



# EAC Strategy to Scale-Up Access to Modern Energy Services



## Rwanda Country Report and Implementation Workplan

April 2008

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## LIST OF SYMBOLS AND ABBREVIATIONS

1€	790 Rwf
1US\$	540 Rwf
BTC	Belgium Technical Cooperation
BUFMAR	Bureau de Formation des Médecins Agrées au Rwanda
CDF	Common Development Fund
CFL	Compact Fluorescent Lamps
CEAR	Centre d'Application de l'Energie au Rwanda
CO <sub>2</sub>	Carbon dioxide
cu.m	cubic meter
CWS	Coffee Washing Station
DRC	Democratic Republic of Congo
EDPRS	Economic Development and Poverty Reduction Strategy
EGZ	Electrogaz
EU	European Union
FENU	Fond d'Equipement des Nations Unis
Frw	Rwanda Francs
GDP	Gross Domestic Product
GoR	Government of Rwanda
H <sub>2</sub> O	Water
H <sub>2</sub> S	Hydrogen sulphide
ICS	Improved Cooking Stoves
ICT	Information Communication Technology
kg	Kilograms
kW	Kilo watt
Kwh	Kilowatt hour
LV	Low Voltage
MHPP	Micro Hydro Power Plant
MINAGRI	Ministry of agriculture
MINICOM	Ministry of commerce

MINEDUC	Ministry of Education
MININFRA	Ministry of Infrastructure
MINIRENA	Ministère de l’Energie, Eau et des Ressources Naturelles
MINISANTE	Ministère de la Santé
MINITRAPE	Ministère de Travaux Publics et de l’Energie
MV	Medium Voltage
MW	Mega watt
NGO	Non Government Organization
NL	Netherlands
ORINFOR	Office Rwandaise de l’Information
PEPFAR	President’s Emergency Program for AIDS Relief
PPP	Private Partnership Project
PV	Photovoltaic
RBS	Rwanda Bureau of Standards
Rwf	Rwandan Frank
RURA	Rwanda Utility Regulatory Agency
SINELAC	Société Internationale d’Electricité des Grands Lacs
SME	Small and Medium Enterprise
SNEL	Société Nationale d’Electricité
SWAP	Sector Wide Approach
SWG	Sector Working Group
SWHS	Solar Water Heating System
TV	Television
UBPR	Union des Banques Populaires au Rwanda
UNIDO	United Nations Industrial Development Organization
US\$	US dollar
Vdc	Voltage direct current
VTC	Voluntary Counseling Test

## **1.0. The current status of energy access**

In Rwanda biomass based fuels dominate the energy scenario, with an estimated 95% of the total energy supply made up of firewood, charcoal, and agricultural residues.

Electricity generation is mainly hydro-based and thermal plants provide for the short term additional needed megawatts. The development of Lake Kivu Methane gas for electricity generation has begun with a pilot project.

The dissemination of renewable energy technologies has been limited to the promotion of improved stoves, improved charcoal production techniques, using of biogas, solar, wind and geothermal are in prospecting.

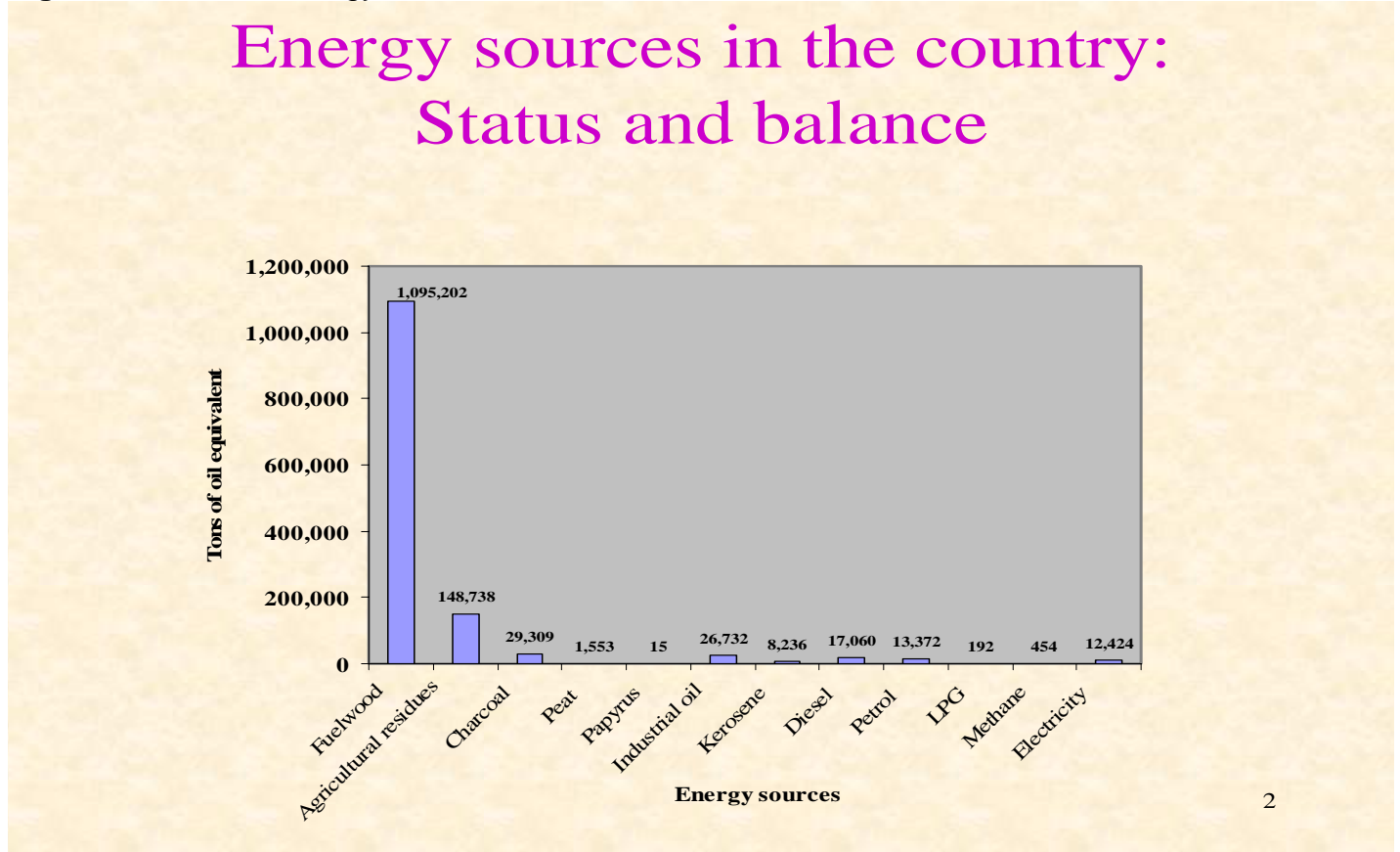
### **1.1. Baseline energy access data**

The data in this sector are disseminated at ministry level and in some institutions like Electrogaz. There is a need to collect them at a central level for their better access. Electrogaz is the Rwanda electricity company and had 77,000 clients in 2006 and targeted are 200,000 clients in 2012 (EDPRS).

There are many ongoing energy projects executed by Electrogaz:

- Rehabilitation of 4 electrical centres and 8 posts,
- Rehabilitation of transmission line of 439 km,
- Meter replacement: 26 000 electricity meters by the end of year 2009,
- Energy saving lamp project (CFL Electrogaz project) ,
- Increasing of number of clients.

