REPUBLIC OF RWANDA

MINISTRY OF INFRASTRUCTURE

National Energy Policy and Strategy

Kigali, May 2011

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LIST OF ACRONYMS

ACP	Africa, Caribbean and Pacific grouping (relations with the EU)
AfDB	African Development Bank
AEPE	Project pour l'Approvisionnement en Eau Potable et Electricité
AFUR	African Forum for Utility Regulators
ARED	Association Rwandaise pour les Energies Durables
BADEA	Banque Arabe pour le Développement de l'Afrique
BEST	Biomass Energy Strategy
BTC	Belgian Development Agency
CBO	Community-based organisation
CDF	Community Development Fund
CDM	Clean Development Mechanism
CEPEX	Central Public Investments and External Finance Bureau
CER	Certified Emission Reduction
CFL	Compact fluorescent lamp
COMESA	Common Market for East and Southern Africa
DEVINFO	Development Information system provided by the United Nations
DRC	Democratic Republic of the Congo
EAC	East African Community
EAPP	East African Power Pool
EDPRS	Economic Development and Poverty Reduction Strategy
ELECTROGAZ	Former name of the Rwanda Utility for Production, Transmission, and Distribution of Electricity and Water
ESMAP	Energy Sector Management Assistance Program
ESSP	Energy Sector Strategic Plan
EU	European Union
EUEI PDF	European Union Energy Initiative Partnership Dialogue Facility
EWSA	Energy, Water and Sanitation Authority

FAO	Food Agriculture Organization
FRW	Rwanda Franc
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GTL	Gas to liquids
GTZ	German Technical Cooperation Agency
GWh	Giga-watt hour (measure of electrical energy)
HDI	Human Development Index
HFO	Heavy Fuel Oil
HIPC	Highly Indebted Poor Country
ICF	Investment Climate Facility for Africa
ICT	Information and Communications Technology
IMF	International Monetary Fund
IPP	Independent Power Producer
KPI	Key Performance Indicator
kWh	Kilo Watt-hour (measure of electrical energy – the basic unit that is billed, so a kWh is also referred to as a 'unit' of electricity)
LRMC	Long-run Marginal Cost
LTIF	Long-term Investment Framework
M&E	Monitoring and Evaluation
MDGs	Millennium Development Goals
MIFOTRA	Ministry of Public Services, Skills Development and Labour
MINAFFET	Ministry of Foreign Affairs and Cooperation
MINAGRI	Ministry of Agriculture and Animal Resources
MINALOC	Ministry of Local Government and Social Affaires
MINECOFIN	Ministry of Finance and Economic Planning

MINELA	Ministry of Environment and Lands
MINICOM	Ministry of Commerce, Industry, Investment Promotion and Cooperatives
MINIFOM	Ministry of Forestry and Mines
MINIJUST	Ministry of Justice
MININFRA	Ministry of Infrastructure
Ml	Mega litre (equal to 1 thousand m^3)
MOU	Memorandum of Understanding
MTEF	Medium Term Expenditure Framework
MW	Megawatt (measure of electrical power or capacity)
NBI	Nile Basin Initiative
NDBP	National Domestic Biogas Programme
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NGO	Non-government organisation
NTB	National Tender Board
PAD	Project Appraisal Document
PER	Public Expenditure Review
PID	Project Identification Document
PM	Prime Minister
PPA	Power Purchase Agreement
PPIAF	Public Private Infrastructure Advisory Facility
PPP	Public-Private Partnership, or, in the context of monetary values, purchasing power parity'
PRSP	Poverty Reduction Strategy Paper
PSF	Private Sector Federation
PSP	private sector participation
PV	Photovoltaic
R&D	Research and development
RBS	Rwanda Bureau of Standards
RDB	Rwanda Development Board

RIG	Rwanda Investment Group
RECO	Rwanda Electricity Corporation
REMA	Rwanda Environmental Management Authority
RRA	Rwanda Revenue Authority
RURA	Rwanda Utility Regulatory Agency
RWASCO	Rwanda Water and Sanitation Corporation
SINELAC	Société Internationale d'Electricité des Grands Lacs
SIG	Sector Implementation Group
SIP	Strategic Issues Paper
SMART	specific, measurable, achievable, realistic and timely
STEG	Tunisian Electricity and Gas Company
SWAp	Sector Wide Approach
SWG	Sector Working Group
TOE	Tonnes of oil equivalent (measure of energy content of different fuels)
UAF	Universal Access Fund
UERP	Urgent Electricity Rehabilitation Project
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
VAT	Value Added Tax
VER	Verified Emission Reduction (for the voluntary carbon market)
Vision 2020	Rwanda Vision 2020 (long-term development programme)
VUP	Vision 2020 *Umurenge* Programme (EDPRS Flagship Programme)
WB	World Bank
WSSD	World Summit on Sustainable Development

FOREWORD

Minister's photo

The 2003 Constitution of the Republic of Rwanda aim is to develop human resources, to fight ignorance, to promote technological advancement and the social welfare of the people of Rwanda. Energy is a fundamental tool for promotion of technology and improvement of social welfare. This constitutional requirement makes it incumbent upon the government to formulate an energy policy that will not only sustain the economic growth of the last decade but also to ensure wide spread access to affordable modern energy services for improving the living standards of all people in Rwanda.

In developing this policy, the 'target' approach is to achieve the high rates of projected GDP growth of about 8.1% by 2013 and to about 9.2% using linear regression on the existing data from Ministry of Finance and Economic Planning (MINECOFIN). At the same time, the policy aims at providing affordable energy access for mineral processing, agro industries, increased tourism and electricity access for over 50% of the population by 2017. A key component of the energy policy is cross border electricity export to neighbouring countries after supplying the local demand. The least cost accelerated electricity generation mix of an additional 1000 MW by 2017 will be met from indigenous resources particularly hydropower, geothermal and methane gas. The basis of the strategy is to work towards an "energy transition" in which energy is more efficiently used and an energy mix that promotes the use of indigenous renewable energy resources to progressively displace biomass in the primary energy mix.

The Ministry of Infrastructure is dedicated to the economic, social and environmentally sustainable development of the Rwandan energy sector. In pursuant of this goal, the Ministry seeks to prioritize the policy statements contained in this paper and translate those options into strategies. The ministry is committed to developing concrete plans to activate these policy options, and will undertake specific actions to ultimately make these plans a reality with the support of all people and institutions of Rwanda. The proposed policy seeks to encourage private sector participation to accelerate the proposed additional power generation. Where applicable, MININFRA will make use of the carbon credit trading schemes when developing additional generation capacity for the benefit of the people of Rwanda.

Eng. Coletha U. RUHAMYA

Minister of State in Charge of Energy and Water

ACKNOWLEDGEMENT

The production of the energy policy document was a consultative process involving members of staff of MININFRA and other stakeholders in the government, development partners, the private sector and civil society who provided very valuable comments.

I wish to pay special tribute to His Excellency the President of the Republic for his inspiration, strategic guidance and his leadership that paved the way, in one way or the other, for the success of the development of this policy. I also wish to recognize inputs from different government institutions, MINICOM, MINEDUC, MINISANTE, MINALOC, MINELA, MINIFOM, RURA, EWSA, OGMR, etc that contributed to the content of this policy paper. Our Development Partners, mainly The World Bank, The Netherlands Government, The African Development Bank, The Belgium Government, The European Union, JICA, GTZ, SNV, AFD etc have contributed to the successful development of this policy.

I am grateful to European Union Energy Initiative-Partners Dialogue Facility (EUEI-PDF) for the financial assistance provided to the government of Rwanda and the energy sector in particular to facilitate the development of this policy

And finally, colleagues from the Ministry: Hon. Minister of Infrastructure who played a leading role, Permanent Secretary and officials in the Energy Sector Department whose contributions were the basis for formulating this policy along with the Consultant.

Eng. Coletha U. RUHAMYA

Minister of State in Charge of Energy and Water

EXECUTIVE SUMMARY

Energy is a key strategic sector for Rwanda because it is a basic requirement for the development of the national economy. The provision of adequate energy infrastructure is essential for the development of industries and businesses especially for the development of energy intensive industries such as mining and for ensuring a high quality service delivery from social institutions such as health facilities, schools and administrative offices to the Rwandan population. In the future, Rwanda could also become a net exporter of electricity to the region if production exceeds local demand. The target is to develop over 1000 MW additional generating capacity by 2017. The policy will therefore be reviewed periodically to align itself to Rwanda strategic requirements.

Rwanda is committed to a sustainable and durable development path that will focus on a green and low carbon development with regard to electricity generation as well as biomass utilization. Rwanda will therefore focus on maximizing the use of its energy resources while at the same time encouraging and participating in the regional initiatives. While developing the energy resources, community involvement will be a priority.

In formulating this policy, the main issues of the energy sector in Rwanda and its linkages with the rest of the economy and the international scene were considered. These include the following:

(a) Rwanda has significant local renewable energy resources, especially hydro power, geothermal and methane gas that can be developed to improve energy supply.

(b) Planning for modern energy supply especially electricity had been limited in the past and a paradigm shift in energy planning is required to achieve equitable modern energy distribution.

(c) The sector needs large investment in generation, transmission and distribution and prudent utility practices.

(d) Sustainable development is a big priority for the Rwandan government while also expanding access to sufficient, affordable, reliable, and adequate energy supply.

(e) The energy sector is directly linked to other sectors of the economy, and it is crucial for their functioning. The policy framework provides for harmonization with the policies of other sectors of the economy.

(f) The policy shall provide a conducive environment to attract private financing and encourage energy trade and other aspects of partnerships. This is particularly required as the energy sector is currently constrained by inadequate financing.

(g) Competition as a principle to attain efficiency shall apply to the electricity market

(h) Generation of electric power shall be fully open to public and private investors as independent power producers. Investment shall be based on social, economic and financial criteria that support development of Rwanda.

(i) Promote enhanced regional cooperation to accelerate development of shared energy resources mainly in hydropower, methane gas and geothermal.

(j) Institutional and legal issues are addressed in this policy especially in the areas of renewable energy.

The approach used in formulating the policy involved a detailed analysis of the sector from both the supply and demand perspectives. Policy objectives and strategies have been developed for the supply sub-sectors i.e. power, petroleum, biomass and new and renewable energy. The same has been done for the major demand side sub sectors i.e. households and institutions, industry and commerce, transport and agriculture. This detailed approach in setting policy objectives and strategies will help to define action plans in a more focused manner.

Based on the background outlined above, this policy framework provides;

(a) the vision of contributing effectively to the growth of the national economy and thereby improving the standard of living for the entire nation in a sustainable and environmentally sound manner;

(b) the mission to create conditions for the provision of sufficient, safe, reliable, efficient, cost-effective and environmentally appropriate energy services to households and to all economic sectors on a sustainable basis;

(c) the policy objectives;

(d) the analysis of the energy sector, which includes the energy consumption per capita, the energy demand and supply, the sector trajectory, as well as the institutional framework;

(e) the policy statements on key issues as well as on subsectors and energy demand categories;

(f) the energy sector strategic plan, which gives the strategies of the subsectors;

There are also a number of cross-cutting themes which are reflected in this energy policy. These include Institutional roles and responsibilities, Private sector participation, Gender, Social inclusion, Environment, Research and development, Regional and international cooperation.

1.0 ISSUE – THE NATIONAL ENERGY POLICY FOR RWANDA

1.1 General Issues–Challenges and constraints of the energy sector

Energy is an essential requirement for the economic development of Rwanda and for the provision of services to its population in schools, health facilities and administrative offices. It will drive the development of industries, businesses and it will power the communication infrastructure.

A quick analysis of the current status of Energy Sector in Rwanda would outline the following constraints

(a) Issues relating to energy supply and demand

i. Low institutional and human capacity: the current energy sector faces low capacity across the delivery chain: planning, designing of projects and programs and contracts negotiations and managements.

ii. The Power utility as well as the local private sector needs to be strengthened in order to implement and sustain the electricity access scale up program.

(b Power supply constraints

i. Only recently has the Government of Rwanda in cooperation with its development partners and the private sector started to invest into additional power generation.

ii. The tariff per kWh is relatively high due to the size of the system, the existence of rental capacity and the use of fossil fuels

iii. Limited access for poor and rural households to modern energy, access to electricity in Rwanda is low at around 14%. The Government of Rwanda has however made tremendous efforts in providing 60% of the households with improved stoves.

(c) Issues relating to institutional aspects

i. Available financing for programs and projects is not sufficient to implement all strategic activities

ii. Coordination with other ministries, government agencies and local communities is important and needs to be strengthened. Programs and projects to supply energy to schools, health centers and local administrative offices are dealt with in coordination with MINEDUC, MINISANTE,

MINALOC and districts. Biomass development, especially components related to planting more biomass/forestry and charcoal production are implemented in partnership with MINIFOM and MINELA. Petroleum activities are developed in partnerships with MINICOM and MINIFOM. There are also other Ministries and institutions involved in the energy contract negotiations such as MINECOFIN, MINIJUST, RDB, EWSA and RURA.

iii. The private sector in the energy sector in Rwanda has inadequate technical and financial capacity. There are very few service companies that can be contracted for projects and programs design, contracts managements and project implementation.

iv. The conditions for the private sector to get involved in the energy market for example through electricity supply has to be improved and the capacity of the public institutions to negotiate with the private sector has to be strengthened.

(d) Issues relating to regional and international aspects

One of the areas that the policy will focus on is regional cooperation and international trade of energy. This energy policy is in harmony with the East African Community and COMESA Energy policies in terms of issues to be addressed and content. While planning for electricity expansion, the policy recognizes that primary energy resources in Africa are not uniformly distributed. International cooperation in the energy sector becomes necessary in order to share these resources.

Grid interconnections to transport electricity generated within the East African Community and COMESA need to be built. Institutional, legal and regulatory framework needs to be in place to facilitate energy exchanges and trade. Rwanda has subscribed to the Eastern African Power Pool and efforts to strengthen this institution will be necessary to operate the interconnections.

Petroleum products in Rwanda are expensive due to high transport costs. Rwanda may need to evaluate the possibility of reducing the transport costs by building a petroleum products pipeline that will connect Rwanda to Kenya through Uganda. Ongoing discoveries in Uganda may also reduce the cost of oil products.

Rwanda is also playing an important role by actively participating in regional and international institutions in the Energy Sector such as Great Lakes Energy (EGL), SINELAC, Forum of Energy Ministers for Africa (FEMA), African Union Energy Commission (AFREC) and is a member of IRENA, and the International Atomic Energy Agency (IAEA) with an aim to develop the sector for common benefits.

1.2 Rationale for updating the energy policy

In order to meet the country's development aspirations, a strong policy and institutional framework is needed to manage existing energy supplies and facilitate substantial investment in all forms of energy.

The 2004 energy policy reflected the emergency orientation in the energy sector at that time and had a short-term focus. The revision of the Energy Policy becomes necessary in order to reflect the current situation of the sector and specifically the expansion plans, the focus on sustainable development and the involvement of the private sector.

Important changes have occurred since 2004 such as Rwanda's membership to the East African Community as well as the development of ambitious strategic objectives of the government of Rwanda.

The review is holistic in nature, examining all aspects related to Rwanda's energy development. The revised policy is needed to:

a) set the National Energy Policy within Rwanda's long-term development plans and strategies;

b) give particular attention to requirements for the progressive development of the electricity sector;

c) have greater focus on household energy requirements and gender dimensions;

d) bring the statement up-to-date by reflecting the latest developments in methane and renewable energy and their environmental implications;

e) state more clearly Rwanda's commitment to private sector participation and to regional cooperation in energy.

2.0 CONTEXT

2.1 Development overview

With a total area of 26,338 km2 and a population of close to 10 million people, Rwanda is the most densely populated country in mainland Africa. Based on the information available from MINECOFIN, the agriculture sector employs 80 per cent of the population and constitutes over a third of Rwanda's gross domestic product (GDP). Agricultural output is predominantly in the informal sector, and a third is still produced in the non-monetary economy. As shown in 2.1 below, the remaining half of GDP is in services, with industry making up between 14 and 16 per cent of GDP growth in the years since 2000. The projected GDP growth of about 8.1% by 2013 and to about 9.2% using linear regression on the existing data from MINECOFIN

In 2008, GDP at current prices was estimated to be Rwf 2,565 billion. In the same year, the population of Rwanda was estimated at 9.5 million people. GDP per head was therefore Rwf 269,000 or US$ 492 at the nominal exchange rate of 547 Rwf to 1 US dollar. Agricultural, forestry and fishing activity contributed 33% of the GDP while industry contributed 15% and services contributed 45%. Adjustments (mainly taxes on products) accounted for 6%. The estimates calculated at constant 2006 prices show that GDP went up by 11.2% in real terms in 2008, following an increase of 5.5% in 2007. In 2008, agricultural production was estimated to have increased by 9%. In 2008, production in the industrial sector increased by 16%, mainly because of construction while in the services sector production increased by 11%.

2.2 Mainstreaming energy into national development strategies

Rwanda has elaborated a number of planning documents to guide national development over different time horizons. The nation's current priority socio-economic goals form the basis of the ***Economic Development and Poverty Reduction Strategy (EDPRS)*** which covers the period 2008-2012. The EDPRS is the medium term programmatic framework for achieving the country's long term development aspirations as embodied in Rwanda ***Vision 2020***, as well as the intermediate targets in the 2015 ***Millennium Development Goals (MDGs***). Recently the Government announced its revised targets for the period up to 2017, and for the energy sector it is planned to produce 1000 MW and connect 50% of the population to electricity by 2017.

2.2.1 Rwanda's Economic Development and Poverty Reduction Strategy

Rwanda's first Poverty Reduction Strategy (2002-2005) focused on the social sectors. The approach in the second generation poverty strategy (EDPRS) is to concentrate on economic growth as a means of providing jobs and unlock resources for poverty reduction. In the EDPRS, infrastructure development, particularly energy, has a crucial role to play. The planned activities in the EDPRS program together with forecast growth in tourism, industrial processes especially in mining, agro industries and other high energy intensity industries like cement processing will require sound policy guidelines. The National Energy policy is therefore designed to support each of the EDPRS flagships:

Flagship 1: Growth for Jobs and Exports promotes rapid economic growth through increased investment, particularly by the private sector, with immediate employment and foreign exchange benefits. Key sectors identified as having immediate export potential are mining, agriculture and tourism.

