress dust emission, - Proper maintenance of equipment and use of mufflers, as appropriate, to minimize noise, - Speed restrictions for trucks and vehicles shall be enforced to minimize dust and noise emission - Scheduling of noise generating activities during daytime, as much as possible, to avoid disturbance to nearby communities; if evening construction is necessary, affected households and groups should be notified beforehand - Ensure all vehicles and equipment are properly maintained to meet emission standards and are covered by valid operating permits 	<p>Construction/Rehabilitation of Conventional substations</p> <p>Construction of Medium and low voltage overhead transmission lines</p> <p>Installation of GIS Facilities</p>
Disruption to traffic movements may occur due to construction - related activities.	<p>Proper coordination with local authorities regarding traffic flow supervision and diversion shall be made.</p> <p>Road closures and corresponding schedules as well as posting of traffic advisory signs to minimize traffic build-up shall be implemented in coordination with local authorities.</p> <p>Design travel routes for construction vehicles to avoid areas</p>	<p>Construction/Rehabilitation of Conventional substations</p> <p>Construction of Medium and low voltage overhead transmission lines</p> <p>Installation of GIS</p>

Irrigation canals in adjacent agricultural land, dykes may be damaged during construction.	of congestion Any damage to irrigation channels shall be immediately repaired and damages shall be compensated, as appropriate.	Facilities Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines
Access roads used during transport of construction materials and equipment may be damaged.	Restoration of damaged roads shall be undertaken upon completion of construction.	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines Installation of GIS Facilities
Failure to restore temporary construction sites.	All temporary construction sites will be cleared of debris and structures, ground shall be leveled (as necessary), revegetated (as necessary) and restored before turning over to communes and households.	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines Installation of GIS Facilities
Possible conflicts with and/or disruption to local community	If construction worker camps are required, select the locations in consultation with local authorities. Train workers on suitable interactions with local community including prevention of transmissible diseases.	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines
Health risks due to unhygienic conditions at workers' camps.	Basic medical care shall be provided at camp sites. Workers shall be provided with potable water supply and hygienic sanitation facilities. Proper storage as well as regular collection and proper disposal of solid wastes shall be implemented. Health and safety orientation shall be conducted for construction workers.	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines Installation of GIS Facilities
Safety hazards during construction	Workers will be oriented on safe practices and shall be provided with appropriate personnel protective gear (e.g., safety shoes, hard hats, safety goggles). There will be provision for adequate protection to the general public, such as safety barriers and warning signs in construction areas. Appropriate lighting shall be installed in construction areas when works occur after dark	Construction/Rehabilitation of Conventional substations Construction of Medium and low voltage overhead transmission lines Installation of GIS Facilities
Operation		
Flooding of adjacent areas	Drainage facilities within and around the substation site shall be properly designed and constructed to avoid flooding of surrounding properties during operation phase.	Construction/Rehabilitation of Conventional substations
Safety hazards	An emergency response plan, adequate fire-fighting facilities and proper training of employees on fire prevention and control shall be provided. Unauthorized persons shall not be allowed within plant premises and adequate warning signs shall be provided.	Construction/Rehabilitation of Conventional substations Operation of GIS Facilities

Impacts to water quality due to sewage generation	Toilets with septic tanks at office facilities shall be provided.	Construction/Rehabilitation of Conventional substations Operation of GIS Facilities
Pollution due to use of herbicides	Use of herbicides to control vegetation height within the right of way shall be prohibited	Construction of Medium and low voltage overhead transmission lines
Soil and water contamination due to leaks of hazardous substances	PCB-containing equipment shall not be used. Power companies shall secure hazardous substance management permit prior the operation. Leaks shall be repaired immediately and waste oil shall be stored and disposed of consistent with applicable laws and regulations. There shall be provisions for concrete-lined transformer bays as well as drainage and oil-water separator to handle spills, leaks and oily water run-off that could emanate from the transformers.	Construction/Rehabilitation of Conventional substations
Gas leaks during operation could pose hazards to the environment and plant personnel	Substation equipment containing SF6 is gas-tight. The plant will be equipped with continuous gas monitoring apparatus such that any leakage would be discovered at an early stage and shall be repaired immediately. In case of leaks, inhalation of SF6 is non-toxic but may cause asphyxiation when oxygen level in the air is low. Provision of adequate ventilation throughout the plant premises will prevent this condition. A manual on safety procedures during operation and maintenance of the GIS facilities shall be developed and corresponding training of plant personnel shall be carried out prior to operation.	Operation of GIS Facilities

V.3. SUBPROJECT DECOMMISSIONING

Decommissioning of the subproject will involve dismantling and removing all the structures of the substation sites, dismantling the supporting infrastructure (towers) and all those structures that were associated with this subproject implementation. Some of the impacts of this subproject phase are similar to those that have been discussed during rehabilitation and operational phase.

But there are those impacts that are specific to subproject decommissioning after the subproject life is over. After the subproject decommissioning, the proponent will be required to rehabilitate the site to its former status or near what it was before the subproject was commissioned. EWSA will be responsible for preparing the decommissioning plan because it is the proponent and as specified by the Organic Law, the subproject proponent remains responsible for this. As per the regulations of REMA the proponent will bear the costs for decommissioning and site rehabilitation.

REFERENCES

- RECO/EARP, 2009: Subproject Appraisal Document
- Rwanda Energy Policy 2004.
- Institute of the energy and the environment of the French speaking countries, 1999-2000: Environmental Assessment. Networks of E7 appraisal for the Global environment.
- MINITERE: Organic Law carrying management and protection of the environment, the law N° 4//2005 of April 8, 2005
- MINITERE: Organic Law carrying regime fundamental N°08/2005 of the 14/07 /2002
- REMA EIA Regulations and Guidelines 2006.
- EARP, 2010: Environmental and Social Management Framework
- EARP, 2010: Resettlement Policy Framework
- World Bank, 1999 Manual on environmental assessment. Policies, procedures and sectoral guidelines.
- World Bank (1994a). *Environmental Assessment Sourcebook, Volume I: Policies, Procedures and Cross-Sectoral Issues*, Environment Department, World Bank Technical Paper No. 139, Washington, D.C. (1994b). *Environmental Assessment Sourcebook, Volume II: Sectoral Guidelines*, Environment Department,
- World Bank Technical Paper No. 140, Washington, D.C. (1994c). *Environmental Assessment Sourcebook, Volume III: Guidelines for Environmental Assessment of Energy and Industry Subprojects*, Environment Department, World Bank Technical Paper No. 154, Washington, D.C.
- Environmental and Social Management Framework, EARP, 2009.