Figure1: Source of energy



**Source:** Renewable project

The electrification at the national level can be illustrated with the following table:

Table 1: Status of electrification for 3 institutions

Source	District	Public institutions	Tot. Number	Electrified	Nonelectrified	Grid connected	Diesel genset	Solar	Mix solar/diesel
			<b>Tot</b>	<b>E</b>	<b>NE</b>	<b>EGZ</b>	<b>GE</b>	<b>PS</b>	<b>GE/PS</b>
<b>Database</b>	<b>National</b>	Administrative Bureau of District	30	30	0	25	5	3	3
		Administrative Bureau of Sector	416	116	300	95	-	21	0
		Primary School	2300	250	2050	250	n.a	n.a.	n.a
		Secondary School	457	240	217	240	240	20	240
		District Hospital	33	33	0	28	3	2	2
		Health Centre	426	216	210	112	12	92	
		Dispensary	n.a						
		<b>Total</b>	<b>3568</b>	<b>769</b>	<b>2694</b>	<b>750</b>	<b>19</b>	<b>127</b>	

Source : MININFRA

**Tot:** total number;  
**E:** electrified;  
**NE:** not electrified;  
**EGZ:** ELECTROGAZ (National electricity, water and gas utility )  
**GE:** diesel generator set  
**PS:** Solar  
**GE/PS:** Mix solar/diesel

## Target 1: Access to modern cooking energy service

- Rwanda depends on biomass for 95% of its energy, which is derived from fuelwood (rural areas) and charcoal (urban areas) and used primarily for cooking. According to WHO, more than 8,000 deaths are attributable annually to indoor air pollution from solid fuel use which is responsible for 5.8% of Rwanda's national burden of disease (2002)
- An estimated 94% of the total primary energy supply made up of firewood, charcoal, and agricultural residues. Objective will be to decrease the fuel wood consumption from the current 94% to 50% of national energy consumption. Innovative program to initiate the end user demand for modern cooking practices is ongoing.
- Positive regional exchange shows that Rwanda has copied the Kenya Jiko and has now different ICS made through ICS projects. The market penetration of ICS (Lorena, Canamake, Tabara, Rondereza) in Kigali is 40 % (Source: USAID) but the innovation goes slowly and that has implication on low economic development of Rwanda.
- Ownership of Lorena type improved stoves in rural area is very high (80% is reported).
- Few people are using LPG (private sector is the leader): 0.2 % (according to MININFRA).
- The Government of Rwanda with support from the Netherlands Government is planning to disseminate domestic biodigesters in rural area. The target of the GoR is to have at least 15,000 domestic biodigesters by 2012. In prisons where the Technology of biogas has started, it has found that they are saving around 60% of firewood used before construction of biodigesters

### Charcoal

- Charcoal Price: 4500-5000 Frw (US\$ 8.3 -9.2) for 33 kg, around 143 Frw (US\$ 0.26) / kg when purchased in bags.
- 9 kilograms of wood is consumed to produce 1 kilogram of charcoal.
- The land pressure and an overdependence on biomass could cause high diminution of forest resources which are decreasing in some areas of Rwanda even if 100% of the charcoal comes from planted trees by farmers in their villages. Planting of trees is a policy executed at the family level in Rwanda. Forestation projects exist for more forestation and natural forest is protected by the law.
- Over 97% of the Rwandan population uses biomass for cooking and heating and a sizeable proportion uses biomass for lighting - an indicator of the extreme poverty conditions in Rwanda.
- Approximately 40-50 percent of all stoves currently sold in Kigali are ICS (Lorena, Canamake, Tabara, Rondereza) stoves. The improved cooking stoves (ICS) are assumed to have a life expectancy of 2 years.
- Compared to the square metal stove, the ICS (Lorena, Canamake, Tabara, Rondereza) was 34.7% more efficient. The ICS (Lorena, Canamake, Tabara, Rondereza) consumed 28.7% less charcoal on average than the traditional all-clay stove. For households using other types of stoves or a combination of stoves, the ICS (Lorena, Canamake, Tabara, Rondereza) saved an average of 35.2%.

There is a lack of understanding about charcoal and may be the baseline biomass sector study now underway will bring more comprehension of the issue.



## Target 2. : Access to modern energy by urban and peri urban electrification

- 49 % of the electricity currently used in Rwanda is generated from hydro power;
- EGL, SNEL, SINELAC are the main producer of electricity for Rwanda and ELG is the main supplier of electricity for urban and peri urban areas;
- Energy price in Rwanda: US\$0.21 per kWh, 112 FRw/kWh (excluding 18% VAT, and FRW 424 (US\$ 0.79) monthly meter rent),
- Rural electricity access from the present 4% to 10% by 2012 and 35 % of access to electricity in 2020 (EDPRS);
- The per capita electricity consumption in Rwanda is around 30 kWh in comparison to neighbors countries Uganda (66 kWh), Kenya (140 kWh), Tanzania (85 kWh);
- The increasing of the population in urban and peri urban area of Rwanda is observed since 1994. That means the demand of energy is increasing even if the income is staying low for the population in those areas and Rwanda vision document estimated that by 2020, at least 35 % of the population will be connected to electricity (up from the current 6%, most of them will be in the cited areas). The increasing demand of electric tools in small workshops can help to satisfy the urban demand for some equipments made in peri urban area. Unconnected households will be equipped with affordable, modern lighting for the increasing access to improved, modern lighting products and services for the poor. At the same time off grid access plan will be approved and investments implemented for targeted isolated systems. According to ELG and MININFRA data, following table can provide additional energy capacity for the next 5 years that can be used for urban and peri urban electrification.

Energy sources	Capacity (MW)	Timing
UERP	20	2008
Pilot project methane gas	5	2008
Methane gas (KPI)	35	2009 to 2012
Several MHP	78.5	2008 to 2012
Energy saving through FCL	30	ongoing
<b>Total</b>	<b>158.5</b>	<b>2012</b>

- To reinforce the speed up access to this target, Rwanda can use interregional interconnectivity which can bring additional power.

## Target 3: Schools and health Centre (HC) connected to electricity

- The promotion of several micro-hydro power is on going. It is planned that health, Schools and administration centre facilities have access to reliable energy for lighting, technology applications and refrigeration through solar energy program and micro hydro power electricity generation.
- All universities are connected to electricity
- In 2008, 25 % of schools have electricity through Electrogaz or Generators and the target is 50 % of schools in 2012 (EDPRS)
- Few primary schools are connected. There is a project to construct 150 biodigesters and their biogas stoves for public secondary schools.

- There is over 365 health facilities in Rwanda, as many as a quarter are un-electrified, and as many as 40% of those that do have electricity have systems that are not working well.

#### Health Facilities and Electrification Status in Rwanda (World Bank)

TYPE OF FACILITY	TOTAL	ELECTRIFIED	NON-ELECTRIFIED	GRID	DIESEL	PV
District Hospital	33	33	0	28	3	2
Health Center	332	216	116	112	12	92

Source: World Bank, 2006

112 health centre are grid connected, 12 with generators or 92 with solar power and 116 without power. All hospitals are connected (see table above). The electricity generated from solar PV is mainly used for lighting, radio, and medical refrigeration in these institutions. Solar Photovoltaic systems are widely recognized as an attractive means to address some of the rural energy problems, since they offer a number of advantages such as (1) No fuel requirements, (2) It is green energy, the only disadvantage is maintenance of battery.

All solar projects planned to be financed by BTC; EU PEPFAR should take into account the sustainability of the project.. There is an overall lack of energy system “know-how.” This means that the capacity building of local technicians and how they will be paid in the future should be included in the contract for future perspective.

#### Target 4: Access to mechanical power

Access to energy for productive use such as agro-processing, water pumping and other high energy intensive activities is very low in Rwanda due to low industrialization of rural areas. Special programme for improving tools of artisans for wood working are under MINICOM. Other programmes to stimulate the use of electricity for economic purposes such as (CWS, mills, small agro processing units, water pumps, welding etc. are under MINAGRI and MINICOM. MININFRA is indirectly involved. Productive use is not directly targeted and a lack of linkages among the sectors is observed. Greater collaboration among sectors in establishing existing demand can enhance the productive use in the above sectors.

In remote areas, the power source usually used for milling (cassava, wheat, maize, sorghum; etc) is diesel generator, etc.