Flagship 2: Vision 2020 *Umurenge* directly addresses the pro-poor components of the national growth agenda by releasing the productive capacity of the poor in rural areas through a combination of public works, promotion of cooperatives, credit packages and direct support.

Flagship 3: Governance is to provide an anchor for pro-poor growth by building on Rwanda's reputation as a country with a low incidence of corruption and a regional comparative advantage in "soft infrastructure", including good regulatory, judicial and institutional governance and macro-economic stability.

One of the important lessons from Rwanda's first generation Poverty Reduction Strategy Programme (carried out over the period 2002-2005) is that a high rate of economic growth is a pre-requisite to effectively reduce poverty. In recent years, the Rwanda economy has been growing at a rate between 5.5% and 7% per annum. Provided infrastructure constraints and skills bottlenecks can be overcome, the country is poised to maintain these relatively high growth rates. Through combining growth with a number of complementary interventions to address social issues directly, the broad developmental targets of the EDPRS will be achieved.

During the EDPRS period, the main issues in the energy sector revolve around access to energy, costs of supply, energy security and the institutional framework in the management of energy. The specific issues that have been highlighted in the energy component of the EDPRS and therefore have been addressed by the Energy Sector Strategic Plan are to:

i. Increase ***access*** to electricity for enterprises and households

ii. Reduce the ***costs of energy supply*** while introducing cost-reflective tariffs

iii. ***Diversify*** sources of energy supply and enhance energy security

iv. Strengthen the ***governance*** framework and institutional capacity of the energy sector

2.2.2 Vision 2020

Vision 2020 is the country's long-term development blueprint. It is an achievable program based on the following pillars:

i. Reconstruction of the nation and its social capital anchored on good governance, underpinned by a capable state;

ii. Transformation of agriculture into a productive, high value, market oriented sector, with forward linkages to other sectors;

iii. Development of an efficient private sector spearheaded by competitiveness and entrepreneurship;

iv. Comprehensive human resources development, encompassing education, health, and ICT skills aimed at public sector, private sector and civil society. To be integrated with demographic, health and gender issues;

v. Infrastructure development, entailing improved transport links, energy and water supplies and ICT networks;

vi. Promotion of regional economic integration and cooperation.

The above pillars are at all times to be affected by a number of cross-cutting issues, including gender equality and sustainable environmental and natural resource management, spirit of social cohesion and equity.

Vision 2020 envisages sustained high rates of economic growth, with much of this being derived from knowledge-based, service sector activities, such as tourism and ICT. In the energy sector, Vision 2020 emphasizes increased production of energy from existing sources and diversification into alternative energy sources. Hydroelectricity, Lake Kivu methane gas, solar thermal and photovoltaic energy, wind, geothermal and peat are emphasized. Increased access of the population to electricity is identified as a major priority and shall reach at least 60% access rate by 2020. Contribution of biomass energy to the overall primary energy consumption balance of the country will drop from the current 85% to 50% by the same time horizon.

2.3 Millennium Development Goals and Energy

The MDGs are an international initiative whose primary objective is to reduce global poverty. The initiatives identified 8 MDGs embracing economic, social and environmental dimensions of human development. Access to energy was not made one of the 8 MDGs, but analysis of the goals shows that energy services are an essential input into each of the primary MDGs.

The linkages of energy to each of the 8 MDGs is summarised in table 1 below:

Drawn from UNDP (2005): *Achieving the Millennium Development Goals: The role of Energy Services*

Table 1: Energy and the MDGs

MDG Target	Energy linkages
1. Eradicate extreme poverty and hunger	Energy inputs such as electricity and fuels are essential for creating jobs, industrial activities, transportation, commerce, micro-enterprises and agriculture. To meet human nutritional needs, almost all staple foods must be cooked, which requires heat and fuels.
2. Achieve universal primary education	To attract teachers to rural areas, electricity is needed for schools, and children need illumination after dusk to be able to study. Many children, especially girls, do not attend primary school as they must collect wood and water to meet family subsistence needs. Energy is also required to power ICT in education.
3. Promote gender equality and empower women	Adult women spend a large part of their day cooking and collecting water and fuelwood, which leaves them with little time for other productive activities. Without modern fuels and stoves, and a lack of mechanical power for food processing and transportation, women often remain tied to drudgery.
4. Reduce child mortality	Diseases caused by lack of clean boiled water, and respiratory illness caused by the effects of indoor air pollution from traditional fuels and stoves, directly contribute to infant and child disease and mortality.
5. Improve maternal health	Lack of electricity in health clinics, poor illumination for night-time deliveries, and the daily drudgery and physical burden of fuel collection and transport, all contribute to poor maternal health conditions, especially in rural areas.
6. Combat HIV/AIDS, malaria and other diseases	Electricity is needed for radio and television, which can spread important public health information to combat deadly diseases. Health care facilities require electricity and the services that it provides (illumination, refrigeration, sterilization, etc.) to deliver safe, effective services.
7. Ensure environmental sustainability	Energy production, distribution and consumption can contribute to indoor air pollution, local particulates, land degradation, acid rain, and global warming. Cleaner energy systems are needed to address all of these issues to contribute to environmental sustainability.
8. Develop a global partnership for development	The World Summit for Sustainable Development (WSSD) called for partnerships between public entities, development agencies, civil society and the private sector to support sustainable development, including the delivery of affordable, reliable and environmentally sustainable energy services.

Source: UNDP/GTZ (2005): Scaling up Modern Energy Services in East Africa to alleviate poverty and meet the MDGs, East African Community.

The development impacts of energy-related interventions in the context of the MDGs have been analysed in a number of countries, with the following emerging as the key factors[1]:

[1] Drawn from UNDP (2005): *Achieving the Millennium Development Goals: The role of Energy Services*

Considerable strides will have been made during the EDPRS (2008-2012) period in each of these dimensions. Beyond 2012, this experience will need to be built upon and extended initially to reach the MDG time horizon of 2015 and then the goals of Vision 2020.

i. Motive power – energy services that can be used for agricultural, manufacturing, transport and other livelihood activities – is a particularly important service for the poor.

ii. Improvements in energy infrastructure – particularly electricity – are associated with industrialisation and reductions in poverty.

iii. Energy services also play a critical role in improving education and gender equality.

iv. Equally important is the impact energy services have on health.

2.4 Relationship between the energy policy and other policies and strategies

Energy being a prime mover for other sectors to develop, the energy policy will enable the implementation of other national policies and strategy for development and therefore there should be a strong relationship. All targeted objectives in the energy policy are designed based on the needs identified in other subsectors such as production industry development, agriculture development, mining, building industry, education and health development, ICT, etc.

The Energy policy complements other existing policies that touch on socio-economic issues. The energy policy document aims to provide a broad overarching policy framework for other key policies, strategies and official documents affecting economic development of the country such as Economic Development and Poverty Reduction Strategy (EDPRS), Rwanda Tea Strategy (2008), Rwanda Coffee Strategy (2008), Strategic Plan for the Transformation of Agriculture in Rwanda (2009), Mining Policy (2010), SME Policy (Draft 2010), National Export Strategy, Public Private Partnership policy framework, just to mention a few.

3.0 VISION, MISSION AND OBJECTIVES

3.1 Vision and mission

The **vision** of the energy sector is to contribute effectively 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 energy policy vision contributes directly to achieving Rwanda's Vision 2020 short, medium and long-term goals. It will also contribute to promoting Rwanda's achievement of the Millennium Development Goals especially poverty reduction, gender empowerment and sustainable growth

The **mission** of the energy sector is to create conditions for the provision of sufficient, safe, reliable, efficient, cost-effective and environmentally appropriate energy services to households and to all economic sectors on a sustainable basis.

3.2 Energy policy Objectives

The energy policy objectives are to support national development through:

a) ensuring the availability of *sufficient, **reliable and affordable energy*** supplies for ***all Rwandans***;

b) promoting the ***rational and efficient use*** of energy;

c) establishing ***environmentally sound and sustainable*** systems of energy production, procurement, transportation, distribution and end-use.

The achievement of the above-mentioned Rwanda's national energy policy vision and objectives will be promoted by implementing the energy sector strategic plan.

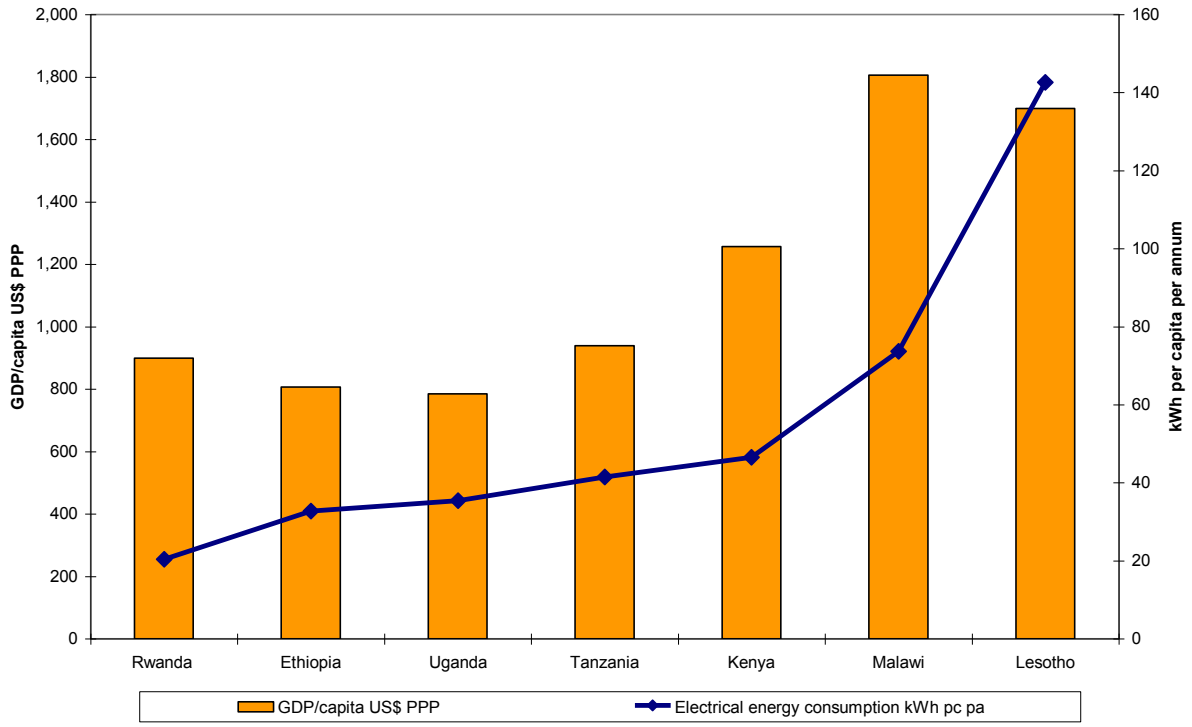
4.0 ANALYSIS

4.1 Low consumption of energy per capita

International comparative data show that Rwanda has very low levels of energy consumption on a per capita basis. This is true not just of per capita petroleum and electricity consumption, but even of primary energy. Average per capita primary energy consumption in sub-Saharan Africa is around 0.6 toe (tonnes of oil equivalent), while the figure for Rwanda (Figure 1) is only just over a quarter of this level (0.17 toe per capita pa). Industrialised country levels are of the order of 4.7 toe per capita pa.

As illustrated in the graph below, Rwanda is particularly far behind in the consumption of electrical energy.

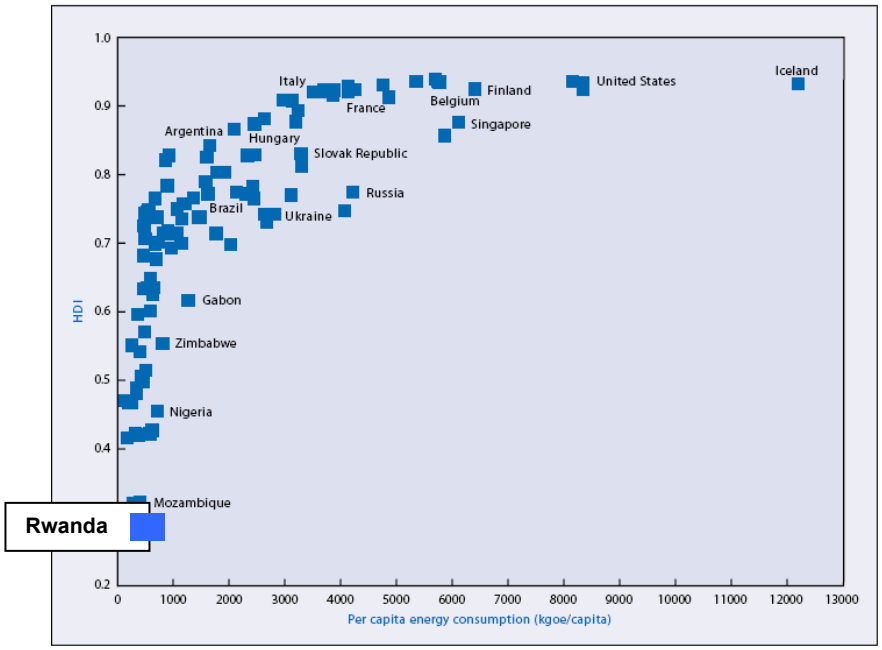
Figure 1 Comparative data on electricity consumption



Sources: IMF for economic data, national utilities for electricity data. PPP = purchasing power parity.

It is clear that consumption of energy must grow very rapidly if reasonable levels of economic growth are to be achieved. Energy demand is correlated not just with GDP but also with broader measures of development, such as the human development index (HDI) – see figure 2. The HDI combines GDP per capita (in purchasing power parity terms) with life expectancy, literacy and school enrolment indicators to get a broader measure of development than purely economic measures would show.

Figure 2Human development index and energy consumption



Note: HDI for Rwanda was 0.46 in 2009, per capita energy consumption 170 kg toe
Source: UNDP, World Energy Assessment, 2004

4.2 Energy supply and demand

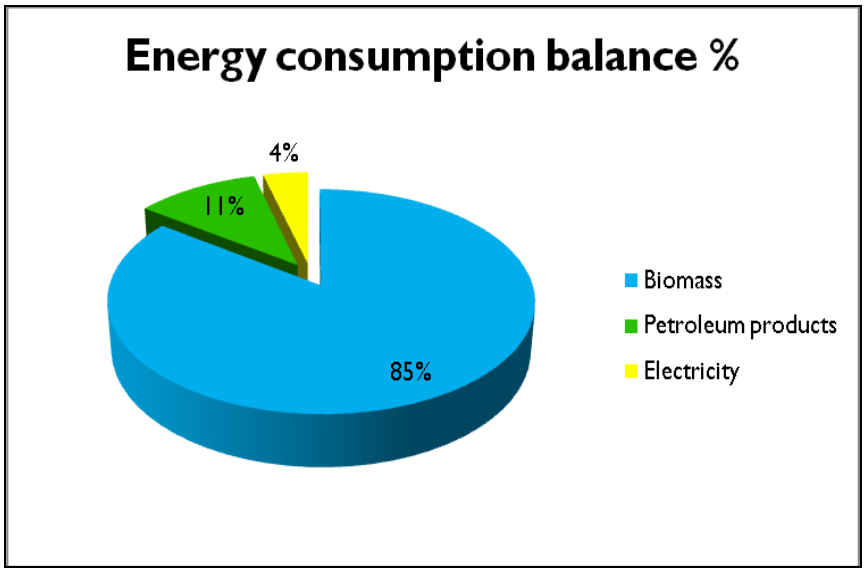
Although there is a downward trend, today approximately 85% of primary energy comes from biomass, in the form of wood that is used directly as a fuel (57%) or is converted into charcoal (23%), together with smaller amounts of crop residues and peat (5%). Of the 15% of non-biomass primary energy, petroleum products account for 11% (used mainly in the transport sector) and electricity for approximately 4%.

The use of biomass energy has potentially serious environmental implications and will not be sustainable unless managed properly. About two thirds of the forest cover in the country has disappeared since the 1950s and although charcoal production is often blamed there are many other factors such as land clearing for agriculture and habitation and the creation of tea plantations. Biomass energy will remain dominant for cooking and other household uses and in this regard it is imperative that forests and woodlots be more productively managed and charcoal more efficiently produced. Failure in this realm could result in further deforestation.

More efficient production and use of biomass energy by households needs to be complemented by promoting other sources of energy, including biogas, peat, LPG, kerosene and of course electricity. This could be in the form of small photovoltaic systems for household lighting, radios etc, but the ultimate goal is for households to have access to reliable grid or mini-grid supplies. Mainly electricity is the most convenient and useful form of energy for almost all of

the key end-uses associated with the EDPRS strategy for national development. Internationally, there is a strong correlation between electricity consumption, economic performance and poverty reduction, so the challenge is to rapidly raise the level of electricity access and efficient usage of electrical energy. The current primary energy supply in Rwanda is illustrated in Figure 3.

Figure 3 Primary energy balance



At present, Rwanda has about 85 MW of installed electricity production capacity, with consumption of electricity being at a low level of 20 kWh per capita per year. This compares with average per capita annual consumption of electricity in sub-Saharan Africa of 478 kWh, and for developing countries as a whole of 1,200 kWh per capita per annum. It is in this context that the most prominent element of the preferred options of this Energy policy presented in section 6 is aimed at increased access to electricity.

4.3 Energy sector trajectory

Vision 2020 aims at transforming Rwanda into a middle-income country by the year 2020. Substantial changes will be required in the energy sector to underpin that transformation:

i. much greater access to and higher per capita consumption of modern forms of energy such as petroleum products and electricity

ii. diversification of energy supply for different end-uses, including for cooking at the household level

iii. exploitation of opportunities for regional coordination and trade in energy, particularly the petroleum and electricity sectors

iv. improving end user efficiency by using efficient stoves and charcoal production systems in the biomass sector, low energy lighting and efficient electrical appliances

v. close attention to reducing unwanted environmental impacts of energy exploitation and usage and focus on sustainability.