Lack of power is a major handicap for the industrialization in particular in rural area. Public Private Partnership (PPP) with Netherlands funds and GTZ technical cooperation wants to build some MHP in the country to overcome the problem.

## 1.2. Institutional framework

An adequate institutional framework is established with the energy strategy according to EDPRS (Economic development and Poverty Reduction Strategy).

The process of devolution will allow Districts to undertake the MININFRA responsibilities from 2008. But the Districts still do not have enough technical capacities to respond to the energy needs of local population. An €18 million European Union project has one of the objectives to train people at the lower level of the administration. The MININFRA will continue to be responsible for energy policy at the same time the follow up on the policy implementation. Electrogaz, has the task of distribution and commercialization of electricity and water. **Rwanda** Utility Regulatory Agency (RURA) makes regulations relating to the electricity generation, transmission, distribution and utilization of electricity including license fees, permits as well as grid, service and safety codes. In addition, the utility is responsible for the establishment of tariffs structure, investigated approved tariffs and rates charges. RBS is responsible for the quality of equipments, materials and products.

The Ministry facilitates mobilization of resources into areas where market forces fail to ensure adequate energy services.

The roles and relations of the different players (private sector, NGO's, etc) is coordinated through the MININFRA in using regulations determined by the law.

## 1.3. Policies

Rwanda has with vision 2020 an ambitious target to become a middle income country with a GDP of \$ 900 from \$230 of 2002. To achieve that goal, one of the requirements is that the access to electricity should be around 35%. To achieve this, the Government of Rwanda plans to develop the renewable energy technologies: methane gas, solar energy, biogas, micro hydro energy, wind energy, and geothermal. The regional interconnectivity will also be used to meet the target. In the same context it is important to contribute to the expansion of access to modern energy especially renewable energies. To promote awareness on gender issues concerning men and women and children's social role in the energy sector in facilitating their education in energy issues.

To achieve the medium term Economic and Poverty Reduction Strategy of the GoR (EDPRS in 2012), Rwanda needs to increase its 10% of access to electricity from the current 6% and diversify energy resources. According to EDPRS, the total capacity will increase from the present 45 MW to 130 MW by 2012. The electricity coverage from institutions will rise from 50 % to 80 %. The government will train 300 additional professionals to ensure that the new generating capacity is adequately maintained.

Within the development policy implemented at the district level, significant further results can be achieved in a relatively short time by increasing the number of fuel efficient cookstoves used by households. Performance indicators (**Imihigo**) at Districts level can speed up this process. However, checks are required to verify that these improved stoves indeed provide the savings and benefits as planned.

## Working with the private sector

The energy sector privatization is encouraged through the Public Private Partnership (PPP) and the introduction of the law which facilitates the private sector to be active in energy sector. The MININFRA which has a state minister of energy continue to promote policy against energy deficit using energy saving lamp. In order to improve energy efficiency in partnerships with the private sector, the GoR is considering promoting the use of SWHSs in both residential and commercial heating applications mainly in urban areas. The inputs material for solar Heating Systems are exempt of taxes and so the GoR supports indirect mechanisms to promote importers, builders, residential customers and commercial business to encourage them to use SWHs. Hybrid solar and electric solution where electricity is used to heat water as back-up can also serve as an appropriate solution to save energy. Solar Water Heating Systems can be disseminated by the private sector in health centre or schools

There is no Energy Act. However, a draft of Energy Law has been finalized by MININFRA. Following policy action are being set up as priorities:

1. Put in place diesel generator to meet the crisis of blackouts caused by delayed investment and drought is already done;
2. Provide economic power by developing the use of Lake Kivu methane, and by bringing on line more hydro power is ongoing;
3. Enhance overall electrical infrastructure to meet demand growth and supply quality needs – generation, transmission and major distribution construction and rehabilitation is an ongoing activity;
4. Deliver a program of rural electrification on the basis of enhanced distribution networks, micro hydro, and solar power;
5. Implement a wood and charcoal efficiency and substitution strategy to counter the deforestation crisis is implemented through renewable project;
6. Continue steady progress to a viable electricity and gas sector consistent in meeting social development strategy;
7. Commence utilization of Kivu gas for other than power generation: pilot project is expected to deliver 5 MW soon; and
8. Determine options for response to oil prices and petroleum products costs, and their impact on the economy: oil Pipeline project is underway .

## 1.4. Financial mechanisms

MINECOFIN and donors are sharing responsibility for financial resources mobilization and MININFRA is the lead implementing agency in coordinating all activities through other line ministries or public agencies (EDPRS). A SWAp has been organized by MININFRA for the increasing of the stakeholder's consultations in energy sector. In the same point of view, a Sector working group (SWG) is already operational. The private sector finance and execute energy projects through direct investments or public private partnership but the government continues to drive the energy development despite stated privatization goals.

The uptake of alternative renewable energy has greatly been hampered by a number of barriers. That is why the GOR introduced the law to facilitate the purchase of solar equipments. The focus of Government of Rwanda's energy strategy is to promote activities that will increase access to electricity and modern energy in general and hence improve the quality of life in the country in an environmentally friendly manner. The adoption of the law N° 21/2006 of 28 /04/2006 establishing exemption on import duties on solar equipments has been a good strategy for promoting solar energy financing in Rwanda.

Rwanda receives financial supported from its partners like WB, EU, USAID, BTC, NL, AFDB, etc. Partners in Health (PIH) project (Clinton Foundation and private funded) have plans to install over \$200k worth of hybrid PV-genset systems in Kirehe District. This work includes design, training, installation, maintenance and follow-up work. Columbia University (PEPFAR/CDC-funded) plans to install over \$400k worth of PV hybrid and battery back-up systems in approximately 16 health clinics. This work also includes design, training, installation, maintenance and follow-up work. The US\$5 million project, World Bank/Global Environment Facility (GEF) Sustainable Energy Project, presently in planning stages with the World Bank, will provide GEF grant funding for the solar industry, and will also work with the Ministry of Health to help it incorporate solar systems in off-grid health facilities. The start of the European Union project, a Rural Energy PV/micro hydro project with €18 M can boost in building of capacity, in assisting the development of the private sector and in implementing energy systems at the Umudugudu (village) level.

## 1.5. Codes and standards

The Government of Rwanda has created RURA, REMA and RBS for utilities regulations, environment management and norms and standards regulations.

REMA should provide guidelines for hydropower plant location for example and protect the environment through for example encouragement of the population in massive tree planting.

RURA reviews and approves detailed reports regarding system operations and states required regulatory authority for grid and commercial code, and other system operating or technical rules and procedures, etc. RURA reports violations of ISO system operating rules, and impose penalties for non-compliance.

RBS is responsible for quality of all local and import equipments or materials.

All institutions are at their starting phase and need to build capacities for better operationalization of their activities. Lack of standards and codes for energy issues hampered some energy development initiatives (quality of energy equipment, guidelines for new MHP localization, etc.)

## 2.0. SWOT analysis

### 2.1. Energy resources

#### 2.1.1. Current Use of Hydro Power

Recognizing the high number of micro hydro potential sites that Rwanda possesses due to its natural geographical situation and considering the paramount importance of electricity for rural socio-economic development. Studies by the Ministry of Infrastructure have identified more than 160 sites with potential ranging from 20 kW to over 600 kW. Two micro hydro projects are underway, a Dutch financed GTZ executed Public Private Partnership program targeting to install 6 plants (combined 2 MW) with 6 private utilities and UNIDO who is installing 3 plants (2 are operational already). An EU financed ACP-Energy Facility program will start in March 2008 targeting to install a further 3 MW and the Belgian financed project targeting another 10 plants.