Exactly how large an increase in modern forms of energy will be required depends on the pattern of growth that is adopted. Vision 2020 envisages the progressive development of a knowledge-based economy, with high paying jobs becoming available in the services sector rather than in the more energy intensive primary production sectors (agriculture, mining, manufacturing and tourism).

Very high levels of growth in petroleum products and electricity will be required if Vision 2020 objectives are adopted as assumptions for projecting the energy requirements (table 2). The revised planning period of 2017 requires that the number of households to be connected should exceed 1,200,000. If this growth is projected to 2020, then over 2,000,000 households should be connected.

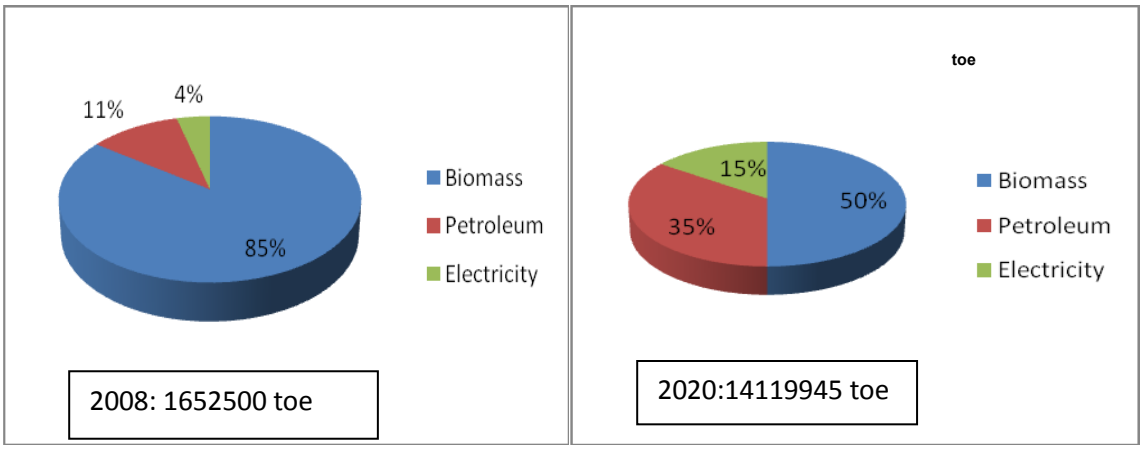
In the petroleum sector, 15% pa growth is assumed to be needed to underpin more than 7% GDP growth. This could well prove to be too modest if the economic growth pattern requires a large contribution from the transport sector (e.g. if the proposal to develop Rwanda as a regional transport hub comes to fruition).

Table 2 Annual average growth rates 2008-2020

Item	Units	2008	Annual Average Growth	2020
Population	no.	9,886,767	2.3%	13,000,000
GDP (US$ m)	US$ m	3,460	7.0%	7,800
Exports (goods and services)	US$ m	405	10.5%	1,342
Imports (goods and services)	US$ m	903	6.0%	1,817
Households with electricity	no.	92,000	21.0%	2,000,000
Biomass (net)	toe	1,108,600	2.3%	1,453,700
Petroleum products	th m^3 / Ml	225	15%	1933
Electricity – energy	GWh	225	25%	3500
Electricity – capacity (incl. regional supplies)	MW	55	294%	1300
Primary energy (gross)	toe	1,652,500	15%	14119945

In the electricity sector, it is assumed that at least 25% pa growth would be needed in all sectors of the economy. The more modest rate of primary energy growth (15% pa) arises when biomass is included in the calculations. The share of biomass in primary energy is reduced from 85% of the total to 50% (Figure 4) but still remains dominant in the overall primary energy consumption.

Figure 4 Energy consumption in toe in 2008 and 2020



Using energy more efficiently, moving away from biomass and using much higher levels of energy per capita can together be characterised as an "energy transition".

4.4 Extent of energy transition by 2020

The nexus of GDP growth (necessarily involving high levels of investment, with a significant proportion of capital goods being imported), net foreign currency generation (exports minus imports and debt service, plus international assistance inflows) and energy requirements place significant constraints on the energy transition. Figure 4 above summarised annual average growth rates for a number of key variables over 2008-2020. The driver for the high GDP growth rate is an even higher, sustained performance in exports.

The ability of Rwanda to continue to run trade deficits will depend on the continued support of international development partners, which in effect allows a much higher level of imports than would otherwise be the case. The import of petroleum and electricity is a priority call on foreign currency, with the consequence that the availability of foreign currency for the rest of the economy declines when the world oil price rises. Higher average oil prices over the period through 2020 would leave too little foreign currency for other demands in the economy, and the likely consequence would be a fall in the level of investment and hence in the level of growth, making unfeasible the scenario outlined in Table 3. It may be that some additional assistance might be forthcoming from development partners should oil prices remain very high, but in the longer term the economy will have to adapt to whatever international markets dictate. Some of these problems can be alleviated by developing least cost base load geothermal energy to replace some of the oil fired generators.

The energy sector clearly has to contribute to foreign currency balances by emphasizing indigenous sources of primary energy, particularly for electricity generation (hydropower, methane, geothermal, peat, solar PV and wind power). It is to be noted, however, that having a domestic feedstock for electricity production does not mean that there is no foreign currency element in the electricity that is produced. Items such as equipment, spare parts and technical inputs all have to be paid for in foreign currency. In the calculations, a foreign currency allowance of US$0.05 or FRW 27 per kWh (including also the costs of directly imported electricity – noting though that SINELAC is partly owned by Rwanda) has been made when calculating the total foreign exchange requirements of the energy sector. If the development of indigenous sources of energy is not accelerated, then the annual average growth in petroleum products would be more than the predicted 15%.

On a per capita basis primary energy consumption will reach 0.2 toe per capita pa by 2020.

Table 3 Per capita annual average growth rates 2008-2020

Item	Units per annum	2008	Annual Average Growth	2020
GDP per capita	US$	350	8.2%	900
Biomass (net) per household using w/c for cooking[2]	kg oil equiv	555	-0.5%	300
Petroleum products	litres	23	15.0%	123
Electricity - energy	kWh	23	29%	488
Electricity - capacity	kW	5.6	294%	113
Primary energy (gross)	kg oil equiv	167	5%	300

4.5Institutional framework

4.5.1 Overall energy responsibilities

The implementation aspects the Energy Policy/Strategy will be separated from the policy-making and overall coordination role of **MININFRA**. The implementation role will then be shifted to the ***Energy, Water and Sanitation Authority (EWSA).***

The other energy institution with major national responsibilities is the regulator, **RURA**. The energy section of RURA has been strengthened, reinforcing its capacity to contribute to the development of the sector through modern and professional regulation.

The **private sector** has an important role to play as an energy user (in energy efficiency and conservation) and as an energy supplier (through investment in the established energy sub-sectors as well as new and renewable technologies). The private sector also has a crucial role to play in minimising and mitigating the environmental impacts of energy production and use.

Table 4 summarises current roles and responsibilities in the energy sector. As the table shows, a significant number of Ministries and government agencies have important roles in the energy sector. A joint team, led by MININFRA, is to be put in place to ensure effective inter-ministerial and inter-agency coordination.

[2] Wood or charcoal.

Table 4 Current institutional roles and responsibilities in the energy sector

Function	MIN-INFRA / EWSA	Other Ministries and government institutions	RURA, REMA and other regulators	RECO (Rwanda Electricity Corporation)	Private sector
Policy and regulatory framework					
Policy-making	☼				
Energy planning	☼	☼		☼	
Energy pricing	☼	☼	☼		
Energy efficiency and conservation	☼	☼		☼	☼
Energy and environment		☼	☼		☼
Sub-sector development and investment					
Charcoal and stoves	☼	☼	☼		☼
Briquettes etc	☼	☼			☼
Petroleum	☼	☼	☼		☼
Electricity	☼	☼	☼	☼	☼
Methane	☼		☼	☼	☼
Peat	☼	☼			☼
Waste	☼	☼	☼		☼
Geothermal	☼	☼		☼	☼
Solar water heating	☼	☼			☼
Solar PV	☼	☼		☼	☼
Wind	☼	☼		☼	☼

Notes: **Energy planning** and projects involve MINISANTE, MINEDUC and at the local level MINALOC, charcoal also involves MINIFOM; **Petroleum**: MININFRA responsible for fuel storage facility; **Petroleum taxatio**n determined by MINECOFIN, margins by MINICOM; **Environment**: MINELA and REMA ; **Private investment** involves a number of Ministries including MINECOFIN, MINICOM, MINIJUST and agencies such as RDB and RRA; **Peat**: MINIFOM and OGMR are responsible for peat resources. **EWSA**: proposed implementation agency, will focus on projects and programs design and implementation. EWSA will also carry out all the activities currently carried out by RECO.

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4.5.2 Institutional development in the electricity sub-sector

Electricity has a central role to play in the growth of the economy, as all of the sectors of the economy identified for growth depend on electricity. The way in which the electricity sector is expected to develop over time is thus of particular importance. In the very long term, it is intended that the electricity sector will be unbundled into generation, transmission, distribution and supply components, with competition being stimulated in the generation and supply segments. It would be counter-productive to move rapidly in this direction, however, and what is envisaged in the short to medium term is to develop the existing structures in methodical and progressive steps:

a) **Formation of a national electricity utility:** Electrogaz has been separated into two national utility companies, an electricity company and a water company. While both companies remain in public ownership, they will be operated on commercial lines under performance–based contracts with government. The electricity company is known as the ***Rwanda Electricity Corporation (RECO) until the Energy Water and Sanitation Authority (EWSA) is established and operational***

b) **EWSA autonomy**: EWSA is to have sufficient autonomy to be effective in executing its role, including autonomy in the setting of salaries to be able to hire staff with adequate skills and experience.

c) **Electricity tariffs and subsidies:** EWSA will be required to set cost-reflective tariffs, which will be regulated by RURA. The tariffs are to be set so as to cover all recurrent costs. Consideration will be given later to tariffs also covering at least some proportion of the electricity sector capital investment programme. Any direct tariff subsidies will be transparent and will be funded by the government. Cross-subsidies, either within a customer category or across customer categories will be transparent and subject to approval by RURA.

d) **Technical regulation:** RURA will also be responsible for technical regulation of the electricity as well as related energy sub-sectors, including the enforcement of the technical standards in the electrical and gas infrastructure.

e) **Electricity market structure:** In the short to medium term, EWSA will be the dominant player in the electricity market. It will be entirely responsible for transmission and distribution via the main national grid. At the same time, self-contained off-grid schemes are encouraged: these can be owned and operated by EWSA or by private developers. While EWSA will continue to have an important role in generation and distribution, independent power producers (IPPs) will also encouraged in the generation sector. EWSA will in effect remain a vertically integrated national utility.

f) **Licensing:** to underpin the above structure, different types of licences are to be issued by RURA: (i) ***IPP licences***: All generation projects or concessions involving private investors are to be licensed by RURA. (ii) ***Off-grid licences:*** Where concessions are granted to private companies to generate, transmit and distribute electricity within an area of the country not covered by EWSA, the tariff and other supply provisions are to be regulated by RURA.

g) **Electricity sector planning and project implementation**: The planning, procurement, transactions expertise and project implementation functions of both MININFRA and EWSA are to be strengthened to carry out the following functions:

i. ***MININFRA*** as the line Ministry responsible for the electricity sub-sector is to continue to have primary responsibility for setting the overall strategy for the future development of the energy sector, including the electricity sub-sector.

ii. ***MININFRA*** is the vehicle for promoting investment in exploration and development of new energy resources and energy efficiency/conservation. The Ministry co-ordinates the support of the donor community and promotes the involvement of private investors. Where IPP projects are developed with the assistance of the Ministry the development will be closely coordinated with EWSA. A power purchase agreements (PPA) will need to be agreed between each IPP and EWSA.

iii. In order to carry out its role of brokering IPP projects, MININFRA/EWSA is to develop the capacity to initiate competitive bidding processes for new IPPs, effectively conduct contract negotiations and move transactions rapidly to financial closure and implementation.

iv. **EWSA** is to become progressively more involved in the planning and execution of projects. In the short term, the focus will be on transmission and distribution projects to be implemented under the roll-out programme. In the medium term, EWSA is to acquire the technical skills to plan and implement all types of projects in the electricity sector.

h) **The Electricity Access Roll-out Programme:** is a major component of the Energy Sector Strategy, and is to be continued if possible at an even higher level of connections per year in the post-2012 period. The roll-out programme is to be funded in part by the Government and Development Partners and in part by EWSA and its customers.

4.5.3 Development of institutional structures in other sub-sectors

In order to promote the changes in the energy sector envisaged in this policy, some changes in the institutional roles and responsibilities within the sector will be necessary. These changes are relatively modest and will be superimposed on the existing, fundamentally sound, structure:

a) **Biomass sub-sector**: wood fuel, charcoal, briquettes and production of energy from solid waste landfills largely fall under MINIFOM, MINELA, MININFRA and MINAGRI, together with MINALOC and local government structures, which *inter alia* administer the controls currently in place on tree cutting for different purposes. This institutional structure is endorsed, but the policy going forward will be to streamline and reduce the controls on biomass exploitation, as past experience has shown that they are largely inappropriate and obstructive because charcoal production is generally from planted trees (in large commercial forests or small woodlots) and not natural woodland.

b) **Petroleum sub-sector:** The current structure is to remain in place. Upstream development (presently confined largely to petroleum exploration), planning and investments in fuel storage are to remain the responsibility of MININFRA/EWSA. If

petroleum resources are found, the institutional structure to plan and manage upstream activities will need to be developed. Downstream in the petroleum sector, pricing is to continue to be determined by an inter-ministerial committee, with final responsibility for fuel taxation and industry margins falling on MINECOFIN and MINICOM respectively.

c) **Methane gas** development at Lake Kivu is to be governed by the mandatory management prescriptions for the Gas extraction and Management of Lake Kivu and the Gas Law (currently in Draft form in parliament). The law allows immediate private investment in production facilities, to enable development of Lake Kivu and other natural gas facilities.

d) **New and renewable sub-sector**: MININFRA (on a policy level) and EWSA (for the implementation of projects) are to remain the lead Ministry responsible for all of the following: hydro, methane, peat, geothermal, solar and wind energy. By the nature of most of these types of energy, which, except for methane and geothermal, are widely distributed across the country, local government structures and local communities must necessarily also be involved in their future development. Private sector structures, such as ARED (Association Rwandaise pour les Energies Durables), are welcomed to promote the interests of private developers of renewable energies. The indirect use of geothermal resources in horticulture, agro industries and tourism will also be encouraged and supported. Well head generating units will be encouraged for early generation and off-grid generation.

4.5.4 Capacity building

There is to be a strong emphasis on capacity-building in MININFRA and EWSA and all other institutions involved in energy sector management. While it is relevant to ensure that the institutional structure develops in a rational way over time, of much greater importance is the need to be certain that the institutions at all times have the human, information technology and other material resources necessary to be effective in carrying out their designated roles and responsibilities.

Part of the approach being adopted is to ensure that the Ministry and related agencies are much better prepared to negotiate with private sector energy project developers. MININFRA is developing model agreements and contracts, suitable for a variety of energy projects, together with a coherent framework for the procurement of new power projects. This includes dynamic planning capability, transparent criteria for allocating new opportunities to EWSA or the private sector, timely initiation of competitive bidding processes and model contracts.

On-going training is designed to deliver the following outcomes:

a) Increased ability of MININFRA and EWSA staff to negotiate energy contracts and to be more informed "buyers" of additional expert legal, financial and technical transactional advice when this is needed.

b) In-house expertise on energy project finance and structuring (in MININFRA, EWSA and RURA).

c) Increased capacity in RURA so that it is a fully functional regulator in the energy sector.

d) MININFRA capacity to evaluate and develop proposals for carbon credit projects.

e) Increased capacity in MININFRA and EWSA to acquire skills through recruitment, hiring of consultants, ability to formulate TORs and to enter into agreements etc, as well as enhanced capability to use the skills acquired.

Other capacity-building activities in the public sector include sending people abroad for masters degrees and training courses. The present focus areas for training are methane gas, petroleum, geothermal, hydropower, rural electrification and sustainable development.

Capacity building shall also extend to the technicians for the construction of biogas plants, for the installation and maintenance of Solar PV systems, for the construction and maintenance of micro hydro power plants etc. MININFRA will cooperate with the Technical schools and the Workforce Development Agency for this purpose.

As part of the long-term preparation of energy sector managers, energy education and training is encouraged at all levels of society. This includes energy education in school curricula, vocational training centres, colleges and other learning institutions.

5.0. PREFERRED OPTION

5.1Policy statements on key issues

5.1.1 Integrated approach to energy planning

Energy planning is most effective when it is part of a broad national planning framework:

(a) Sectoral planning is to take fully into account the ***linkages*** between different energy sub-sectors and the economy as a whole.

(b) In particular, energy sector development is to be planned to assist in ***boosting exports***, the driver in the national growth strategy.

(c) At the same time, a balance is to be struck between energy for growth and energy to further ***social objectives and poverty reduction***.

5.1.2 Use of indigenous energy resources

As a landlocked country with limited foreign currency resources, the burden of having to import energy (particularly petroleum products) is considerable. The policy in respect of this burden is as follows:

(a) ***Indigenous energy resources*** are to be fully developed to meet as much of the country's energy needs as it is economic to do

(b) The social and economic ***viability of increasing the proportion of energy supplied from indigenous resources*** will be continually re-assessed.

5.1.3 Energy efficiency and conservation

The best use has to be made of existing energy supplies as well as future additions to energy supplies, and in so doing adverse environmental consequences of energy use will also be minimised. The policy in respect of energy efficiency and energy conservation is as follows:

(a) The best use of energy supplies is to be made through using ***efficient technologies*** and providing appropriate ***economic incentives*** for prudent use of energy resources to satisfy energy needs

(b) Major users of energy shall be urged to carry out regular ***energy audits*** and to follow up to address areas of inefficiency identified in the audits.

(c) The potential for ***energy demand management*** to 'free up' energy from existing sources is to be exploited before energy supply augmentation projects are considered.

5.1.4 Energy pricing and subsidy policies

Correct pricing of energy is important in providing appropriate signals to consumers to encourage efficient and productive use of energy and to ensure that energy suppliers can operate on a sustainable basis, including making investments to expand access to modern energy for the bulk of the population. The basic policy on energy pricing is as follows:

(a) ***Energy prices are to be set to recover the costs of supply, at least of operating and maintenance costs and at a later stage also to recover capital costs.*** Government or donor resources which are available for subsidies contribute more to equity and efficiency objectives if they are spent on once-off capital subsidies than on subsidies to recurrent costs:

(b) Resources available for energy subsidies are to be spent primarily on ***once-off capital subsidies*** to enhance access to modern forms of energy than on recurrent on-going subsidies to reduce the cost of energy to those who already have access.

(c) It is recognised that strict application of the energy pricing policy could cause difficulty for many consumers. In order to make electricity affordable for most parts of the Rwandan population, subsidies might be required. Where a recurrent subsidy is considered warranted on social grounds, the policy is that:

(d) ***All forms of subsidy should be made transparent*** to energy consumers.

(e) ***Cross-subsidies*** (for example within or between electricity customer categories) should be justified on the grounds of maximising social welfare.

(f) ***Direct subsidies*** should be provided in a transparent fashion by the Government.

(g) The ***economic implications*** of subsidies will be systematically analysed.

5.1.5 Regulatory framework

The inherently monopolistic aspects of parts of the energy sector and the public health and safety requirements of most forms of energy are such that economic and technical regulation has a major role to play. Policy on regulation of the energy sector is as follows:

(a) ***Independence*** must be the basic principle governing energy price regulation and licensing of energy providers that is carried out by the Rwanda Utility Regulatory Agency (RURA).

(b) Sufficient ***regulatory capacity*** will be developed in RURA to regulate energy prices specifically for electricity and the various other regulatory bodies involved in the technical, environmental and safety standards necessary for the energy sector.

5.1.6 Energy sector governance

In the past, problems of weak institutions have been compounded by uncertainty about governance. The following policy is enunciated:

(a) Management of the energy sector, including decision-making about projects, must be ***open, transparent*** and firmly oriented on pursuing the ***best interests of the nation as a whole.***

(b) A common ***Sector-Wide Approach (SWAp)*** will be the basis of the process between the government and development partners to ensure proper coordination, efficiency and effectiveness in the use of resources in the Rwandan energy sector.

(c) Procurement should be rooted in the principles of ***transparency, equal treatment*** and ***non-discrimination*** between competing bidders.

5.1.7 Institutional framework and capacity-building

Strong energy sector institutions are essential if the ambitious targets set for growth in energy and overall socio-economic development of Rwanda are to be met. The following policy statements apply to the institutional framework of the energy sector:

(a) Each institution involved in the energy sector should have clearly defined ***roles and responsibilities.***

(b) Overall coordination of the energy sector is the responsibility of the Ministry of Infrastructure (***MININFRA).***

(c) The separation of policy making and strategy formulation from implementation has been endorsed and the ***Energy, Water and Sanitation Authority (EWSA)*** will assume the implementation role.

(d) Key institutions in energy sub-sectors in particular ***the Rwanda Electricity Corporation (RECO)*** will have sufficient autonomy under EWSA to be effective in executing its role, including autonomy in the setting of salaries to be able to hire staff with adequate skills and experience.

(e) ***Inter-ministerial teams*** will ensure effective inter-ministerial and inter-agency coordination and shall be called upon for crosscutting issues for example on hydrocarbons (MINICOM), biomass (MINELA and MINIFOM), MINIJUST for contractual issues, MINECOFIN for investment decisions, MINALOC, MINISANTE and MINEDUC for electrification of public institutions etc.

(f) An effective ***energy information system***, housed in MININFRA, will be established to facilitate management of the energy sector.

(g) Attention will be paid to ***capacity-building*** at all levels so that there are the human, computing and other resources necessary in the institutions for them to be effective.

5.1.8 Private sector participation in energy

To achieve the rapid growth in the energy sector which is required, the private sector will have to play a much greater role than has been the case in the past. The following policy statements apply:

(a) The ***private sector*** participation at any and all levels of the energy supply industry should be promoted particularly in the following areas:

- forestry, charcoal and peat projects
- petroleum and geothermal exploration
- petroleum product storage and distribution
- methane projects (methane from Lake Kivu, urban landfill or other sources)
- large electricity generation projects
- micro-hydro, solar PV and wind generation projects
- small distribution grids
- solar water heating
- distribution and back-up service of household-level energy systems, including efficient and safe wood, charcoal, kerosene and LPG stoves and lights
- energy efficiency initiatives

(b) The Government will be committed to developing an overall framework and long term capacity in negotiating and establishing relations with the private sector regarding energy projects.

(c) Where ***Public-Private Partnerships (PPPs)*** are desirable, government will work with private sector entities to ensure the speedy structuring and financing of PPP projects in the energy sector

(d) MININFRA will work closely with other government agencies established to assist private investors in all sectors of the economy, particularly the Rwanda Development Board (RDB).

5.1.9 Financing energy sector investments

Financing shall be mobilised both for large-scale national energy projects and for small local initiatives. The relevant policy statements are as follows:

(a) Government will be committed to ***optimising the financing of the energy sector*** from the various sources that are available, particularly own fiscal resources and external financing.

(b) Taking note of the country's macro-economic requirements, financing of projects which ***minimise government guarantees*** and hence ***contingent liabilities*** in the budget will be sought.

(c) Energy projects must be ***prioritised*** for support by government and/or development partners according to current sector priorities. For ***electricity projects*** the priority list shall be determined by the cost effectiveness of competing projects in facilitating increased access to electricity, reducing the average cost of electricity supply and enhancing security of supply.

(d) Expansion of ***micro-financing options*** for small energy projects will be encouraged.

5.2 Policy statements on energy sub-sectors

5.2.1 Biomass sub-sector

Biomass fuels, particularly woodfuel and charcoal, provide accessible and affordable sources of energy for 86% of the Rwandan population. Biomass fuels will continue to be important in the future. The development of this sector will be supported through the following policy statements:

(a) Production of wood for woodfuel and charcoal must recognised as an ***important rural economic activity*** that can be conducted in an environmentally sound manner if all regulations are adhered to and sufficient wood is planted.

(b) Plantations, woodlots and mixed agro-forestry will be ***expanded and better managed (planting and harvesting) on a sustainable basis*** to support growing wood fuel and charcoal production.

(c) ***Improved technologies*** for charcoal production and improved stoves to make more efficient use of biomass fuels will be disseminated.

(d) ***Under-exploited forms of biomass*** such as papyrus and typha will be promoted particularly through the briquetting of such materials for cooking and heating.

(e) ***Other energy sources for cooking and heating*** such as biomass briquettes (peat, papyrus, waste), kerosene (using efficient and safe pressure stoves and lights), LPG or Solar energy for water heating will be promoted.

(f) Dissemination of ***biogas digesters*** will be promoted to rural farmers which have the required animal dung or agricultural residue and to schools, hospitals and other institutions where human waste can be transformed into biogas and slurry.

(g) Production of methane or other forms of ***energy from solid waste landfills*** or through ***gasification processes*** will be encouraged.

5.2.2 Biofuels

For a land-locked country which is presently wholly dependent on imported petroleum products, the possibility of producing biofuels from domestic resources has to be carefully considered. There are basically two main avenues which are currently being pursued in other countries:

Ethanol which can be used as a substitute for petrol or as a means of 'extending' imported petrol – this is derived from sugar or sugar-related byproducts

Biodiesel could be produced from waste oils or from oil-rich crops such as oil palm, jatropha and pongamia.

In most cases where there is significant biofuels production, this is the result of significant government subsidies or mandated production requirements which artificially enhance the price. In a country which cannot afford such subsidies or measures and where population

density is relatively high and agricultural land is already intensively cultivated biofuel production needs to be considered very carefully.

A draft biodiesel policy has been developed under the Ministry of Education. At this stage the national policy is therefore to:

(a) Carefully explore the potential of biofuel production projects in Rwanda taking into account not just the direct costs and benefits, but indirect opportunity costs particularly in respect of potential reductions in food crops and import substitution or export cash crops, the implications for use of water resources and the environment, net employment implications and a detailed risk analysis.

(b) Support the development of ***small-scale biofuels projects*** which can supply biofuels appropriately and economically for particular applications eg. remote rural grinding mills.

5.2.3 Petroleum sub-sector

Petroleum products are currently all imported and this represents a considerable drain on Rwanda's foreign currency resources. The policy in the petroleum sector has two main elements – an upstream component, currently concerned with exploration for possible petroleum resources, and a downstream component that relates to the importation of refined products. Downstream petroleum issues are dealt with by the Ministry of Trade and Industry (MINICOM) with the exception of petroleum storage that is dealt with in MININFRA.

(a) The upstream policies are:

i. To ensure that ***petroleum exploration*** is carried out.

ii. To ensure that the adequate ***legal and regulatory framework*** is put in place with regard to petroleum exploration in order to facilitate negotiations with the private sector.

iii. Management of petroleum resources shall be transparent and for the benefit of the Rwandan population.

iv. Should oil or gas resources be identified, the necessary ***upstream developments*** necessary to exploit these resources will be actively pursued.

v. Should ***petroleum revenues*** be generated they will be managed transparently and with maximum benefit to the national economy.

vi. The ***optimal degree of processing*** of crude in country will be carefully considered before any investment in refining capacity is considered.

(b) The downstream policies are to:

i. Reduce the ***cost*** of petroleum products that are imported, including exploring the costs, potential benefits and risks of bulk procurement of products and exploring different transport modes (petroleum products pipeline).

ii. Increase ***security of supply*** by increased storage capacity (to a target of 6 months' supply) and diversification of supply routes.

iii. Enhance environmental protection, health and safety by establishing adequate ***standards*** and ensuring that these are adhered to.

iv. In a spirit of ***regional cooperation***, work with neighbouring countries to reduce the costs of procurement, transportation and storage of petroleum products.

5.2.4 Electricity sub-sector

The main policy aspects of the electricity sector are commitments in the following areas:

(a) increasing ***access*** to electricity to the population, to businesses and social service institutions in order to support economic development (this will be mainly achieved through the National Electricity Access Roll Out Programme)

(b) reduction in the ***cost*** of electricity;

(c) ***diversification*** in sources of electricity supply;

(d) increased participation by the ***private sector*** in the electricity industry specifically for generation;

(e) enhanced ***regional cooperation*** in electricity to reduce overall costs and improve security of supply;

(f) ***clarification of roles*** within public sector structures and development of ***skills*** in planning, procurement, and transactions' negotiation;

(g) development of the ***legal, institutional and financial framework*** for rapid development of the electricity sector.

The introduction of ***competition*** within the electricity industry is a long-term policy goal.

5.2.5 New and renewable energies

Rwanda has scope to develop a range of alternative energy sources which hitherto have been relatively neglected. These include biomass alternatives (crop residues, papyrus and typha), methane, peat, geothermal, solar and wind energy. In respect of these and other potential energy resources which are not being fully exploited, the policy is to:

(a) Proceed with further ***research and development*** of biogas, biofuels and technologies to utilise methane, peat, geothermal, solar and wind energy.

(b) Complement the technical side with investigations of ***the economic feasibility and social acceptability*** of using new and renewable forms of energy.

(c) Work with ***other countries and regional bodies*** so as to have research programmes which complement one another, rather than duplicating efforts and wasting scarce resources available for these purposes.

(d) Provide economically justified ***feed-in tariffs*** or other mechanisms to give incentives and reduce risks for electricity production from renewable sources.

(e) Establish ***norms, codes of practice, guidelines and standards*** for new and renewable energy technologies.

5.3 Policy statements on energy demand categories

5.3.1 Household energy

The household sector constitutes the largest share of total primary energy consumption and is thus a major focus of energy policy. The policy for household energy is oriented to addressing poverty, the main elements being to:

(a) Ensure ***reliable supplies of energy at the household level*** by improving the supply of affordable sources of energy (with a primary focus on energy for cooking), this being targeted particularly at low income households.

(b) Offer ***training and improved stoves*** to increase the efficiency in the use of biomass resources, recognising that biomass will remain a dominant source of energy, especially in the rural areas, for the foreseeable future.

(c) Target provision of ***energy to productive activities*** such as home-based industries in order to directly raise household incomes.

(d) Promote ***alternative forms of energy for household use***, informing women in particular on energy source and technology choices in order to reduce the time burden and the health risks for women associated with current biomass energy usage – alternatives are to include LPG and kerosene specifically.

(e) Ensure that new technologies meet the highest ***health and safety standards.*** This applies particularly to LPG and kerosene stoves.

5.3.2 Agriculture

Agriculture is Rwanda's most important productive sector. Around 80% of the population are involved in farming activities and agriculture accounts for more than 40% of GDP. The level of non-human energy use in agriculture is currently very low. Rural incomes can be increased through developing agro-processing facilities, an important pre-requisite being adequate supplies of energy.

Energy policy precepts for the agricultural sector are:

(a) Ensure ***sufficient energy supply*** to meet the increasing demand in agriculture sector.

(b) Facilitate ***agro-processing centres*** with appropriate energy alternatives, with emphasis on electrification in order to promote small-scale industry, employment creation and economic growth.

(c) Encourage ***energy efficiency*** in ploughing and transportation, where these activities are mechanised, and in irrigation, coffee washing stations, agro-processing and other agricultural activities.

(d) Support the ***commercialisation of production of fuelwood and charcoal*** from woodlots and plantations.

(e) Investigate the possible trade-offs between production of crops suitable for conversion to ***bio-fuels*** and production of food and cash crops.

(f) Create an enabling environment for governmental institutions and private sector engaged in ***research and development*** into appropriate energy technologies for agriculture and options for energy products to be produced by the agricultural sector.

5.3.3 Industry and services

Industry and services (public and private) are currently the dominant users of electrical energy, accounting for over 60% of RECO sales, and are also major users of petroleum products. Old equipment and outdated technologies mean that much of the energy is used inefficiently within these sectors. The policy will:

(a) Provide ***reliable and sufficient energy*** to industries and services

(b) Aim at ***reducing the cost of energy*** in order to decrease the economic development cost in Rwanda.

(c) Promote improved ***energy management*** practices, including the use of ***Energy Audits*** and follow-on energy efficiency and conservation measures.

(d) Create awareness of the importance of using ***cleaner energy sources*** where possible, with environmental performance being included in energy audits and energy management strategies.

(e) Encourage efficient use of ***alternative energy sources,*** particularly environmentally preferable ones**.**

(f) Improve ***coordination*** of institutions concerned with energy, industry and environmental issues.

5.3.4 Information and communications technologies

Information and communications technologies (ICT) have a crucial role to play in the national development strategy that has been mapped out for the EDPRS period and beyond to Vision 2020. The energy input requirements are modest but critical, while the resulting benefits and possibilities that are opened up are immense. The policy with respect to ICT will:

(a) Ensure sufficient, appropriate and cost effective ***electricity supplies*** to meet the ICT needs in both rural and urban areas.

(b) Promote and enhance use of modern information technology for planning, assessments, policy analysis, database networks and managerial ***services in the energy sector***.

5.3.5 Transport

Over 75% of imported petroleum products are utilised in the transport sector. The development of transport has major direct and indirect effects on overall socio-economic development prospects. Efficient and sustainable use of energy in the transport sector is crucial. Energy policy in relation to the transport sector is oriented to:

(a) Promote ***energy conservation and efficiency*** through encouraging proper maintenance of vehicles and good driving practices.

(b) Encourage the development of affordable and well run ***mass transport systems*** so that the proliferation of individual goods and passenger vehicles is reduced.

(c) Reduce ***pollution*** by encouraging the use of environmentally friendly fossil fuels such as unleaded petrol and low sulphur diesel.

(d) Encourage research into ***alternative fuels*** for transport purposes, such as ethanol, methanol and biodiesel.

5.4 Cross cutting policy issues

5.4.1 Gender

More than half the population spend a significant part of everyday fetching and carrying fuel and cooking food. With the assistance of children, nearly all of this work is done by women. These activities are not just time consuming, but they often have adverse health impacts either through physical injuries from lifting and carrying or though inhalation of toxic fumes while cooking.

In recognition of this reality, prominence is given in this energy policy to specifically address the needs of women:

(a) The ***diversification of energy sources for cooking and lighting*** in the home has a high priority and will be promoted.

(b) In developing alternatives for household energy, attention will be paid to ***health and safety*** as well as ***efficiency, cost and convenience***.

(c) Women are will be ***sensitised*** on energy issues as well as being given opportunities to ***try out new technological options*** before they are disseminated more widely.

5.4.2 Social inclusion and HIV/AIDS

Social inclusion is an important objective of the socio-economic development strategy embodied in national development programmes. Key elements of energy policy that are oriented to addressing HIV/AIDS and enhancing social inclusion are:

(a) Supply of ***energy to health centres and schools*** to improve service delivery

(b) Improved ***lighting in rural homes***, thereby assisting young people to study

(c) Contribution to ***HIV/AIDS programme***:

   i. electrifying health centres will bring benefits for patients

   ii. energy for sensitization programmes may make it possible to run more effective campaigns to change behaviour, avoiding the spread of HIV/AIDS

(d) Creation of ***job opportunities***, particularly for young people living in rural areas, and thereby the slowing of migration to urban centres:

   i. short-term construction jobs associated with energy projects (such as methane gas pipelines, hydroelectric power stations, mini-hydro schemes, electricity distribution networks associated with the grid roll-out programme etc)

   ii. long-term jobs or self-employment possibilities once improved supplies of energy for use for productive purposes is locally available.