Electrogaz domestic generation capacity consists of about 29 MW, most of it in the Ntaruka and Mukungwa powerplants. The Mukungwa station draws water from Lake Ruhondo that is in turn supplied partly from Lake Burera for Ntaruka station at a higher elevation. Electrogaz also purchases power from the Rusizi I plant (3.5 MW) of SNEL of DRC, and Rusizi II (capacity 12 MW), owned by SINELAC, which is jointly owned by DRC, Rwanda, and Burundi. The Rusizi River flows from Lake Kivu which forms part of Rwanda's border with Democratic Republic of Congo (DRC). Many micro hydro powers are under construction:

1. Construction of three (3) micro hydropower by CTB=1.8 MW (Keya, Nkora)
2. Construction of 8 micro hydropower = 6.7 MW (Janja, Mukungwa 2, Rugezi)
3. Construction of micro hydropower de Rukarara, 9.5 MW
4. Construction of micro hydropower de Nyabarongo 27.5 MW
5. Construction of 6 micro hydropower /NL (PPP) = 1.5MW (Mazimeru, Musara)

#### 2.1.2. Petroleum products

In early 2005, EGZ commissioned 12 MW of new diesel plants at the Gatsata and Jabana substations. The Government signed a contract for 15 MW of rental diesel plants. To respond to the supply emergency, Electrogaz quickly rehabilitated the Gatsata diesel generation plant in Kigali to meet two daily peak shortfalls beginning in January 2004. With growing demand and considerable lead-times for the development of additional hydroelectric supplies, the combination of restricted hydroelectric supplies from both domestic as well as regionally shared resources means that for the foreseeable future Electrogaz will be relying on high-cost diesel-based generation. (Rwanda's petroleum products supplies come from Mombasa via Kampala by road, and the transport cost for small quantities of petroleum products raises landed cost substantially.). Some rehabilitation have been done:

1. Rehabilitation petroleum storage in Bigogwe (5000 m<sup>3</sup>)
2. Rehabilitation petroleum storage in Rwabuye (3600 m<sup>3</sup>)
3. Construction of Kigali storage (70 000 m<sup>3</sup>)

### 2.1.3. Solar

In the current market situation, the GoR is the major PV buyer currently and has keen interest in expanding its own use. The primary, immediate opportunity to expand the solar PV market and correspondingly achieve the economies of scale in the supply chains is for meeting rural public institutions' high priority electricity/ICT needs. There is also interest in some private health clinics and churches which needs to be supported. However, free equipment fatigue has been observed and some institutional PV systems appear out of order while the user instead of repairing rather waits for another donor to provide new equipment.

The electricity generated from solar PV is mainly used for lighting, TV & radio, and medical refrigeration in these institutions. Solar Photovoltaic systems are widely recognized as an attractive means to address some of the rural energy problems, since they offer a number of advantages such as (1) No fuel requirements, (2) It is green energy. The only disadvantage is that the use of electricity can only be minimal (no cooking, ironing, etc) and operation and maintenance of battery is expensive.

Rural electrification is one of the important steps towards achieving the vision 2020 with target to achieve at least 35 % of access to electricity. Solar photovoltaic (PV) in Rwanda is almost exclusively used on a small scale of kilowatt peak of solar panels to generate off-grid electricity to be supplied to community centres in remote areas.

Based on current status of electrification in the rural areas (less than 1% of the rural population has access to electricity) and considering some other initiatives from Common Development Fund (CDF), MINISANTE (Ministry of Health) and MINEDUC (Ministry of Education), in solar energy, 140 health centers, 142 public secondary schools, 150 administrative offices of sectors, 2 administrative offices of Districts and 3 hospitals have been proposed to be electrified by solar photovoltaic. The estimated cost of investments for the above institutions by solar photovoltaic is approximately US\$ 11.3 million (MININFRA).

### 2.1.4. Methane gas

Lake Kivu methane gas could be used for electricity generation, lighting and cooking. Its accessibility to the rural poor in form of gas or transformed into electricity will resolve many energy problems. With an aim to reduce the firewood consumed from 94% up to 50% as set in the vision 2020 and keeping in mind that public schools in Rwanda play a significant role in wood fuel consumption for cooking purpose, 300 biogas plants with biogas stoves are proposed to be built in 150 public secondary schools and this project will cost approximately US\$ 4,500,000. A market driven biogas program for households is underway targeting 15,000 households by 2011.

### Biogas

The other type of renewable energy that is considered is biogas. Biogas is the result of biomethanisation of organic material inside a biogas plant called biodigester. Biomethanisation

is a biological process by which anaerobic fermentation leads to produce methane from organic waste. During this process not only methane is produced but also other chemicals also are available like carbon dioxide (CO<sub>2</sub>) water (H<sub>2</sub>O) and a very little quantity of hydrogen sulphide (H<sub>2</sub>S). Biogas production takes time depending on raw material, temperature, and process adopted etc. The anaerobic fermentation process is applicable to wet organic mater with a temperature of 65°C in the absence of oxygen. The program 2007 to 2011 for the construction of 15 000 biodigesters is market driven and supported by the Netherlands.

### **2.1.5. Peat**

Quantity of peat existing in Rwanda is in the order of 155 million tones. It can be used to replace fire wood in institutional kitchens or to generate electricity.

### **2.1.6. Geothermal**

There is an agreement between Rwanda and BGR (Germany) as a prerequisite to start the plan of operations in geothermal sector since November 2007. Investigations have started since January 2008 and MININFRA has already sent technicians in Kenya for geothermal training. Kenya as member of EAC is more advanced in geothermal energy.

## **2.2. Institutional capacity**

At the local levels, there is no institutional capacity to initiate, develop, promote and implement energy access projects at the district and Umudugudu (village) levels. In the rural areas, there are few public sector personnel involved in energy access issues.

At central level, there is a need to separate policy and strategy development from implementation & execution of activities.

The development of the energy sector is dependent on the appropriate utilization and development of human resources. Though a gender balanced human resource development program for the energy sector is an important tool in order to ensure the fair provision of training and education. Facilitate education and training for women in all energy aspects is proposed in the draft policy.

Today, there is a lack of trained and skilled energy experts in the sector. There is, therefore, a need to encourage and facilitate training in various disciplines necessary for the development of the energy sector: local communities, stakeholders of civil society and private sector. The existing Encouragement of micro hydro power generation by local investors can boost the training on the job and is essential for the spill-over effect.

Performance monitoring system is used to determine needs in capacity building in different areas necessary for the realization of the objectives of the MININFRA.



## 2.3. Policy and legal framework

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. For this reason, MININFRA plans to review its 2004 policy. It is supposed that the policy will establish an adequate Institutional reform to make energy sector efficient in a way that encourages private investment needed enhancing competitiveness in quality of energy services. The biomass sector is dominated by charcoal business used in urban areas while the fuel wood is in rural areas. The forest harvesting for charcoal production, fire wood and construction is regulated by local authority at District level. They give licenses according to REMA regulations in respecting the stage of harvesting. Natural forest is protected by the law.

### Legal framework

The energy Law shall maximize private sector participation and disengage the Government from direct electricity production and service activities through a carefully managed transition process over time in establishing a transparent institutional framework with a clear division of roles. That will lead to the promotion of sustainable development of rural electricity networks which meets the energy needs of the population. The following institutions will play the main role in energy sector: The MININFRA plays the lead role; UERP; the Regulatory Authority; Electrogaz; Independent System Operator; Producers; Transmission Owners/Operators; Distribution Owners/Operators; Suppliers; and Customers.

## 2.4. Financial capacity

There are limited financial resources and budget allocation to energy sector because of importance of priorities in development process and a lot of country needs. At one side, many households with low income have serious difficulty in raising the necessary funds for buying improved stoves or to be connected on ELG grid. On the another side, there is a possibility of leasing of appliances through commercial banks or micro finance institutions. In any cases, it is crucial to think of how to include income generating activities within the energy projects. That can allow some family to generate revenue. For private sector and NGOs involved in energy sector reducing taxes on the one hand, and increasing subsidies paid through the MININFRA budget on the other hand, can give incentives to investors in energy sector, and can bring enough good results. The elimination of cross-subsidization from large energy consumers to households and other smaller consumers will go a long way towards improving product competitiveness at the market place. The existing PPP in micro hydro power sector could be extended to other energy services.