5.4.3 Environment

There are close interactions between almost all forms of energy use and the natural and human environment. The relevant policy statements in this regard are as follows:

(a) Rwanda is committed to ***mitigating the adverse impacts*** of traditional energy supply chains and of developing and disseminating ***environmentally friendly energy technologies***.

(b) Comprehensive ***environmental standards*** are to be set and strictly enforced for all levels of the energy sector with specific attention to the methane gas and petroleum sectors.

(c) Wherever possible, development of environmentally sound energy is to be supported through accessing internationally marketable carbon credits through the ***Clean Development Mechanism (CDM)*** or through the ***voluntary carbon emissions market***:

   i. Applications will be made to obtain ***Certified Emissions Reductions (CERs)***

   ii. In other cases, ***Verified Emissions Reductions (VERs)*** will be pursued, using internationally recognised standards such as the Gold Standard on the Voluntary Carbon Standard to enhance their value in the voluntary carbon market.

   iii. The proceeds from CERs or VERs will be invested by government in further renewable and sustainable energy projects.

(d) C***apacity to evaluate proposals for carbon credit projects*** will be developed and efforts will be made to ensure that Rwanda maximises the benefits that can be derived from the CDM programme and the voluntary carbon market.

5.4.4 Regional and international co-operation

Rwanda fully supports the deepening of regional cooperation and regional integration in the energy sector. In particular, Rwanda is committed to the following:

(a) Participating actively in the formulation of the Regional Energy Masterplans being coordinated by the East African Community (EAC), and similar regional energy planning such as Common Market for East and Southern Africa (COMESA) or Energie des Pays des Grands Lacs (EGL) a subsidiary of the Communauté Economique des Pays des Grands Lacs (CEPGL) and other regional initiatives.

(b) Regional strategies for efficient procurement, transportation and storage of petroleum products

(c) Regional electrical power projects promoted under the auspices of

i. The East African Power Pool (EAPP)

ii. The Nile Equatorial Lakes Subsidiary Action Program (NELSAP), which falls under the Nile Basin Initiative (NBI)

(d) Joint development with the DRC of Lake Kivu methane gas and petroleum exploration.

5.4.5 Research and development

As a country, Rwanda is committed to promoting research and development in a number of areas of energy, and to do so in a spirit of cooperation with its regional and international partners.

Rwanda's commitment to energy research and development (R&D) is in three complementary dimensions:

Technical R&D into innovative, environmentally-sound energy technologies, particularly in respect of biomass and other renewable energy sources.

Social R&D, examining the practical aspects and social acceptability of utilising and adopting energy technologies, particularly from the viewpoint of women.

Economic and financial R&D, examining the costs, benefits and affordability of energy alternatives, the marketing and follow-up required for successful commercialisation and the extent to which local communities and entrepreneurs, particularly women, can be encouraged to become energy suppliers.

Rwanda is pioneering research and development in areas such as methane extraction from Lake Kivu.

6.0 ENERGY SECTOR STRATEGIC PLAN

6.1 Biomass

6.1.1 Biomass sub-sector status

Biomass accounts for approximately 85% of current primary energy usage. According to estimates in the Biomass Energy Strategy (BEST) study, the 2008 consumption of commercial fuel wood is about 700,000 tonnes, while that of charcoal is 150,000 tonnes, requiring about 1.2m tones of wood to produce. The current situation is one in which production from existing plantations (including small household woodlots as well as large-scale state and private plantations) does not appear adequate to meet demand. To meet future requirements, productivity of woodlots and plantations needs to be improved, more efficient ways of producing charcoal need to be adopted and more efficient use of wood and charcoal made by the final end-users. The last aspect is to be achieved through more efficient stoves which also need to address the health problems associated with indoor air pollution from traditional biomass-based cooking methods.

The estimated value of production of biomass is around US$122 million per annum (FRW 66 billion), or over three times the value of coffee production (US$40 million or FRW 22 billion per annum). A large number of Rwandans depend on the production and sale of wood fuel and charcoal for their livelihoods. The main charcoal supply areas are Southern and Western Provinces, with the largest market being Kigali. The prices of charcoal have been increasing rapidly in recent years: this has put a heavy burden on the budgets of low income households.

6.1.2 Biomass Energy Strategy

The biomass energy strategy is based on three main elements:

a) Producing more biomass through better management of plantations and removal of restrictions on cutting and transport of wood and charcoal (except where the material originates from natural woodland)

b) Saving biomass through more efficient charcoal production and improved stoves (for both wood and charcoal)

c) Substituting biomass with other sources of energy (such as LPG and kerosene using pressure stoves). Electricity is expected to make a minor contribution, but only at the high end market due to its high cost.

A number of different ministries will be involved in implementation and funds will be channelled through those ministry budgets e.g. MINIFOM is to be responsible for tree planting.

More ***efficient production of wood and charcoal*** has considerable potential. One aspect is to increase the production of wood in woodlots – eucalyptus, for instance, is now producing only 6.8 cubic metres of wood per year per hectare but this could be increased up to 20 cubic metres by using different forest management techniques. A second aspect is to improve the conversion of wood to charcoal. Tests in Rwanda of techniques used in other countries have indicated that

it may be possible to increase the charcoal yield by as much as 30-40% by using modern and improved kilns. A number of projects are under way to support these improved approaches.

Improved stoves are a practical and affordable way of reducing wood fuel and charcoal use and reducing health problems associated with traditional cooking methods. In the rural areas, a sustainable approach has been adopted of training householders in the construction of mud stoves which can significantly reduce the use of firewood and produce much less smoke. With more than 50% of households owning an improved stove, Rwanda is already well ahead of most other countries in of Africa. By the end of 2012, the aim is to have reached 100% coverage. The challenge, however, is not just the coverage but ensuring that the various available designs do produce the promised efficiency benefits and that the construction is durable, so that the stoves will be well-used and long-lasting assets in Rwandan homes.

6.1.3 Biogas Programme

The National Domestic Biogas Programme (NDBP), which is partly funded by the Dutch Government, implemented by MININFRA and receives technical and institutional support from the Dutch and German agencies SNV and GTZ, aims to install at least 5,000 biogas digesters in rural households owning 2 – 3 cows by the end of 2011. Government's one-cow-per-family programme will facilitate further, more widespread adoption of biogas.

Beyond domestic purposes, biogas has been used in prisons in Rwanda for many years. It is now being expanded to institutions such as schools, prisons and hospitals.

Biogas projects may be eligible for carbon credits either on the certified or the voluntary markets.

6.2 Petroleum

6.2.1 Petroleum sub-sector status

The present situation is one in which all of the country's petroleum product needs are imported. Following Uganda's success in identifying oil in the northern part of the Rift Valley, hopes have been raised that indigenous petroleum resources might be discovered. The structural similarities between the two sides of the rift valley appear to be the main factor for the interest in oil exploration in Rwanda. The presence of methane gas dissolved in the deep waters of Lake Kivu, which could potentially originate partly from the earth crust, is interpreted by some experts as an indication of probable oil presence below the Lake sediments.

Other proposals for substituting imported fuels with domestically produced ones include converting methane into liquid fuels. This concept is currently being investigated from both technical and financial viability viewpoints.

The combination of high prices of fuels on the international market and the very long and expensive supply route is resulting in extremely high prices for petroleum products in Rwanda. In addition to high costs, the country is dependent on a limited choice of supply routes and is vulnerable to interruptions in supply. Storage is limited to 2 months supply – see table 5.

Petroleum products are normally imported via the 'Northern Corridor' route (pipeline to Eldoret, then road tanker through Uganda and then into Rwanda). During the period of instability in Kenya following the December 2007 elections, product was imported through

Tanzania. This incident reinforced the need to diversify import routes, while also reducing the costs of transport of liquid fuels as much as possible.

Table 5 Existing petroleum product storage (thousand cubic metres)

Site	Super	Diesel	Jet A-1	Kerosene	Fuel oil	Total
Gatsata	6.2	4.9		2.45	1.8	15.35
Kabuye	2.9	2.0			0.55	5.45
Rwabuye	1.8	1.8				3.6
Bigogwe	2.9	1.9				4.7
Kanombe			1.5			1.5
Total	**13.7**	**10.6**	**1.5**	**2.5**	**2.35**	**30.6**

From national trade data from Rwanda Revenue Authority (RRA), total imports of petroleum products in 2009 were 222,404,601 litres compared to 159,411,356 litres in 2008. This represents an increase of about 40 %. The imports are mainly dominated by diesel and petrol as shown below

- Diesel 103,624,633l pa
- Petrol 74,025,910 l pa
- Kerosene 12,006,010 l pa
- Jet fuel 1,044,002 l pa
- Heavy fuel Oil (HFO) 31,433,859 l pa
- Other Heavy fuel Oils (HFO) 2,770,187 l pa
- LPG 240 tonnes

Demand for the above products is forecast to grow at an average of 10% pa up to 2020. The cost of procurement is an important consideration from a macro-economic viewpoint. At present, oil products account for 25% by value of imports. The proportion of export revenues spent on oil products is even higher - 55%. By 2020, the aim is to have increased export revenues sufficiently for the proportion spent on petroleum products to be less than 50% despite the large increase in petroleum products that is envisaged. Whether these targets can be met will depend to a significant degree on how international oil prices develop over the period to 2020.

Due in part to the high prices and unsustainable production of charcoal, and health risks associated with using kerosene, there is increased interest in LPG as a fuel for cooking. The price, however, is a major deterrent as it is more expensive than LPG in Kenya where the consumption per capita is 50 times higher than in Rwanda. Another problem is the lack of a well developed distribution network and sufficient refilling facilities, but for this infrastructure to be economic, LPG would have to be more extensively used in Rwanda and made available in a variety of cylinder sizes. Therefore an aggressive promotion campaign for LPG will be

supported by MININFRA. In the context or the harmonization of customs within the East African Union, LPG has been exempted from import as well as from VAT.

6.2.2 Petroleum energy strategy

The strategy for petroleum energy is summarised as:

(1) Reduce costs of transport through Extension of the proposed Eldoret-Kampala pipeline to Kigali and Construction of the Isaka-Kigali rail link

(2) Ensure security of supply by increasing storage capacity and bulk supply

(3) Development of standards (trading, transport, environmental, etc)

6.2.3 Regional transport projects

As emphasized above, the cost of transporting petroleum products from the ports at the coast (either Mombasa or Dar-es-Salaam) is extremely high. The main options to be developed within the framework of the Energy Strategy to address this issue are:

a) ***Extension of the proposed Eldoret-Kampala pipeline to Kigali*:** this involves the construction of a 520 km extension from Kampala to Kigali. The feasibility studies conducted so far indicate that the project is viable, being set to reduce procurement costs by 11-25%. The next stage of developing this project will be to commission the technical design. The project will be funded by the private sector.

b) ***Construction of the Isaka-Kigali rail link***: this would facilitate product being brought from Dar-es-Salaam to Kigali by rail tanker. This would provide an economic alternative route to the Northern Corridor.

6.2.4 Petroleum storage projects

At present, there are two government projects which have been completed, namely:

a) Rehabilitation of oil storage at ***Bigogwe*** with a capacity of 4,700 thousand cubic metres

b) Rehabilitation of oil storage at ***Rwabuye*** with a capacity of 3,600 thousand cubic metres

To reach the target of at least doubling storage capacity to the equivalent of 4 months supply other projects are currently under development with the private sector. The estimated additional storage capacity currently under negotiation is around 60,000 cubic metres for liquid fuels and 70 cubic metres for LPG.

6.2.5 Bulk procurement of petroleum products

From the viewpoint of economies of scale, it may be advantageous for Rwanda to have a national bulk procurement strategy, but for this to be feasible additional in-country storage or shared regional storage would be needed. There is interest in both Kenya and Tanzania in bulk procurement and a regional approach could well be of benefit to all countries of East Africa. For Rwanda, the way in which the procurement system would operate would need to be carefully assessed, with the private sector undertaking the logistics and the government role if possible

being limited to ensuring that the mechanism chosen consistently produces the most socially beneficial outcome. A study is needed to elaborate the options and assess the relative benefits of each one in relation to the current procurement method.

6.2.6 Standards in the petroleum industry

As noted previously, there is need for a thorough overhaul of the standards which should apply to the petroleum sector. MINICOM, working with the Rwanda Bureau of Standards (RBS) and environmental authorities, is to undertake a detailed elaboration of minimum standards to which all operators in the petroleum industry must adhere. The following standards will be developed:

a) Petroleum products standards and Petroleum facilities construction standards (wholesale, retail and consumer dispensing sites and storage depots)

b) Petroleum transportation standards and practices i.e. standards for road tankers that ferry petroleum outside and inside Rwanda

c) Petroleum Sector environmental standards and guidelines

Once the standards have been set and gazetted, all petrol stations will be required to have and adhere to a clear environmental health and safety policy.

6.3 ELECTRICITY

6.3.1 Electricity sub-sector status

The present electricity supplies are derived principally from thermal sources and hydropower sources. Table 6 below summaries the 2009 available capacity and energy production (before losses).

Table 6 Electricity capacity and energy in 2009

Source of supply	Capacity (MW)	Energy (GWh)
Thermal	37.8	
Hydro	37.5	
Methane to Power	1.80	
Solar Power	0.25	
Total	77.05	245.6

Table 7 below shows that the installed capacity at 96.44MW is higher than the available capacity of 86.84MW of which 0.74 MW is off-grid generation. Current electricity demand is around 65 MW that is met by generation but there is a projected emergency deficit of 26 MW which will be

met from diesel generation in the short term. The demand is estimated to grow to 130 MW peak load by 2012, planned 1000 and to 1300 MW by 2020.

Table 7 Current electricity generation capacity

Category	Name	Installed Capacity (in MW)	Available Capacity (in MW)
In house Hydro Power	Ntaruka	11.25	11.25
	Mukungwa	12	12
	Gihira	1.8	0 (rehabilitation)
	Gisenyi	1.2	0 (rehabilitation)
	Rukarara	9.5	3 – 8 MW Under commissioning
	Rugezi	2.2	Under commissioning
Imported Hydro Power	Rusizi 1 (SNEL)	3.5	3.5
	Rusizi 2 (SINELAC)	12	11
	Kabale (UETCL)	-	1
Micro Hydro Power	Nyamyotsi I	0.1	0.1
	Mutobo	0.2	0.2
	Agatobwe	0.2	0.2
	Nyamyotsi II	0.1	0.1
	Murunda(REPRO)	0.1	0.1
	Rushaki	0.04	0.04
In house Thermal Power	Jabana (Diesel)	7.8	7.8
	Jabana (Heavy Fuel Oil)	20	20
Rental Thermal Power	Aggreko (Gikondo)	10	10
Methane to Power	KP1	4.2	1.3
Solar Power	Kigali Solar	0.25	0.25
Total		**96.44**	**86.84**

The national Hydropower Atlas project has identified 333 hydro sites in the country with a combined capacity of 96 MW. Part of these sites is already under development. Rwanda's share of hydropower potential on border rivers is at least 150 MW. As discussed in more detail in Section 6.3.3 below, both Rusumo Falls on the border with Tanzania and Rusizi III and Rusizi IV on the border with the DRC are scheduled for joint development with Tanzania/Burundi and Burundi/DRC respectively. As a member of the East African Power Pool and the Nile Basin Initiative, Rwanda also has the possibility to import electricity generated from hydropower plants from further afield in the region.

Future domestic generation developments for the main grid are expected to continue from both hydropower sources and thermal (heavy fuel oil and methane-based production from Lake Kivu growing in importance). Hydropower will also be important for small off-grid systems,

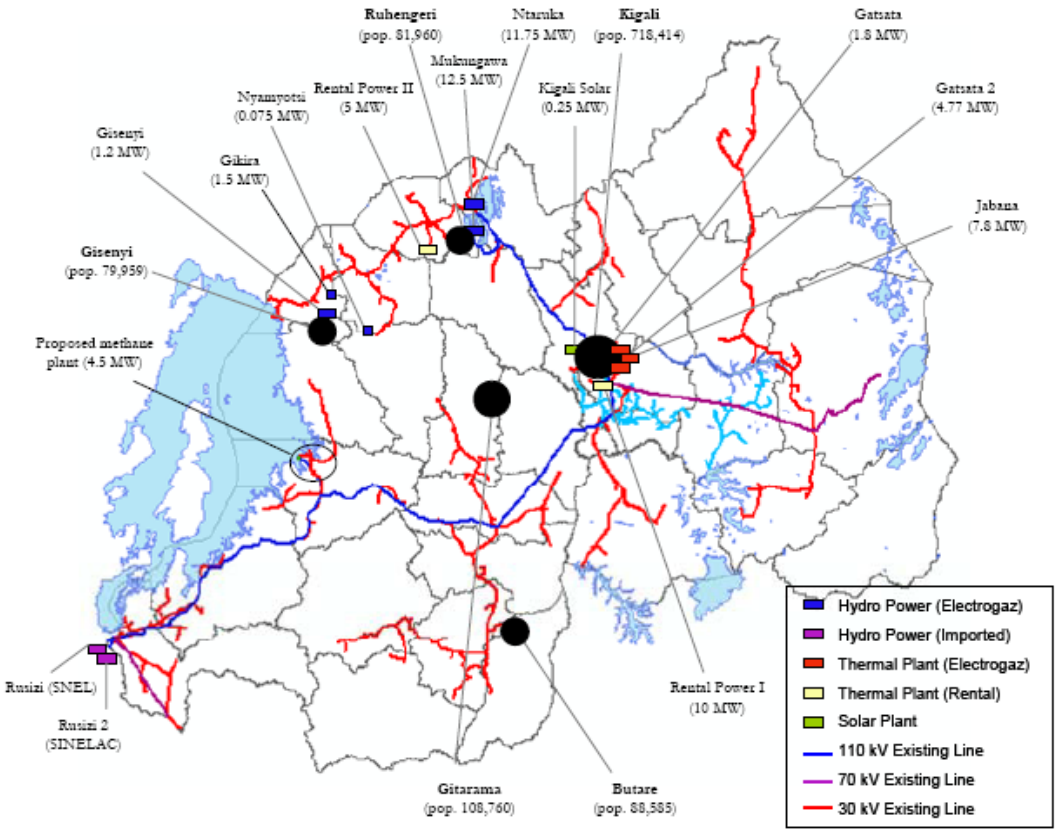
with solar playing a growing role for isolated applications. Geothermal and wind power are also being investigated (see Sections 6.3.3.4 and 6.3.3.6 below), with initial geothermal estimates suggesting that further investigation of geothermal potential is warranted.

The national transmission grid, which is illustrated in Figure 5, consists of some 383.6 km of high voltage lines and 4900 km of medium and low voltage lines. The distribution system consists of both medium voltage (30 kV, 15 kV and 6.6 kV) and low-voltage (380 volt three-phase and 220 volt single-phase) networks, with a significant proportion being located in Kigali and much of that is undergrounded.

Since the year 2000, the number of RECO customers has been increasing. From the 2006, RECO has experienced a very sharp increase in the number of customers (Figure 6) and by September 2010, RECO had over 169,000 customers. Total sales of electricity in 2009 amounted to 245,612 MWh. The composition of RECO electricity customers as of 2009 was as follows:

- LV customers: 141,827
- MV (large) customers: 670
- Total customers 142,497

Figure 5 Transmission grid and location of generation



Source: GIS Centre National University of Rwanda (2008)

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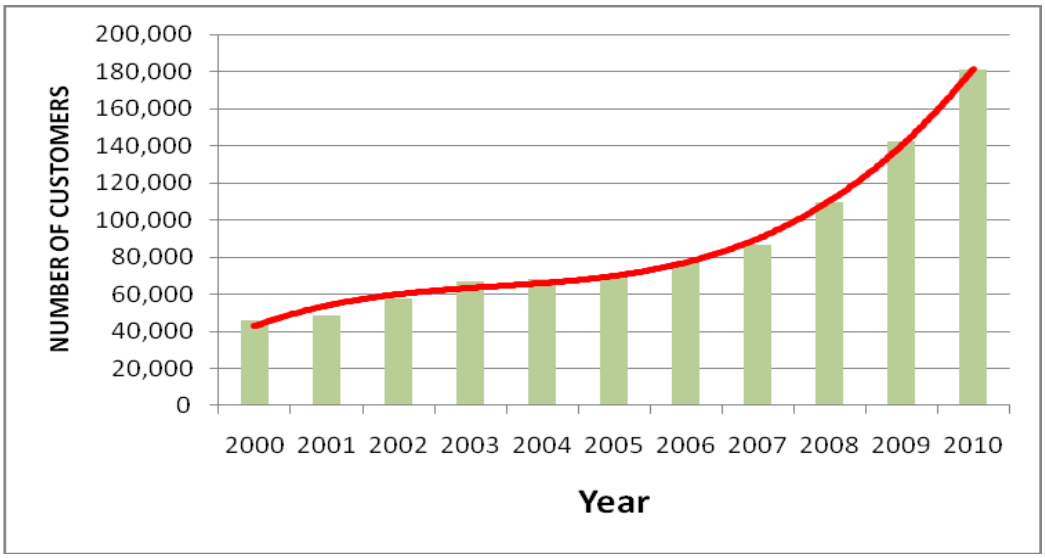
Figure 6 Evolution of RECO customers between 2000 and 2010



Electricity access in Rwanda is still low; it is estimated that currently only 14% of the population has access to electricity supplies. Most supplied households are located in urban areas.

In addition to the lack of access to electricity, the high price per kWh is another of the main immediate issues to be addressed in the electricity sector. Currently the retail tariff is 112 FRW/kWh (0.21 US$/kWh) for domestic consumers and 105 FRW/kWh (0.19 US$/kWh) for large commercial and industrial consumers (plus VAT). The current price would be even higher without government subsidies, which include a waiver on import duties on imported fuel plus a direct subvention to RECO to offset the high price paid for the electricity produced by the rented generator.

6.3.2 Electricity Development Strategy

The primary goal of the accelerated electricity development strategy for the period 2011 to 2017 is to generate the planned additional 1,000 MW of electricity by developing least cost electricity generation options using indigenous energy resources and also from shared energy resources with the neighboring countries of DRC, Burundi and Tanzania. The specific objectives of the strategy are to:

(a) Address the challenges in projects currently under implementation and develop plans to successfully complete them;
(b) Implement the least cost electricity generation mix by developing specific projects with clear time lines;
(c) Secure the necessary funding for planned electricity projects, including ensuring sufficient private sector investment (both local and foreign);
(d) Develop the required legal & regulatory framework to support the implementation plan;
(e) Develop conducive policies including appropriate incentives and tariffs to attract private sector participation;
(f) Develop human resource capacity to implement the planned electricity generation projects;
(g) Involve local communities to the extent possible in developing energy projects.

In order to increase access to modern energy, investment and initiatives are required in electricity generation, transmission and distribution. Based on the general objectives outlined in

its Strategy paper, the electricity sub-sector has therefore elaborated the specific targets to be achieved during the period 2011 to 2017. The following targets have been set:

(a) Hydropower generation shall be increased to about 340 MW
(b) Geothermal resources shall be developed to deliver 310 MW to the national grid
(c) Methane gas to power projects shall deliver 300 MW to the national grid
(d) Peat resources shall be developed to deliver 200MW to the national grid
(e) 10 MW of additional diesel generation shall be required to meet the immediate power needs and serve as a backup for the short term.
(f) 5 MW shall be generated from renewable energy sources (solar PV, micro hydro power or wind) and distributed to local communities beyond the national electricity grid
(g) By 2017 we shall have reached a total of 1,200,000 connections to the national grid (from the current 204,000 connections) which will be equivalent to 50% of access
(h) 100% of schools, 100% of health facilities and 100% of sector offices shall be electrified by 2017 either through connection to the grid or through reliable off-grid systems
(i) The transmission grid shall be strengthened and expanded by an additional 2100 km in order to meet power supply and demand requirements (High Voltage lines and substations)

Some specific strategies for electricity development include:

a. For Micro hydropower plants

(i) Encourage PPP models to invest in the construction of small micro hydropower plants with capacity not exceeding 0.25 MW. This shall include Local Government, Cooperatives and Local Private Sector.
(ii) Government to assist in preparing feasibility studies, the procurement of consultants and service providers and provision of technical advice.
(iii) Mobilize the Private Sector to invest in plants with capacity exceeding 0.25 MW.
(iv) Government to mobilize Development Partners to support studies and construction of plants exceeding 0.25 MW

b. For Solar and Waste to Energy plants

(i) Encourage investment by the local PPP (schools, health centres and similar institutions) to develop solar and waste to energy plants
(ii) Promote the construction of communal plants in Imidugudu in collaboration with Local Government
(iii) Provide supervision of works in order to ensure quality
(iv) Source and encourage the involvement of Private Sector on PPP basis for bigger solar and biogas plants
(v) Search for technical solutions; including new more efficient types of domestic biogas plants and use of low cost materials to reduce the cost of the plants
(vi) Increase Government Contribution to attract more people to join the program

c. For Methane gas, Geothermal, Peat, Hydropower plants (and other bigger plants)

(i) Attract and encourage private sector investors to develop projects on a IPP or PPP basis
(ii) Government to avail more funding and resources for the development of bigger plants

6.3.3 Electricity Generation

The electricity generation projects already in various stages of planning, negotiation and implementation are as follows:

a) ***Lake Kivu*** methane gas projects: 25 MW from KivuWatt expected in 2012, and a further 275 to 300 MW by end-2017 by private investors/GoR

b) ***New hydro***: Nyabarongo I (28 MW) by 2013.

c) ***Micro-hydro***: total of 12 projects, with a total capacity of approximately 9.2MW; financed by various development partners, the GoR and the private sector by 2013.

d) ***Geothermal***: If adequate funding is secured, geothermal can contribute an additional 85 MW by 2013 by using 4 drilling rigs

e) ***Peat***: GoR/REC project for 15MW by 2012.

Details of the above projects are summarised in table 8, together with the target commissioning dates.

If all the projects are realized, the total additional capacity added in Rwanda by 2013 would be approximately 232 MW as shown in table 8.

Any capacity that is installed ahead of domestic demand growth could be used for exports, taking advantage of the opportunities for electricity trade within the region that will be opened up by the strengthening of the interconnections with Uganda and Burundi. Opportunities for exports are to be explored under the umbrella of the East African Power Pool.

Table 8 Possible additional capacity by 2013

Source	**Capacity (MW)**	**Commissioning**
Lake Kivu methane projects		
RIG/REC upgrade project	25	2013
KivuWatt	25	2012
Israel Africa	3.5	2012
Israel Africa	30	2013
Hydro projects		
Nyabarongo I	28	2013
Micro hydro Power Plants		
6 GoR	4.0	2011
2 PSP/GIZ	1	2011
3 BTC	3.18	2011
Geothermal development		
Geothermal well head generating units	10.0	2013

Geothermal I Plant	75	2014
Peat to power		
GoR/PEC	15	2012
Total	**223.28**	

Source: MININFRA

6.3.3.1 Hydro power

Rwanda has three avenues to develop its hydropower resources – micro hydropower, small domestic hydropower, and regional hydropower projects. As already mentioned above, about 96MW potential capacity is estimated from 333 micro hydro sites as identified by the National Hydropower Atlas project of 2007.

In addition, Rwanda has the potential to develop other domestic small hydropower resources such as the 17 MW Nyabarongo II project. Rwanda's share of hydropower potential on Border Rivers is at least 144 MW, with both Rusumo Falls on the border with Tanzania and Rusizi III and Rusizi IV on the border with the DRC scheduled for joint development with Tanzania/Burundi and Burundi/DRC respectively. In addition to the 2 operational plants on Rusizi, one of which is soon to be rehabilitated, there are two further phases being considered: (i) Rusizi III (48 MW) and (ii) Rusizi IV (96 MW). These studies are managed under EGL (Energie des Grands Lacs) and are expected to be completed by mid 2011. A preliminary estimate of the capital costs for Rusizi III (48 MW) is USD 120 million and for Rusizi IV (96MW) is USD 240million. The generation project at Rusumo Falls (21 MW) is estimated at a cost of USD 53M, and together with the associated transmission project, it is being managed by NELSAP. Feasibility studies for both projects are expected to be completed by end 2011. The development of the regional power projects would require interconnection between Ruzizi in the west and Rusumo in the East (Figure 7)

Table 9 Possible additional hydro power capacity by 2017

Expected Commissioning	Responsible	Project	Status	Expected Capacity (MW)	Total Capacity Added (MW)
2011	GTZ	2 Micro hydros[3]	Under construction	1	8.2
	GOR	6 Micro Hydros[4]	Under construction	4	
	CTB	3 Micro Hydros[5]	Under construction	3.2	
2013	CTB/EU/GoR	Rukarara II		2	30

[3] Mazimeru, Musarara

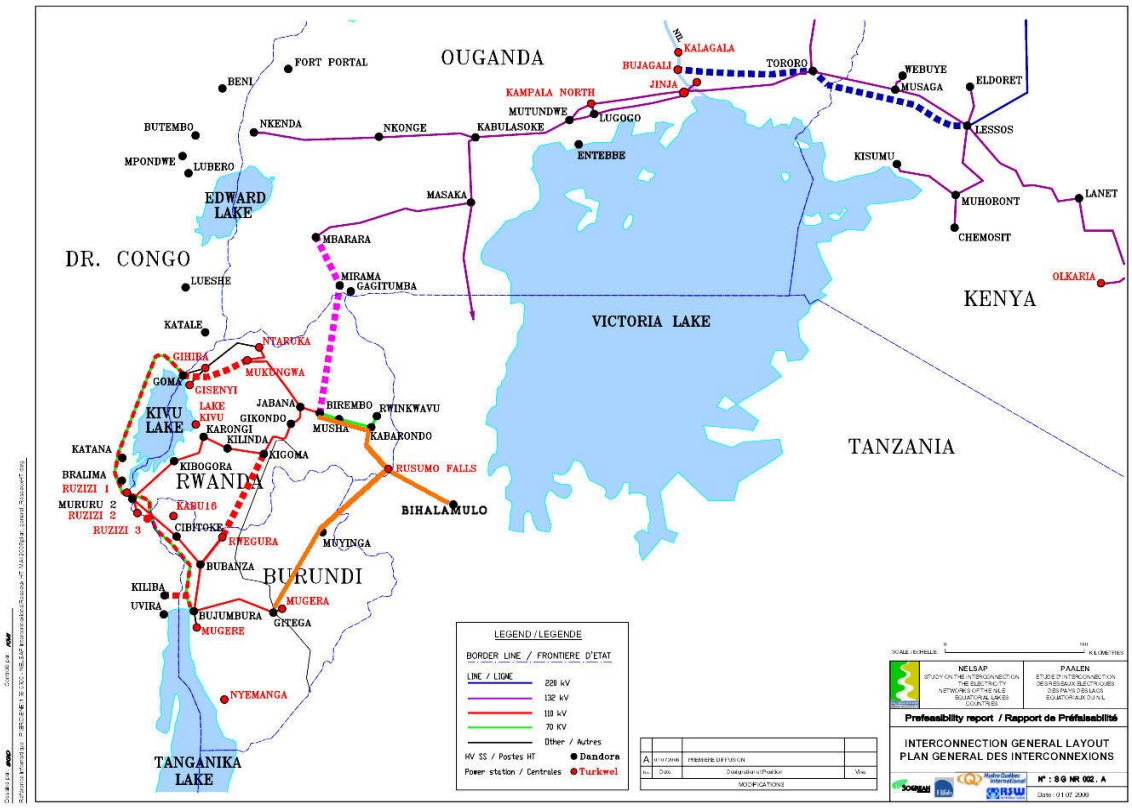
[4] Janja, Mukungwa II, Nyabahanga, Nyirabuhombohombo, Gashashi, Nshili I

[5] Nkora, Keya, Cyimbili

Expected Commissioning	Responsible	Project	Status	Expected Capacity (MW)	Total Capacity Added (MW)
	GOR	Nyabarongo I Hydro	Under construction	28	
2014	GoR	Ntaruka A		2	
	GoR/IPP (REFAD)	Rukarara IV/Mushishiro Hydro		5	11.5
	GoR/IPP (Rwanda Mountain Tea)	Giciye Micro hydro		4.5	
2015	GoR/Burundi	Akanyaru Hydro		3.9	3.9
2016	Rwanda/BR/DRC	Ruzizi III Hydro	feasibility study stage	48	69
	Rwanda/TZ/BR	Rusumo Hydro	feasibility study stage	21	
2017	Nyabarongo II	Nyabarongo II Hydro multipurpose		17	
	Rwanda/DRC/BR	Ruzizi IV Hydro	pre-feasibility study stage	96	184
	GoR/IPPs	Micro hydros		50	

Source: MININFRA

Figure 7 Interconnected network and new projects at Ruzizi and Rusumo



6.3.3.2 Methane gas

6.3.3.2.1. Methane gas sub-sector status

Lake Kivu is estimated to contain 250 billion cubic metres of carbon dioxide and 55 billion cubic metres of methane gas, with a further 150 to 250 million cubic metres of methane being generated annually in the lake. The resource is shared equally between Rwanda and the Democratic Republic of the Congo (DRC).

Methane has been used in a small scale way since the 1960s, but it is only in recent years that serious plans for utilising this resource have been made. The main end-use that is presently envisaged is the production of electricity. The use of a proportion of the methane for heating applications and for petrochemicals (in particular for conversion to liquid fuels) is also being considered and investigated. For electricity production, the quantity of methane that is available is believed to be sufficient to power 700 MW of electricity generation (half for Rwanda) over a period of 55 years.

6.3.3.2.2. Methane gas projects

The government-sponsored a 3.6 MW methane gas pilot project (KP1) that was completed in November 2008 and it has been supplying electricity to the national grid. It has acted as a catalyst in attracting funding for other Lake Kivu methane gas projects. The GoR is in the process of entering into a joint venture partnership with Israel Africa Ltd for the KP1 pilot project. The plan is to first reach maximum capacity of the pilot plant, and then upgrade it to 50MW in two phases. Other projects being developed are:

a) The Rwandan Investment Group (RIG) is developing another pilot project of 3.6 MW, success of which will lead to development of 50 MW facilities.

b) A Gas Concession Agreement and Power Purchase Agreement for 100 MW have been signed with a US American private investor in March 2009.

c) Other private sector initiatives by groups of local and foreign investors envisage projects of between 50 MW and 100 MW by each group, though the bigger projects may be developed in phases of 20-25 MW per phase. Discussions on the structuring and financing of these projects, and the establishment of power purchase and other necessary agreements, are on-going.

d) It is envisaged to develop a joint 200 MW methane gas to power project by the Governments of DRC and Rwanda. Modalities of this project remain yet to be negotiated.

It also planned to use an equivalent of 50MW of methane gas to produce liquid fuel, and it is in this regard that a Memorandum of Agreement has been signed with a private investor for a gas to liquid project.

6.3.3.3 Peat energy

6.3.3.3.1 Peat development status

Peat is presently used to only a very limited extent, yet the country has significant quantities of this fuel, with reserves being estimated at 155 million tons. In Rwanda, the use of peat as a burning fuel has been tested in community institutions, for brick making and in use in small industries, but to date the usage is not very widespread. Findings from MININFRA and MINIFOM research has shown that peat cannot replace firewood for domestic cooking and heating if the technical adaptations of the stoves for smoke evacuation are properly taken care of. Rwanda Investment Group (RIG), a local private company, is already using peat for production of heat in cement factory to replace heavy fuel oil. Further research is to be conducted into the possibility of compressing peat into briquettes for better burning qualities, or to go further and carbonise peat into charcoal has been found not to be feasible. It is planned to supply peat to brick makers, tea factories and prisons as fuel to replace firewood. It is also envisaged to use peat for electricity production.