Last but not least is the existing availability of financial support from development partners like EU, the World Bank, and UNDP, AFDB (finance the energy master plan study), CTB, GTZ and a number of bilateral donors e.g. Dutch Government are willing and have put sizeable sums of

money into the energy sector. This means that in a number of cases the lack of institutional and human capacity will remain unresolved for some time because training in the sector is a long process with respect to of education, sensitization, etc.

### Target 1: Modern cooking energy services

<p><b>STRENGTH</b></p> <ul style="list-style-type: none"> <li>• Strong political will (Government positive policy (EDPRS: Economic Development and Poverty Reduction Strategy)</li> <li>• Existing of RURA, REMA and RBS</li> <li>• Encouragement of private sector</li> <li>• Facilitate education and training for women in all energy aspects is proposed in the policy</li> <li>• Institutional reform to make efficient energy sector</li> <li>• Policy for massive tree planting</li> <li>• Regional cooperation in exchange of experience in modern cooking energy services (conversion of Kenya Jiko in Rwanda ICS etc)</li> <li>• Existing of a SWAp</li> <li>• Performance monitoring system</li> </ul>	<p><b>WEAKNESS</b></p> <ul style="list-style-type: none"> <li>• Decreasing of forest resources in some areas</li> <li>• Land pressure due to population density</li> <li>• Lack of adequate expertise</li> <li>• Lack of implementation capacity</li> <li>• Low income</li> <li>• Continued government driven development despite stated privatization goals</li> </ul>
<p><b>OPPORTUNITY</b></p> <ul style="list-style-type: none"> <li>• Potential renewable energy</li> <li>• Donor willingness to support: existing SWG (sector Working Group in energy sector)</li> <li>• Availability of strong demand of Appliance</li> <li>• Existing of ICS Projects</li> <li>• Existing of forestation projects</li> <li>• Existing of Biogas project</li> <li>• Existence of Imihigo for agroforestry promoting at district level</li> <li>• Potential cooperation between Ministry of Energy and Ministry of Health to leverage programmatic actions on household energy and health especially regarding awareness raising through the health sector and capacity building</li> </ul>	<p><b>THREAT</b></p> <ul style="list-style-type: none"> <li>• Dependence on petroleum products</li> <li>• Low economic development</li> <li>• High cost of input materials</li> <li>• Innovation goes slowly</li> <li>• Lack of understanding about charcoal may threaten the supply of urban energy</li> </ul>

**Target 2: Access to modern energy by urban and peri urban electrification**

<p><b>STRENGTH</b></p> <ul style="list-style-type: none"> <li>• Strong political will (Government positive policy (EDPRS: Economic Development and Poverty Reduction Strategy)</li> <li>• Encouragement of private sector through public private partnership in micro hydro power</li> <li>• Existence of several micro hydro power projects in construction</li> <li>• Energy master plan in preparation</li> <li>• Agriculture transformation ongoing</li> <li>• Stakeholders consultations for dialogue and coordination</li> <li>• Performance monitoring system</li> </ul>	<p><b>WEAKNESS</b></p> <ul style="list-style-type: none"> <li>• Lack of locally produced equipment and insufficient training opportunities</li> <li>• Lack of adequate expertise: technical low quality and inefficient energy technologies</li> <li>• Limited private investment in the sector</li> <li>• Lack of implementation capacity</li> <li>• Low income in peri-urban areas</li> </ul>
<p><b>OPPORTUNITY</b></p> <ul style="list-style-type: none"> <li>• Potential renewable energy</li> <li>• Donor willingness to support</li> <li>• Availability of Strong demand of electric tools</li> <li>• Existing connection in urban areas</li> </ul>	<p><b>THREAT</b></p> <ul style="list-style-type: none"> <li>• Dependence on government investment</li> <li>• Low economic development</li> <li>• High cost of input materials</li> <li>• Privatization goes slowly</li> </ul>

**Target 3: Schools, Health and community centre connected to electricity**

<p><b>STRENGTH</b></p> <ul style="list-style-type: none"> <li>• Strong political will</li> <li>• Good policies (Energy, education and health)</li> <li>• Many stakeholders comprising responsible government ministries and other practitioners are involved</li> <li>• Strong Institutional set up from the national to the grassroots level</li> <li>• Stakeholders consultations for dialogue and coordination</li> <li>• Performance monitoring system</li> <li>• Tax exemption for solar equipments</li> </ul>	<p><b>WEAKNESS</b></p> <ul style="list-style-type: none"> <li>• Lack of energy experts at local level Limited financial resources and budget allocated to energy sector</li> <li>• Awareness</li> <li>• Lack of standards/codes</li> </ul>
<p><b>OPPORTUNITY</b></p> <ul style="list-style-type: none"> <li>• Willingness of development partners to support programs and projects</li> <li>• Participation of private sector including financial institutions</li> <li>• Availability of technology expert in the EAC</li> <li>• Strong demand of electricity in health and education sectors</li> <li>• Existing projects using solar in schools, health and administrative centre</li> </ul>	<p><b>THREAT</b></p> <ul style="list-style-type: none"> <li>• Change in policies and regulations</li> <li>• Priority for urban centres</li> <li>• High cost of input materials</li> </ul>

## Target 4: Access to mechanical power (motive power and heating)

<p><b>STRENGTH</b></p> <ul style="list-style-type: none"> <li>• Strong political will</li> <li>• Ongoing development of policy in Key ministry (MININFRA)</li> <li>• Performance monitoring system</li> <li>• Programs targeted at EDPRS (Economic Development and Poverty Reduction Strategy)</li> <li>• Existing investment in agro projects in rural areas</li> <li>• Ongoing Electrogaz rehabilitation plan</li> <li>• Many ongoing renewable energy projects</li> <li>• Strong Institutional set up from the national to the grassroots level</li> <li>• Tax exemption for energy equipments</li> </ul>	<p><b>WEAKNESS</b></p> <ul style="list-style-type: none"> <li>• Lack of energy experts at local level</li> <li>• Limited financial resources and budget allocation</li> <li>• Lack of local innovation in energy sector</li> <li>• Lack of awareness among the general public</li> <li>• Low speed of implementation strategy</li> <li>• No clear guidelines for hydropower</li> <li>• Lack of energy office at District level to handle issues of rural energy</li> <li>• Lack of effective linkages among sectors</li> </ul>
<p><b>OPPORTUNITY</b></p> <ul style="list-style-type: none"> <li>• Willingness of development partners to support energy sector (several micro hydro projects ongoing)</li> <li>• Participation of private sector including financial institutions</li> <li>• Community are ready to participate</li> <li>• Strong demand of electricity in development process</li> <li>• Availability of energy sources</li> <li>• Existing project for improving capacity building in food processing</li> <li>• Cooperation and partnership in regional energy interconnectivity</li> </ul>	<p><b>THREAT</b></p> <ul style="list-style-type: none"> <li>• Low income of rural population</li> <li>• Inactive private sector: lack of replication lessons learned in some areas</li> <li>• Resource mobilization takes time</li> <li>• Lack of banks experts who understand hydro power projects for their financing</li> <li>• Lack of rural energy financing schemes</li> <li>• Dispersed settlements</li> <li>• Low innovation capability</li> <li>• Lack of awareness on environment</li> <li>• High cost of materials equipment</li> </ul>