6.3.3.3.2 Peat to power projects by 2017

As already mentioned above, it is envisaged to use peat to produce electricity. A peat master plan prepared in 1993 indicates 40,000 ha of peat bogs of various qualities. The total area of peat bog required to produce 100MW of power from peat is estimated at around 1500 ha depending on thickness of peat layers and quality of the materials. Before any investment can be made in peat to power production, detailed peat and other technical studies will have to be carried out by either the interested companies or by MININFRA. Following this, MININFRA, EWSA and RDB are in the process of developing the necessary technical and legal expertise to negotiate concession agreements and PPAs, which will require a thorough understanding of the costs of peat bog development and electricity generation using peat[6] . While two peat-to-power projects equivalent to 115MW capacity are at different stages of planning and negotiations, 85 MW capacity is still open to interested private sector investors.

Table 10 Possible peat to power projects by 2017

Expected Commissioning	Responsible	Project	Status	Expected Capacity (MW)
2012	GoR/RIG/REC	Peat to power	Under negotiations	15
2013	PUNJ LLOYD	Peat to power	Feasibility study stage	100
2016	IPP to be identified	Peat to power	-	85

Source: MININFRA

[6] A feasibility study to examine the potential to develop a 100 MW peat-to-power project is currently being undertaken by a private developer.

6.3.3.4 Geothermal energy

6.3.3.4.1 Geothermal development status

Geothermal energy is a clean and reliable source of energy, which is not affected by short-term fluctuations in the weather or world producer prices of oil. The geothermal technology is well known and well developed and the risk is only in proving the resource size by drilling. Most of the geothermal plants when installed have very low maintenance costs and high availability. The GoR will therefore give the development of geothermal energy highest priority. The development of geothermal energy can support economic activity in remote areas while providing positive environmental and social impacts.

Geothermal exploration and development in Rwanda is still at a very early stage and substantial investments are required to accelerate geothermal development. Some surface reconnaissance studies have only been carried out in western region (Gisenyi, Karisimbi and Kinigi). Detailed surface studies and exploration drilling are required in all the geothermal prospects. Based on the existing data, it is estimated that the geothermal potential is more than 700MW. Based on the evaluation of the existing data, it is estimated over 300 MW of least cost base lead generation can be generated from geothermal resources.

6.3.3.4.2 Geothermal development proposed projects

The new proposed projects for geothermal development are given in table 11 below:

Table 11 Possible geothermal projects by 2017

Expected Commissioning	Responsible	Project	Status	Expected Capacity (MW)
2013	GoR/IPP	Karisimbi Early Well Head generation unit	Drilling before end of 2011	10
2014	GoR/IPP	Geothermal I	-	75
2016	GoR/IPP	Geothermal II	-	75
2016	GoR/IPP	Geothermal III	-	75
2017	GoR/IPP	Geothermal IV	-	75

Source: MININFRA

The cost per mega-watt of these projects is estimated at USD 2.5 to 3.5 million per MW depending on the funding options and the exploration strategy and the output from the wells. The focus will be on locating high production geothermal wells to reduce the cost of developing the geothermal resources. To make geothermal least cost, it is recommended that Rwanda use rigs in the East African region for initial exploration then buy the rigs for subsequent exploration

The development of geothermal resources involves 2 main activities:

I. Geothermal Resources Exploration (GRE)
    - Reconnaissance studies

- Detailed surface studies
- Exploration and appraisal drilling
- Prefeasibility studies and baseline EIA

II. Geothermal Resources Development (GRD)

- Production drilling
- Power plant design & construction
- Power line construction
- Reservoir monitoring and management

6.3.3.4.3 Geothermal investigations

The responsibility of getting the geothermal resources developed and attracting IPPs lies with the GoR represented directly by the Ministry of Infrastructure (MININFRA). MININFRA proposes to use a strategy that is organized to make maximum use of integrated geological, geochemical, geophysical surveys and reservoir models to establish the nature and extent of the geothermal resource. So as to maintain full use of the data from each step, the assessment would be conducted by a team that would follow the entire project. The exploration and development of the geothermal resources will be carried out in steps to minimize risks and maximize on developing the geothermal potential.

In 2006, MININFRA was given the responsibility of developing Rwanda's geothermal resources for electricity generation. Some surface investigations have been undertaken by a partnership of the German Institute for Geosciences and Natural Resources and KenGen the Kenya Generation company, which has Rift Valley experience of exploiting geothermal energy for electricity generation.

A preliminary report of the regional geophysical and geochemical survey undertaken in 2009 indicated a high temperature reservoir at the Volcanoes National Park in the North of the country and was followed by more detailed geophysical measurements in the Karisimbi area. The presentation of the detailed study in February 2010 already indicated potential drilling locations while recommending further investigations to make optimal use of the resources. These results have been re-interpreted and used to demarcate the geothermal areas that can be given out to interested private developers. The GoR working with development partners will continue to conduct research and acquire exploration. Detailed surface exploration and exploration drilling would be carried out in all the prospects including Bugarama and Kinigi. This would provide a fallback option just in case one of the prospects is not successful at the exploration drilling stage. This would also give the planners information for accurate implementation of the electricity master plan.

The strategy going forward includes two initiatives: namely

- ***Geothermal resource assessment*:** Drilling of exploration and appraisal wells and well testing in geothermal areas areas already being studied will commence in 2011.

- ***Geothermal resource exploration*** in the Southern prospect by competent firms with expertise in geothermal exploration.

Should a significant geothermal source suitable for electricity generation be identified, the next steps will be:

a) Elaboration of the required ***legal and regulatory framework*** for geothermal exploration or concessioning

b) ***Identification of potential investors and financial partners*** who are willing to invest in and/or finance geothermal sector projects

c) ***Power Plant Development*****:** Drilling of production wells, steam pipelines and Power Plant construction

d) ***Capacity building*** of Rwandan experts in geothermal energy will continue.

6.3.3.5 Solar energy

The climate of Rwanda is favourable for solar energy exploitation, both in respect of solar photovoltaic (PV) electricity and solar water heating. Average solar radiation is 4 – 6 kWh per square metre per day, sufficient to heat 50 litres of water from 20^{O}C to 60^{O}C. Solar energy could make a significant contribution in 2 main areas:

a) basic electrification of clinics, schools and administrative offices in remote centres;

b) solar water heating, substituting biomass and electricity water heating, with significant environmental and recurrent cost savings.

Several development partners are working with the Government of Rwanda on the solar electrification of institutions such as health facilities or schools for example.

The Government is intending to make the installation of solar water heating mandatory for all new constructions, specifically residential houses, hotels and hospitals. Currently a solar water heater subsidy scheme is being designed that will provide incentives to households to install solar water heaters which is aimed at reducing peak electricity use.

In principle, solar electricity generation could also be used for supply to the national grid. The first such plant - the 250 kW Kigali Solaire project located on Mount Jali at the outskirts of Kigali - is believed to be the largest solar PV plant so far installed in Africa. Large solar plants are rare because the economics of such installations remains problematic, despite the abundance of solar radiation in Africa.

6.3.3.5.1Solar energy projects

As part of the Energy Strategy, the roll-out of solar PV and solar water heating will continue:

a) **Solar photovoltaic (PV)**: small solar PV systems will be deployed to meet specific needs such as the electricity requirements of remote rural clinics, schools or administrative offices. Small household PV systems will also be promoted as a relatively inexpensive way of giving households at least minimal electricity access for lighting, radio and phone charging. The focus is on the development of a market for solar home systems and small solar lighting products rather than government programs.

b) **Solar water heating**: with the current high price of electricity, solar water heaters make economic sense for both businesses and households and allow for a reduction of peak demand on the gird. Government endorsement of solar water heating and promulgation of standards is expected to increase the rate of up-take of this technology.

Solar energy equipment will remain exempt from import duty, solar water heaters and energy efficient lights (LEDs) have also been exempted from VAT.

It will be crucial to develop a national strategy for the operation and maintenance of solar PV systems and enforce high quality standards for equipment and the installation of the systems in order to ensure well functioning systems over extended periods of time. Sizing and tender guidelines will be developed to support other government institutions and organizations to procure quality systems adequate to meet the specific electricity needs.

6.3.3.6 Wind energy

The potential for wind energy for electricity generation is presently unknown but is actively pursued through the Wind Atlas project that will map the potential in the country. Internationally, wind energy is becoming increasingly used, and Rwanda is poised to gain from the technological advances that are being made, as well as the experience that is emerging on the institutional, regulatory and financial mechanisms that are most conducive to encouraging investments in wind energy.

6.3.3.6.1 Wind energy projects

In the past, the development of wind energy in Rwanda has been constrained primarily by the lack of wind data. To redress this situation the main project is the Wind Atlas:

a) **Wind Atlas**: a study is underway to collect detailed wind data from 5 test sites across the country for at least one year and basic data will be available by end 2010. From this sample data and other meteorological studies, a number of pilot projects will be established, possibly with turbines of 100 kW to 300 kW.

b) **Wind projects**: if the potential is shown to exist, the data will be used to design wind projects for electricity generation across the country.

6.3.3.7 Waste energy

Waste matter is presently exploited for energy in Rwanda through the national biogas programme, which is based on animal and human waste, and some combustible briquettes made from waste. Compost and fertiliser is made from organic waste. There is also potential for methane to be produced from urban solid waste landfills or through gasification of organic wastes.
As part of the Energy Strategy, the potential for landfill methane production or other gasification techniques yielding methane is being investigated. The Ministry of Infrastructure will work closely with the municipalities, specifically the city of Kigali to ensure that the energy component is integrated into the overall solid waste management strategy.

6.3.4 Power transmission

In the next 4 years alone, it is intended that the national grid be extended by 1,700 km. The main transmission projects which have already been planned are to involve construction of the following lines:

i. Rukarara - Kilinda (30 kV)

ii. Nyabarongo - Kilinda (110 kV)

iii. Upgrading of the existing 70 kV line between Jabana substation and Rwinkvavu substation at Birembo to 110 kV

Associated substation works include (a) Rehabilitation works and upgrade at Rulindo, Gasogi, Musha, Kabarondo, Kigoma, Butare and Rwinkwavu sub-stations and (b) new sub-stations at Kilinda, Rukarara, Rubavu, Kigali new Airport and Gifurwe

In addition to the planned extension of the national grid, there are several important regional inter-connector transmission projects, promoted principally by NELSAP, and these include

i. Rwanda-Uganda, 230 km 220 kV line between Birembo and Mbarara

ii. Rwanda-Burundi, 109 km 220 kV line between Kigoma and Rwegura

iii. Rwanda-DRC, 220 kV line between Karongi, Rubavu, Goma, and Kigali

iv. Rwanda-Tanzania, 220 kV line between Birembo, via Bugesera to Rusumo

v. Associated substation works.

Expansion of electricity trade in the region will also require legal and operational agreements to be reached or existing agreements expanded to cater for an expanded regional network.

6.3.5 Electricity Distribution – Electricity Access Roll-out Programme

The priority component of the Energy sector strategy is increased access to electricity for enterprises and households. The EDPRS target is to increase from 77,000 connections at the end of 2007 to at least 350,000 connections by 2012. Included in the targets is the intention to ensure that by 2012, 100% of health centres, 100% of local administration offices and 50% of schools in the country will have access to electricity, either through direct electricity grid connections or through solar energy, or isolated grids from micro-hydro sources.

Beyond 2012, it is envisaged that the pace of household connections will be increased so as to reach the 2017 target of at least 50% of households (1.2 million connections). This is higher than the target of 35% of households being electrified by 2020. Schools will continue to be electrified to reach 100% by 2020 at the latest. The corresponding demand for power (peak MW) and energy (GWh after losses) are given in Table 12.

Table 12 Energy demand projections 2008-2020

	2008	2012	2015	2020
Peak power demand (MW)	55	165	700	1300
Energy demand after losses (GWh)	225	460	1500	2010
% households with electricity	6%	16%	35.0%	60.0%
% energy consumed by households	38%	64%	75%	83%

6.4 Energy efficiency

6.4.1 Energy transformation efficiency

Within Rwanda's current energy balance, the main elements of conversion from primary to secondary forms of energy are diesel and heavy fuel oil to electricity and wood to charcoal. Diesel generation is not generally affordable in rural areas not connected to the grid. The main focus for secondary stage efficiency improvement is in the production of charcoal.

Charcoal production efficiency has improved over the decades in Rwanda. In the late 1980s, early 1990s an extensive survey of producers was carried out and the average transformation efficiency was calculated to be around 1 bag of 35 kg per "stere", or a transformation efficiency of 10%[7]. The 2008 BEST survey found that the conversion rate had increased on average to 1.4 bags of 33 kg per stere or an efficiency of 13%. In the largest production zone, an average of 1.5 bags is obtained (14%). Efficiency has thus improved by 30-40%, raising average production in Rwanda to the same efficiency range achieved in other similar countries. The Biomass Energy Strategy envisages further improvement, setting a target of 15% for average transformation efficiency to be attained by 50% of producers by 2015 and over 60% of producers by 2020.

6.4.2 End-use energy efficiency

End-use efficiency is a key component of the Energy Strategy. Because of links to poverty and well-being, one target of improved efficiency is energy in the ***home***. This embraces, in particular, issues pertaining to biomass and electricity.

It is important that households using biomass for cooking own and use improved stoves. In Rwanda, well over half of households already have improved stoves, the best of which offer considerable energy savings. One of MININFRA's targets is that improved stove coverage will reach 100% by 2012. Research will continue into which of the improved technologies gives the best performance while also being accepted and adopted by women and other household members in rural as well as urban areas.

For households with access to electricity, the use of energy efficient electrical appliances is actively encouraged and promoted. Government is considering introducing a system of energy labelling, coupled with minimum energy efficiency standards, on the import of all electrical appliances. Use of solar water heaters rather than electricity for water heating can pay off its initial investment cost within a three to four year period without any subsidy and is strongly encouraged.

By far the most important use of electrical energy by households is in lighting. The government has already taken steps to address encouraging energy efficient lighting practices by the purchase and distribution of energy efficient compact fluorescent lamps (CFLs). The EDPRS target is a saving of 30 MW by 2012, this being achieved by the installation of 800,000 CFLs[8] as

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[7] A stere is a stacked cubic metre: a stere of air dry eucalyptus wood weighs about 350 kg, giving a conversion rate of 1:10 when the weight of a bag was 35 kg. Nowadays, a standard bag of charcoal weighs 33 kg.

[8] Calculation of savings assumes replacement of 60 W lamps by 11 W CFLs, saving 49 W per lamp, reducing to 37.5 W after diversity.

well as solar water heaters. Through the scheme managed by the utility, households buy the CFLs at a very low cost and in return have to hand in incandescent bulbs that will thus be replaced; households are limited to 5 CFLs at the subsidised rate. CFLs will also distribute with every new connection made. An Emission Reductions Purchase Agreement (ERPA) has been signed for this project with the World Bank Carbon Unit and the advance payment received for the Certified Emission Reductions (CERs) to be generated will be used to procure additional CFLs.

In the ***productive sectors***, energy efficiency strategies will include:

a) in ***agriculture***, more efficient use of petroleum products for pumping, mechanical ploughing and transport and of electricity for irrigation, coffee washing stations, agro-processing etc

b) large ***commercial and industrial*** electricity consumers will be mandated to undertake energy audits to highlight inefficient equipment and outdated technologies which need to be replaced and updated and to pursue energy efficient practices and energy conservation measures

c) an ***audit of the nation electricity network*** will show where technical losses occur and will identify which measures for network strengthening have to be undertaken to reduce them

d) in respect of construction of ***new buildings***, MININFRA shall ensure that energy efficient construction requirements are included in building regulations, which will assist to avoid as much as possible the use of energy consuming cooling or heating and other devices

Government will also continue to promote periodic 'offensives' during which energy efficiency awareness programmes are mounted. Government will continuously assist in the dissemination of information on energy efficiency and renewable energy sources

7.0 STAKEHOLDERS VIEWS

All the various stakeholders mentioned below were involved in a participative approach in the design of this policy through individual interviews and validation workshops.

7.1 Government stakeholders

For the sustainable and successful development of the energy sector, different sector stakeholders are working together in a coordinated manner under the leadership of the Ministry of Infrastructure that is tasked with the development of the energy sector policy and the supervision of its implementation.

Within MININFRA itself a coherent and integrated planning is envisaged that will combine the planning of habitat, water, transport and energy services in order to create synergies and make best use of resources.

While the Ministry of Infrastructure has so far also been responsible for the implementation of the Energy sector policy (including electricity, hydrocarbons and biomass issues), and the monitoring of individual projects, this role will be transferred to the Energy Development Directorate within the new Energy, Water and Sanitation Authority that is in the process of being set up. This entity will under its roof also gather the commercial side of the electricity and water provision through the inclusion of the current RECO and RWASCO utilities.

The Rwanda Utilities Regulatory Agency (RURA) is mandated to regulate the electricity and gas sub-sectors, to issue licenses to sector operators, to regulate tariffs and protect consumer rights in order to ensure fair competition between energy providers and most importantly to facilitate private sector investment into energy projects.