### 3.0. Key findings

- 1) The electricity supply in the country has improved considerable over the last years mainly through introduction of diesel driven generating systems and the improvement of distribution systems. The Government is working hard to develop cheaper resources such as hydropower, methane gas from Lake Kivu, geothermal and wind energy. Simultaneously Electrogaz and MININFRA working hand in hand to triple the number of electricity subscribers over the EDPRS period 2007 – 2012.
- 2) So far the private sector has not played a significant role in the generation of electricity but this is expected to change over the coming years as the proposed electricity law provides new opportunities. Some companies have already shown interest to generate electricity from methane gas and are making preparations for investments..
- 3) At the same time the Government has stimulated the introduction of energy saving technologies such as CFLs to reduce the demand. There are also programmes to further reduce transmission losses.
- 4) Micro hydropower is already in use and further promoted to reach consumer in remote locations. Recently MININFRA has completed the so called micro hydro atlas which provides first data on several hundred potential sites for micro hydro power. The Ministry and some development partners are working with private sector to construct and manage micro hydro power stations with distribution networks.
- 5) There are no special programmes through MININFRA to stimulate the use of electricity for economic purposes such as agro processing, wood working and for instance welding as this is expected to be promoted by other ministries such as MINICOM (commerce), MINAGRI (agriculture) etc.
- 6) Many of the social institutions in the country are already connected to the grid or use solar systems. At the end of the EDPRS period, 100% of all health facilities and administrative centres and 50% of the schools are expected to be provided with electricity.
- 7) Unfortunately, many solar systems are not functioning mainly due to improper maintenance and lack of funds for parts. There are some government and donor initiatives ongoing to rectify this situation and increase the number of PV installations.
- 8) The use of solar systems at household level is not wide spread as equipment remains expensive and the number of distributors in the country is limited.
- 9) Over the last 10 years biogas has been successfully introduced in Rwanda for large institutions such as the prisons and a few schools. The system results in significant reduction in use of fire wood and has great environmental benefits as well. The national biogas programme, which started in 2007, focuses on households with 2/3

cows and it is planned that by end 2011 at least 15,000 households will have invested in their own digesters for cooking and light purposes.

- 10) Significant further results can be achieved in a relatively short time by further increasing the number of fuel efficient cookstoves used by households. Performance indicators (imihigo ) at Districts level can speed up this process. However, checks are required to verify that these improved stoves indeed provide the savings and benefits as planned.
- 11) Only in the cookstoves programmes specific attention is given to the role and tasks of women and their access to modern energy. In other areas no particular gender specific training is given.
- 12) In both rural and urban areas there are few alternatives to the use of charcoal and wood for cooking needs of the households. The use of kerosene and LPG for cooking is very limited due to high prices and limited access and may be lack of sensitization of end users towards health aspects from solid fuel use. .

### 3.1. Institutional and capacity challenges

The energy sector faces a number of challenges and the most important ones are listed below:

- 1) Limited capacity within the ministry due to reduction in staff numbers (decentralization policy) and technical capacities. Therefore much expertise is recruited on short and long term contract basis. The problem is that there are no cadre responsible for energy at the District level. A Directorate for infrastructure is responsible for roads, urbanization, water and energy but most work on roads and urban planning takes most of the time of the Directorate. The presence of existing structures in other sectors, such as the health sector might be an opportunity to bypass lack of public sector personnel involved in energy access issues.
- 2) It is difficult to find and access data on energy availability and use as many people and institutions (also outside the ministry of energy) only have part of the information and there is no central point where information is collected and disseminated.
- 3) The market for renewable energy technologies such as for solar PV systems is underdeveloped which results in higher prices and limited choice for customers. This is made worse due to the high upfront prices.
- 4) Lack of appropriate financing mechanisms for renewable energies such as commercial loans for micro hydro projects and micro credit for PV for instance.
- 5) Lack of standards and regulations which will help to reduce the number of poor quality and failing products on the market and the impacts on health related to these products.

- 6) There is no institution which promotes electricity for economic uses as MININFRA focuses mainly on increasing access to the various consumers.

*The proposed investment will firstly deal with capacity building by way of training, both locally and abroad, mainly to create the critical mass of skilled personnel among all stakeholders in the energy sector. The Rwanda strategy has been formulated that the energy should contribute for accelerated growth, powering the social sectors and meeting basic needs.*

### **3.2. Recommended Actions/recommendations**

#### **Target 1: Access to modern cooking energy for 50% of traditional biomass users**

- The strategy of using improved charcoal and woodstoves should be included in Imihigo program at family level. A survey can be done to measure the penetration rate of the strategy.
- Dissemination of improved stoves can be done through sensitization in schools, community centres and healthcare institutions.
- Introducing innovative financing schemes which may assist producers and users of improved cookstoves and increase uptake. This may in particular focus on women.
- Initiation of long term renewable energy training on the job and capacity building programs.
- Improve and organize regulations on charcoal marketing chain to increase efficiency and improve on the utilization of wood resources.

#### **Target 2: Access to reliable electricity for all urban and peri-urban poor**

- Promote initiatives which help to increase for rural and peri urban poor such as introducing local power distribution by local cooperatives.
- Promote technologies and distribution systems which take in particular account for the needs and purchase power of poor community during the studies of power distribution.
- Promote and support the distribution of solar lightening systems through a market oriented approach in those areas which have no access to the grid.

#### **Target 3: Access to modern energy services for all schools, clinics, hospitals and community centres**

- Introduce standards for solar technologies for schools, health and community centres which are supported through the various Government and donor programmes.
- Ensure that the capacity in the private sector is developed to design, supply, maintain and repair solar systems for institutions.
- Promote and support the use of biogas for cooking needs at schools and hospitals where feasible to reduce wood consumption and environmental costs.
- Using existing technology expertise in the EAC for solar PV development,

- Encourage lighting for schools, health and community centre in making available subsidies to support dissemination of solar PV.

**Target 4: Access to mechanical power within the community for productive use and heating for all communities**

- Encourage cooperatives and private companies which are dealing with the generation of electricity through micro hydro power plants in rural area (Nyamyotsi power plant is an example)
- Promote and support income generating activities in particular agro and food processing by putting in place a mechanism to help those SMEs to connect to the grid.
- Promote the use of electric tools for artisans to increase their productivity and quality of work.
- Encourage the private sector to be owner of distribution assets with specific targets of the electrification of the rural poor and the urban poor in their contract
- Encourage biofuel technologies in planting bio crops that respect environment,
- Convince skilled personnel to go out and work in rural areas on a permanent basis. Higher pay might be required to provide the necessary incentive.

***In general***

- 1. Creation of energy data collecting centre could be helpful*
- 2. To introduce affordable energy tariffs for rural population could be a good strategy.*
- 3. To have many energy companies in the country can promote competition and ensure a better service for the population*



## 4.0. Draft activity implementation plan

Summary Table: implementation plan

<b>Intervention</b>	<b>Main streaming energy access in development planning</b>	<b>Developing pro-poor energy policies &amp; frameworks</b>	<b>Strengthening Capacity to deliver energy services</b>	<b>Identifying business models</b>
<b>Target 1: Access to modern cooking energy service</b>	Integration of improved modern stoves into planning & budgeting process is already done	Continue to promote ongoing activities	Running own training centre;	Studies for identification of existing and potential marketing channels
<b>Target 2: Developing pro-poor energy policies and frameworks</b>	Integration of electricity use for urban and peri urban population into planning & budgeting process	Promotion of cheap appliances affordable for urban and peri urban poor	Sensitize rural population in using electricity for cooling, drying, storage, transformation of products, etc	Support credit schemes for users of electricity in urban and peri-urban areas
<b>Target 3: Schools, Health and community centre connected to electricity</b>	Energy services provided for key public facilities such as schools, clinics and District administration headquarters already into planning	Adoption of a program for electrification of institutions	Capacity building in modern energy access for key personnel of institutions	Studies on energy for institutions (health and administrative centre, schools) in rural zones carried out
<b>Target4: Access to mechanical power (motive power and heating)</b>	Integration of mechanical power into planning & budgeting process	Promotion of cheap machines necessary in the transformation	Capacity building at District level (TOT) in electricity connection and energy saving	Financial support for business people ready for replication of successful PPP in other areas of Rwanda

## **4.1 Target 1: Access to modern cooking energy service**

### **4.1.1 Main streaming energy access in development planning:**

The following activities are proposed:

- Educate planners about need for modern energy cooking services
- Develop a monitoring and evaluation system to be aware of success and failure in ICS dissemination and for reacting accordingly
- Educate and create awareness among consumers through schools, health sector and other institutions .
- Support ICS technology development, adaptation and improvement
- Create lobby groups (Parliamentarians, Business community, NGO's, Donors, etc.) to support energy modern cooking services
- Carry out studies for potential needs for modern energy cooking services

### **4.1.2 Developing pro-poor energy policies and frameworks**

The following activities are proposed:

- Develop a quality control system in collaboration with RBS
- Support activities for national experience and exchange
- Develop policy to encourage forestation (incentives for people who have land and plants trees)

### **4.1.3 Strengthening Capacity to deliver energy services**

The following activities are proposed:

- Select and train trainer of trainers on technical, business and marketing skills of ICS,
- Support certified trainers to train producers on technology and quality aspects,

### **4.1.4 Identifying high potential business models**

The following activities are proposed:

- Support the establishment of producers associations,
- Support producers with professional marketing campaigns for their products,

<b>Key Activities</b>	<b>Results/Outcomes</b>	<b>Timeline</b>	<b>Task Owner</b>
Develop a monitoring and evaluation system to be aware of success and failure in ICS dissemination and for reacting accordingly	Penetration rate of ICS is known	24 months	MININFRA MINALOC, MINECOFIN,
Encourage people who have land to do more forestation	Increased ha of planting trees	24 months	REMA MINAGRI MININFRA
Introduce regulations in charcoal business in organizing the whole chain	Increased percentage of people who are aware of charcoal regulation	24 months	MININFRA MINICOM RBS
Support certified trainers to train producers on technology and quality aspects	Increased number of skilled stakeholders in modern cooking energy services	24 months	MININFRA
Support producers with professional marketing campaigns for their products,	Increased number of stakeholders using professional marketing for their products	24 months	MININFRA

## 4.2. Target 2: Access to modern energy by urban and peri urban electrification

### 4.2.1 Main streaming: Energy access for urban and peri urban population in development planning

- Organize of workshops on slums area connectivity for planners,
- Mobilize lobby groups (parliamentarians, business community, NGOs, etc) for promoting connectivity for urban and peri urban population,
- Carry out studies for potential needs in this area

### 4.2.2 Developing pro-poor energy policies and frameworks

- Support sugar companies to produce electricity from baggasse.
- Develop policy that encourages building of electricity generation, transmission and distribution through cooperatives,
- Develop policy enabling dialog among all stakeholders (civil society, private sector, association of Engineers, association of consumers, etc.) for urban and peri urban connectivity,
- Develop policy which allocates funds to support interventions (subsidies, ) of urban and peri urban connectivity

### 4.2.3 Strengthening Capacity to deliver energy services

- Strengthen capacity of cooperatives in generation, transmission, distribution of electricity for urban and peri –urban areas,
- Sensitize rural population in management and maintenance of energy infrastructure,

### 4.2.4 Identifying high potential business models

- Encourage energy distribution and selling through cooperatives,
- Encourage private sector which is dealing with electrification of urban and peri urban poor,

Key Activities	Results/Outcomes	Timeline	Task Owner
Organize of workshops on slums area connectivity for planners	Increased budget allocated to urban and peri urban electrification	24 months	MININFRA Electrogaz
Develop policy that encourages building of electricity generation, transmission and distribution through cooperatives,	Increased number of cooperatives involved in electricity generation, transmission and distribution	24 months	MININFRA
Strengthen capacity of cooperatives in generation, transmission, distribution of electricity for urban and peri –urban areas	Increased number of cooperatives in generation, transmission, distribution of electricity for urban and peri –urban area	24 months	MININFRA
Encourage energy distribution and selling through cooperatives	Increased level of stakeholders involved in management and maintenance of energy infrastructure	24 months	MININFRA MINICOM
Encourage energy distribution and selling through local cooperatives	More cooperative involved in distribution of energy	24 months	RPSF MINICOM

### **4.3. Target 3: Schools, Health and community centre connected to electricity**

**4.3.1. Main streaming:** Energy services provided for key public facilities such as schools, clinics and District administration headquarters in development process

- Educate planners about electrification need for schools, health and administrative centre in development planning,
- Mobilize multi working groups for promoting the electrification of schools, health and administrative centre,
- Carry out studies for potential needs in this area.

#### **4.3.2. Developing pro-poor energy policies and frameworks**

- Develop policy enabling dialog among all stakeholders (civil society, private sector, association of Engineers, association of beneficiaries, etc.) for electrification of institutions,
- Introduce leasing for medical equipments for refrigeration, cooling, sterilization, lighting for schools, health and community centre,

#### **4.3.3. Strengthening Capacity to deliver energy services**

- Sensitize scholars, medical patient in using and saving energy,
- Support national campaigns (radio, TV, expo, ) on energy use for institutions and their impact on the population health,
- Strengthen capacity in norm and standards for users and technicians of institutions.

#### **4.3.4. Identifying high potential business models**

- Create energy system delivering based on taxation paid by medical insurance,
- Enabling private sector investment which is dealing with energy for schools, health and community centres
- Carry out studies on energy for institutions (health and administrative centre, schools) in rural zones.

Key Activities	Results/Outcomes	Timeline	Task Owner
Mobilize multi working groups for promoting the electrification of schools, health and administrative centre	Number of health centres having energy access is increased.	24 months	Donors MINISANTE
Enhance policy that encourage use of electricity for basic energy needs like refrigeration, cooling, sterilization, lighting for schools, health and community centre	Number of administration headquarters having energy access is increased.	24 months	MINALOC
Organize workshops on schools, health and administrative centre energy connectivity	Increased number of sensitized people in connectivity of institution	24 months	MINEDUC
Encourage private sector which is dealing with energy for schools, health and community centres	Private sector is more involved in connectivity of institutions	24 months	MININFRA and MINALOC

#### 4.4 Target 4: Access to mechanical power (productive use)

##### 4.4.1 Main streaming energy access in development planning

- Educate planners about productive use in development planning,
- Coordinate energy sector according to A SWAp
- Carry out studies for potential needs in this area

##### 4.4.2 Developing pro-poor energy policies and frameworks

- Support electricity distribution by cooperative of consumers,
- Promotion of productive use in enabling dialog among all stakeholders (civil society, private sector, association of Engineers, association of beneficiaries, etc.),

##### 4.4.3 Strengthening Capacity to deliver energy services

- Ensure training of trainers at District level in electricity connection and energy saving,
- Strengthening capacity in electricity regulation,
- Sensitize banks to support all projects for productive use
- Strengthen capacity for bank cadre who make energy projects
- Strengthen capacity in environment protection

##### 4.4.4 Identifying high potential business models

- Create energy system based on taxation paid by insurance,
- Support private sector (cooperatives) to invest in small processing units,
- Support private sector which is dealing with product transformation,
- Carry out studies to promote mechanical power in rural areas

<b>Key Activities</b>	<b>Results/Outcomes</b>	<b>Timeline</b>	<b>Task Owner</b>
Educate planners about productive use in development planning	Increased budget allocated to productive use	24 months	MININFRA
Promotion of productive use in enabling dialog among all stakeholders (civil society, private sector, association of Engineers, association of beneficiaries, etc.),	More stakeholders involved in promotion of the productive use	24 months	MININFRA
Strengthen capacity for bank cadre who make energy projects	Increased number of bank cadre able to make projects	24 months	MININFRA
Carry out studies to promote mechanical power in rural areas	Studies on mechanical power are carried out	24 months	MINEDUC MININFRA