Since Energy is linked closely to other sectors of the economy, MININFRA is cooperating with other line ministries and government institutions, namely:

i. The Ministry of Finance and Economic Planning for the financing of energy sector projects
ii. The Ministry of Commerce on issues regarding petroleum products import and storage as well as cooperation with the private sector
iii. The Ministry of Environment and Lands on Climate Change issues, environmental safeguards for the implementation of energy projects, land use matters for example for biofuel initiatives
iv. The Ministry of Forestry and Mines for all matters related to biomass in order to promote increased production of biomass as well as reduced utilization as well as issues on Peat resources usage to replace biomass
v. The Ministry of Education, the Ministry of Health and the Ministry of Local Government for the planning and implementation of electrification projects for social institutions
vi. Rwanda Development Board for the promotion of investment opportunities in the energy sector, for the provision of energy services to businesses and enterprises and for the issuance of energy impact assessment clearance for energy sector projects

vii. OGMR (the geological survey) for the exploration of geothermal and petroleum resources
viii. The Rwanda Environmental Management Authority for the development of clean development mechanism projects in the context of the Kyoto protocol

7.2 Development partners, NGOs and the private sector

Development Partners active in the energy sector have all agreed to a common development agenda and to a concerted effort to address the energy sector challenges. The active partners consist of:

i. The World Bank supports the national electricity access roll out programme that focuses on grid extension and intensification, the Sustainable Energy Development Project that supports the market development for renewable energies
ii. The African Development Bank finances the construction of regional interconnection transmission lines, rehabilitation of micro hydropower plants and has pledged support for FY 2011 for the electricity access programme
iii. The European Union is supporting the development of the regional hydropower plants on Rusizi river, the construction of micro hydro power stations and rural electrification of schools through solar PV systems
iv. The Belgian Government through its Development Agency is strongly involved in the construction of micro hydropower plants, the electrification of health centres, the construction of transmission lines and is supporting the electricity access programme
v. The Government of the Netherlands is supporting regional interconnections and the rehabilitation of Rusizi II hydropower plant and has been the first donor to disburse their contribution to the Electricity access programme, through GTZ they are also financing the National Domestic Biogas Programme and the PSP hydro programme
vi. The French Development Agency through its debt relief programme for Rwanda is providing support to the national electricity access programme
vii. The Saudi Fund for Development and BADEA in a joint project are financing part of the electricity access programme
viii. The Opec Fund for International Development is contributing to the electricity access project
ix. DFID is developing a new financing mechanism for renewable energy enterprises

Non Governmental Organizations such as SNV and CARE are working in the Biogas and Biomass Subsector. ARED the local association that represents all renewable energy companies is working in the sector in the implementation of energy projects.

Private Sector companies are strongly encouraged to participate in energy projects with a special attention to investment in electricity generation projects and to setting up local manufacturing of electricity network equipment and energy efficiency devices. RECO is already outsourcing works on the distribution network to local private sector companies.

All Energy Sector Stakeholders are regularly participating in the Energy Sector Working Group, the coordination and decision making forum that is held quarterly and to whom energy sector progress is reported.

8.0 IMPLEMENTATION PLAN

The priority of the Energy Sector Implementation plan is to increase electricity generation capacity from 96 MW to over 1000 MW by 2017 and access to electricity from 204,000 connections of today to 1,200,000 (50% of the population) by the same year. The Energy sector strategic plan therefore identifies the key activities/initiatives necessary to attain the energy policy objectives. The implementation plan looks at a period of 7 years from 2011 to 2017. The implementation plan takes into account the current electricity generation capacity, existing projects under implementation, existing projects under implementation, the planned new generation to achieve the additional generating capacity of 1000 MW by 2017, the proposed increase of electricity access of over 50% by 2017, the challenges and barriers to achieving the targets and the way forward. The success of the implementation plan depends on the availability of adequate and secure funding and support from investors and all stake holders. The implementation plan is therefore supported by the development of an electricity master plan, the right policy framework, incentives and tariffs and legal and regulatory framework to increase investment in energy infrastructure, capacity building through private sector and public partnerships. The plan also involves investments in the energy efficiency and conservation.

The implementation plan takes into account the least cost electricity generation mix that gives Rwanda the comparative advantage of using electricity supply to spar economic growth. The least cost base load generating mix option is to use geothermal, Hydro power, peat and Methane gas. A major part of this strategy is to export some of the electricity to be used in high energy intensity factories like mineral processing. The energy market will therefore be a major component of Rwanda's economic development and foreign policy. The factor drivers as indicated in the Electricity master plan are shown below;

- Social -Economic environment of the country
- Social -Economic environment in the countries bordering Rwanda
- Projects agreed and decided on the governmental level
- Development of the size of households and household income elasticity
- Exchange rate between local currency and US$
- Development of the Gross National Product
- Development of the electricity tariffs for households
- Existing electricity tariffs for large consumers especially in mineral processing and large irrigation schemes in the Great Lakes Region
- Development of the electricity tariffs for large consumers and Control of electricity losses
- Development of the specific electricity consumption of ordinary consumers
- Increase of the demand of large consumers
- Development of the specific electricity consumption of large consumers
- Increase of the demand of public sector and development of the specific electricity consumption of public consumers

8.1Planned New Generation to deliver 1000 MW by 2017

The proposed least cost electricity generating mix for 2011 to 2017 to increase generation capacity from 96 MW (baseline in 2010) to 1000 MW, plant size and configuration, transmission and distribution lines, expected commissioning and associated costs are shown in table 13 below. The average connection cost in the coming 7 years is estimated at USD 1200/connection.

Table 13 Action plan: Electricity and Transmission Program for 2011 to 2017 to increase generation capacity from 96 MW to 1000 MW

Expected Commissioning	Plant Size & Configuration/ Length & Size of Transmission & Distribution lines			Responsibility	Generation Option/Transmission & Distribution location	Added Capacity (MW)(	Total Capacity Added (MW)
2011	1	x	10	GoR	Diesel	10	18.4
	2			GTZ	Micro hydro	1	
	6	x		GOR	6 Micro Hydros	4	
	3	x		CTB	3 Micro Hydros + MV &LV	3.2	
	53 solar PV installations in health centers			CTB	Solar PV	0.2	
	Transmission line 100 km			CTB	Rutsiro-Rubavu and Nyaruguru		
2012	1	x	3.5	Israel Africa	Methane	3.5	43.6
	1	x	25	KivuWatt	Methane	25	
	1	x	15	GoR/PEC	Peat	15	
	12 solar PV installations in sector offices			GoR	Solar PV	0.1	
	Transmission line 65 km			EWSA	Karisimbi to Musanze		
	Transmission line-180 km			EWSA	Kibuye-Rubavu- Kigali		
	Distribution line (MV)-450 km			EWSA	Country wide interconnections		
	Access – 300,000 connections			EWSA	Country wide		
	Distribution Sub Stations 400 MVA+ 3 *220 /110 kV sub stations			EWSA	Country wide		
2013	1	x	10	GoR/IPP	Geothermal	10	195
	1	x	50	PUNJ	Peat	100	
	1	x	30	Israel Africa	Methane	30	
	1	x	25	REC	Methane	25	
	1	x	28	GOR	Nyabarongo I Hydro	28	
	1	x	2	CTB/EU/GoR	Rukarara II	2	
2014	1	x	75	KivuWatt	Methane	75	161.5
	1	x	75	GoR/IPP	Geothermal I	75	
	1	x	5	REFAD	RukararaIV/Mushishiro	5	
	1	x	4.5	GoR/RMT	Giciye Micro hydro	4.5	
	1	x	2	GoR	Ntaruka A	2	
	Distribution lines (MV)-450 km			EWSA	Country wide		
	Access – 325,000 connections			EWSA	Country wide		

Expected Commissioning	Plant Size & Configuration/ Length & Size of Transmission & Distribution lines			Responsibility	Generation Option/Transmission & Distribution location	Added Capacity (MW)(	Total Capacity Added (MW)
	Distribution Sub Stations 400 MVA+ 1*220 /110 kV sub stations Sub Station			EWSA	Country wide		
2015	1	x	15	Israel Africa	Methane	15	115.9
	1	x	75	GoR/IPP	Geothermal I	75	
	1	x	22	REC	Methane	22	
	1	x	3.9	GoR/Burundi	Akanyaru	3.9	
	1	x	50	DRC & Rwanda	Methane	50	
	Transmission lines – 130 km			EWSA	Country wide interconnections		
2016	1	x	75	GoR/IPP	Geothermal III	75	229
	1	x	48	Rwanda/BR/DRC	Ruzizi III Hydro	48	
	1	x	21	GoR/Tz/Burundi	Rusumo Falls	21	
	1	x	85	IPP	Peat	85	
	Transmission line -15 km			EWSA	Geothermal III & IV to Gisenyi		
	Transmission line- 10 km			EWSA	Ruzizi III to Ruzizi IV		
	Transmission line-85 km			EWSA	Ruzizi III to Kibuye		
2017	1	x	50	DRC & Rwanda	Methane	50	289
	1	x	75	GoR/IPP	Geothermal IV	75	
	1	x	17	Nyabarongo II	Hydro multipurpose	17	
	1	x	47	Rwanda/DRC/BR	Ruzizi IV Hydro	47	
			50	GoR/IPPs	Micro hydros	50	
	Transmission lines – 85 km			EWSA	Rusumo to Kigali		
	Transmission lines -180 km			EWSA	Country wide Interconnections		
	Distribution lines (MV)-500 km			EWSA	Countrywide		
	Access- 400,000 connections			EWSA	Country wide		

Expected Commissioning	Plant Size & Configuration/ Length & Size of Transmission & Distribution lines	Responsibility	Generation Option/Transmission & Distribution location	Added Capacity (MW)(	Total Capacity Added (MW)
	Distribution Sub Stations 400 MVA+ 3*220 /110 kV sub stations	EWSA	Country wide		
Total Capacity Added					**1052**

8.2 Challenges to achieve the targets

- Low generation capacity to meet the increasing demand and low access to electricity
- Lack of sufficient institutional, legal & regulatory framework and human capacity
- Lack of sufficient funds to finance energy infrastructure
- Unfavorable conditions attached to the loans and grants from foreign
- Ineffective modalities for implementation and management of shared generation resources (political interference from partner states)
- Low level capacity in the Rwandan private sector involved in energy projects
- Low purchasing power of the rural population

8.3 Way forward & Recommendation:

- Promote Private Participation in the Energy Sector
- In consultation with MINECOFIN, explore possibilities of Energy Fund (EF) establishment whereby financing of the basket is home-driven rather than donor driven. Small/reasonable levies on fuel per liter, levies on power consumers can be some of the sources of financing into the EF
- Mobilization of adequate and secure funding
- Demand Side Management of Power Consumption/Conservation e.g. use of Compact Fluorescent Lamps (CFLs) and pre-paid metering systems
- Supply Side Management: About 26 Mw are foreseen to be short fall and plans are under way to procure a back up thermal generator – ToR are prepared for rfp
- Use of Solar Water Heaters, Solar system Street lights
- Develop and implement electricity generation program including a mix of hydro, methane gas to power, geothermal, diesel, solar, biogas and waste to energy projects
- Construction of additional petroleum storage facilities
- Electrification of public and social institutions
- Accelerated electricity roll-out plan
- Construction of regional and national transmission lines
- Promotion and facilitation of development of shared electricity generation resources
- Use and conservation of biomass
- Operationalize the Energy, Water and Sanitation Authority (EWSA) as an implementing institution and strengthen the ministry as policy institution
- Elaborate new specific policies and laws and legislations to enforce the policies: electricity bill, gas bill, new and renewable energy and energy efficiency legislations, geothermal and oil exploration law.
- Implement the Human Capacity Building Master plan across the energy sector institutions

9.0 FINANCIAL IMPLICATIONS

9.1 Financial Overview

The implementation of the energy policy plan will require financial resources from both the private sector as well as from the Government of Rwanda and its development partners.

It is anticipated that the private sector will be especially active in investing in power generation and as petroleum products storage. The funds required to implement the energy sector plan is estimated at about USD 5,274 million, for least cost generation, transmission and accelerated roll-out, energy saving and efficiency, petroleum storage, electrification of public and social institutions, capacity building, use and conservation of biomass and promotion of use of the accelerated generation capacity (Table 14). The majority of the investment for transmission and distribution projects is expected to come from development partners. EWSA and its customers are also expected to contribute to the electricity access scale up programme with 20% of investments required for distribution projects each.

Table 14 Cost estimates for the funds required to implement the accelerated least cost generation mix from 2011 to 2017

Activity	Estimated Total cost for the period 2011 to 2017 (Million USD)	Remarks
Additional Least Cost generation mix	3,019	Requires public and private sector partnership
Transmission and accelerated roll-out plan	1,600	Regional interconnection is key to achieving the overall objectives of additional generation
Energy saving and Efficiency	340	
Petroleum Storage	75	To facilitate 4 months of reserve storage
Electrification of public and social institutions	70	
Use and conservation of Biomass	48	
Promotion of efficient utilization of energy resources	2	
Capacity building(legal, institutional, human resources)	120	
Estimated total capital costs	**5,274**	

9.2 Summary of government support requirements

The sector has a number of projects ranging from large projects with national level benefits and implications, to small interventions which will improve the lives of individual households. Almost all

projects will require some degree of assistance from government agencies. Table 15 summarises the type of energy, its extent of applicability, principal uses and the main elements of public support which are needed.

Table 15 Summary of conditions to promote different energy sources

Energy source	Applicability	Principal uses	Main elements of public support needed
Biomass	Almost universal	Cooking	Strategies for improved woodlots and plantations, more efficient conversion to charcoal and use in the home, improved stoves
Biogas	Reasonably widespread	Cooking	Subsidies to households to acquire digesters, training of construction companies
Downstream petroleum	Widespread	Mainly transport sector	Government investment in improved transport and in storage; taxation policy and price regulation
LPG	Limited application	Cooking and water heating	Promotion and awareness campaign, facilitation of storage and refilling, removal of taxes
Large-scale hydro	Restricted number	Electricity generation	Direct investment and/or IPP negotiations with private promoters; monitoring by EWSA
Microhydro	Scattered in the country	Electricity generation	Simplified legal and regulatory framework to encourage micro-hydro off grid; monitoring by EWSA
Methane for electricity generation	Small number	Electricity generation	Direct investment and/or IPP negotiations with private promoters
Methane for GTL/ fertilisers and petrochemicals	Restricted number, if at all	Substitute for imported products	Direct investment and/or negotiations with private promoters
Peat	Reasonably widespread	Heating purposes; electricity generation	Research, facilitation of supply
Geothermal	Estimated Potential of over 700 MW	Electricity generation	Legal and contractual framework for private sector in power plant construction.. Public financing or low interest loans required for initial exploration drilling
Solar PV	Widespread	Electricity generation	Subsidies; feed-in tariffs for

Energy source	Applicability	Principal uses	Main elements of public support needed
			supplying grid; waiver of taxes on equipment, maintenance strategy
Solar water heating	Widespread	Substitute for biomass and/or electricity for water heating	Regulatory, institutional and financial mechanisms; support to R&D , establishment of a subsidy scheme
Wind	Relatively widespread	Small scale applications	Wind Atlas; specify adequate feed-in tariffs; waiver of import duties on equipment
Waste or other sources of methane	Restricted number	Methane production, possibly for electricity generation, briquettes	Kigali municipality and other local governments need to formulate solid waste management plans, including recycling and re-use
Trade in electricity with neighbouring countries	Significant opportunities	Electricity imports during periods of shortfall, foreign currency earnings when in surplus	Adequate interconnectors (hardware); power trade agreements, market operation rules, wheeling arrangements (software)
Domestic transmission projects	Restricted number	Needed to strengthen backbone to support roll-out programme	Government to assist EWSA in obtaining finance and executing transmission projects
Electricity access	Widespread	Household energy uses, small enterprises	Government to work with development partners for financing and EWSA for implementation, connection and pricing policy
Electricity access – rural household systems	Fall-back when grid or off-grid village systems too expensive	Household energy uses	Setting of standards for solar PV so that consumers can be assured of obtaining value for money
Energy efficiency	Universal	Applies to all	Public sector sponsored efficiency promotion programmes, for practices and devices, users mandated to conduct energy audits

10.0 LEGAL IMPLICATIONS

The energy policy does not necessitate the review and amendment of any existing law but will necessitate the enactment of new laws and regulations that will govern its implementation. These will include the following

a) Electricity law and regulation to create conducive and non discriminatory business environment that will encourage private investments in the energy sector

b) Renewable energy and energy efficiency laws and regulations that will foster the development of renewable energy and energy efficiency technologies in Rwanda

c) Gas law and regulations that will allow private investment in lake Kivu methane gas extraction and use

d) Oil exploration act and regulations that will enforce the oil exploration policy to be formulated.

e) Oil and gas products standards and regulations to be developed.

f) Lake Kivu monitoring bilateral agency will also be established by a law/protocol to ensure the Lake Kivu methane gas is extracted in an environmental friendly manner.

11.0 IMPACT ON BUSINESS

The provision of adequate energy infrastructure will be essential for the development of industries and businesses especially for the development of energy intensive industries such as mining, construction industry, agriculture, manufacturing industry, etc and for ensuring a high quality service delivery from social institutions such as health facilities, schools and administrative offices to the Rwandan population. In the future, Rwanda could also become a net exporter of electricity to the region if production exceeds local demand, especially if all the ongoing initiatives in Lake Kivu methane gas to power and regional projects are commissioned without further delays.

Electricity supply in rural areas serves as a catalyst for SMEs development and this prevents exodus of people to urban areas. Energy sector development goes along with creation of jobs in different stages of development and that creates revenues to enable business transactions.

A relatively cheap energy is an important factor in for manufacturing industries to be competitive on export/international market.

12.0 IMPACT ON EQUALITY, UNITY AND RECONCILIATION

The policy is designed to have immense benefits for the Rwandan people. Economic development lays a foundation for unity and reconciliation. The policy will therefore positively impact on unity and reconciliation in Rwanda by contributing to the economic development of Rwanda. The policy specifically aims at using energy as a tool for social development. It articulates specific strategies to further improve the participation of vulnerable players in the economy such as women and children. It aims at ensuring that the benefits from energy resources exploitation are distributed in all parts of the economy, specifically targeting the growth of the rural areas. Energy projects create local employments for all groups of people and that strengthens the social cohesion and hence strengthens unity and reconciliation.

The policy therefore has a direct positive impact on unity and reconciliation in Rwanda. It also specifically promotes interventions targeting equality in the Rwandan society.

13.0 HANDLING PLAN

The following methods shall be used to disseminate the policy document:

a) Involve all stakeholders in the accelerated implementation of accelerated least cost generation Post the document to the MININFRA website for readers to download.

b) Distribute the document during seminars and workshops held with different stakeholders.

c) Use MINAFFET to distribute the policy to Embassies and the East African community Secretariat

d) The policy document will be shared with the energy sector development partners and regional organizations like NELSAP, CEPGL, COMESA, etc.

e) The policy document shall be reviewed regularly.