**Detailed Workplan : EAC Up-scaling Access to Energy Services - RWANDA**

Outputs & Activities		Target	Milestone	Responsibility	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Inputs (first estimates)
Description													
1	<b>Mainstreaming Energy</b> <i>Output: Increased awareness of authorities at national and local levels of need for access to energy for poor population &amp; (micro) enterprises</i>												
1.1	Set up a national committee to ensure and monitor upscaling of modern energy to poor (includes government, private and civil society)	all	National committee in place	MINICOFIN	x								
1.2	Set up district committees as above	all	District committees in place	MINALOC	x								
1.3	Sensitise central & local authorities through:	all	All responsible authorities are aware of issues	National Committee									
	a) national workshops		2 national workshops	National Committee	x			x					2 national workshops of one day
	b) regional/local workshops		30 districts workshops	MINALOC				x					30 district workshops
	c) radio & TV messages, adverts		Printed and TV materials available	National Committee				x					Support to develop and print communication materials
1.4	Organise a study visit to learn about models for engaging private sector in distribution of electricity	2	Study tour carried out	MININFRA/ Kigali City									study tour for 4 persons to visit 3 countries in EAC, SA and beyond
1.5	Estimate required budgets for upscaling of access to modern energy for poor	all	Budget estimates for different programmes	MINICOFIN				x					Expertise
	a) overview of existing situation and estimated budget for electrification of health, school and admin facilities	3	Budget estimates for electrical connections and PV systems	Minisante, mineduc, minaloc	x								
2	<b>Policies and Frameworks</b> <i>Output: Policies &amp; legal Framework adapted to facilitate access to energy for poor</i>												
2.1	Verify and update policy on ICS to ensure upscaling	1	Policy updated	Min of Natural Resources	x								
	a) Conduct national workshop to identify best practices and ensure coordination.	1	Best Practices	Min of Natural Resources	x								National workshop, 2 days, Kigali
	b) develop mechanism for subsidy for ICS		Expert study	Min of Natural Resources			x						Consultancy 4 weeks, 1 international & 1 national





	a) Set up a data base system		Database developed and tested	MINALOC										Expertise to develop database, 4 weeks
	b) train staff		Staff of 30 districts and central level trained	MINALOC		x				x				Training days, 120 days
	c) collect and analyse data		Data available and up to date	MINALOC		x				x				
5	<i>Output: Increased capacity of actors involved in access to energy for poor (Gov/nat/local, private sector, NGO, ...)</i>													
5.1	Develop capacity of electrogaz to increase service for modern energy to poor													
	a) introduce low cost board technology and practices	2	Boards available and used in poor areas	MININFRA/ ELG				x						Procurement of xx number of boards to start upscaling
	b) set up a system of subcontractors to install and maintain systems for poor clients	2	10 local contractors established	MININFRA/ ELG						x				business and technical training for contractors, 100 training days
	c) Provide training for electricians in private sector	2	100 electricians trained in low costs connections	MININFRA/ MIFOTRA						x				technical training for electricians funded, 300 days
5.2	Develop capacity of alternative distribution Agencies in technical and financial aspects		3 associations ready to distribute electricity	MINALOC										
5.2	Develop a model/system for maintenance of PV systems in both financial and technical aspects	3												
	a) training of technical staff to ensure maintenance	3	Technical staff available at district level	MINALOC										2* 30 technicians trained through short courses of 2 * 2 weeks
	b) financial model to pay for maintenance & repair costs		Model proposed and ready for implementation	MININFRA/MININSANTE etc										Consultancy input and study tour
5.3	Develop and introduce training modules for renewable energy in technical schools		Curriculum materials available	MIFOTRA										Expertise to develop curriculum and fuding for printing etc
5.4	Sensitize cooperatives & private sector in the opportunities of electricity for productive purposes	4												
	a) support cooperatives/ small businesses in to prepare business plans													Expert on BDS modules
	b) Develop capacity of banks/ MFIs to evaluate business plans for small enterprises using modern energy													100 training days for bank staff

## 5.0. Annexes

### Annex 1: List of Individuals and agencies contacted and particulars

Nr.	Name	Organization	Phone	E-mail
1	Nzeyimana Bonaventure	MININFRA	8833694	<a href="mailto:Lnzeyimana@yahoo.fr">Lnzeyimana@yahoo.fr</a>
2	Mukakalisa Françoise	MININFRA	8650818	<a href="mailto:mukafranco@yahoo.fr">mukafranco@yahoo.fr</a>
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5	Ruzigana Silas	MININFRA	8434030	<a href="mailto:ruziganasi@yahoo.fr">ruziganasi@yahoo.fr</a>
6	Hategeka Augustin	MININFRA	8502413	<a href="mailto:ahategeka@yahoo.fr">ahategeka@yahoo.fr</a>
7	Fernstrom Erik	World Bank	8820353	<a href="mailto:efrenstrom@worldbank.org">efrenstrom@worldbank.org</a>
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40	Kanyamihigo Charles	Electrogaz		

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## Annex 3: Planning in energy sector

Ministry of Infrastructures			
Energy sector			
Activities	Planned Results	Timing	Budget in Mios FRW
<b>2.1. Enhance institutional framework to improve governance and capacity in the sector</b>			<b>570</b>
2102. Strategic study on energy efficiency	1. National energy saving potential is quantified. 2. National strategy created (incl institutional, legal and financial factors)	2008	165
2103. Elaboration and adoption of law on electricity and law on gaz	1. Better organized gas and electricity sectors. 2. Private sector investment increased	2007-2008	55
2104. Human resource development, training, sensitization	National capacity to carry out projects increased	2008-2012	50
<b>2.2. Improve access</b>			<b>24,188</b>
2201. Construction of three (3) micro hydro power plants / CTB=1.8 MW (Keya, Nkora)	National capacity increased by 1.8 MW	2008-2009	1,186
2202. Construction of 8 micro hydro power plants = 6.7 MW (Janja, Mukungwa 2, Rugezi)	National capacity increased by 6.7 MW	2008-2009	1,500
2203. Construction of central hydro power plant of Rukarara, 9.5 MW	National capacity increased by 9.5 MW	2008-2009	1,000
2204. Construction of central hydro power plant of Nyabarongo 27.5 MW	National capacity increased by 27.5 MW	2008-2009	4,726
2205. Construction of 6 micro hydro power plants / NL (PPP)= 1.5MW (Mazimeru, Musara)	National capacity increased by 1.5MW	2008-2009	531

2206. Study and construction of micro hydro power plants in the Kibuye and Cyangugu	National capacity increased by 1.5MW	2008-2009	789
2207. Rehabilitation of the three micro hydro power plants: Mukungwa 1, Gihara et Gisenyi	National capacity increased by 20 MW	2008-2009	3,994
2208. UERP: Urgent electricity rehabilitation project (UERP): 20 MW HFO, Rehabilitation of Tran	National capacity increased by 20MW	2008-2009	7,017
2209. Network line micro hydro power plants MT- 20km (Cyimbili, Pfunda and Nkora) / CTB	National transmission capacity increased by 20km	2008-2009	513
2210. Electricity line Gisenyi- Mukungwa: HT - 110KV-62KM	National distribution and transmission capacity increased by 110KV-62km	2008-2009	900
2211. Electricity line HT 110 KV Kibuye-Gisenyi:	National distribution and transmission capacity increased by 110 KV:(Kibuye-Gisenyi)	2008-2009	193
2212. Electricity line Kigali- Kiyumba 30KV:MT-51km	National distribution and transmission capacity increased by 30KV:MT-51km	2008-2009	136
2213. Line MT 11 KV Rambo-Cap Rubona (5.3km)	National distribution and transmission capacity increased by 11KV-5.3km	2008-2009	180
2214. Line MT 30 KV Rukarara- Kilinda (84km)	National distribution and transmission capacity increased by 30KV-5.3km	2008-2009	500
2215. Electrification Umutara	National distribution and transmission capacity increased by 30KV-84km	2008-2009	500
<b>2.3 Improve diversification of energy sources</b>			<b>3,172</b>
2302. Energy access in rural area: /energy facility/ CE	Access to electricity from renewable sources (solar, hydro etc) increased by:10,000 households; 350 public institutions connected	2008-2010	338
2303. Electrification by solar energy (CTB)	70-80 health centres provided with access to electricity	2008	161
2306. Project to substitute wood and wood coal: improved stoves	Improved technology provided	2008-2009	332