



Renewable Energies in East Africa

Regional Report on Potentials and Marktes – 5 Country Analyses

Energy-policy Framework Papers,
Section »Energy and Transport«

IMPRINT

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FOREWORD

BACKGROUND

In recent years a large number of developing and emerging countries have changed the structure of their energy sectors, often accompanied by a liberalization of their markets. In many cases, **Renewable Energies (RE)** are a more and more important strategic component for the countries' diversification of their national energy supply.

A growing energy demand deriving from the increasing energy consumption of growing economies worldwide, accompanied by volatile prices for fossil fuels and by increasing environmental and climate challenges, boosts the demand for RE technologies. RE have a **competitive advantage** because they provide a long-term energy supply (for electricity, heating or cooling) based on locally available RE sources and thus help to reduce dependency on energy imports. In addition, RE provide appropriate technological solutions for the electrification of rural or semi-urban areas where they can be used independently from grid-connection. RE are a key for the provision of modern energy services in these areas and contribute to the local economic and social development.

While the technical potential for RE resources such as wind, solar, hydropower, biomass or geothermal energy is considered high in most developing and emerging countries, these regions are still faced with significant barriers for the development of commercially driven and sustainable RE markets. The lack of appropriate policies and the respective business environment are constraints that restrict the dissemination of RE in these countries. The success of comprehensive policy frameworks for the promotion of RE – such as RE feed-in-tariffs or incentive instruments like tax relieves – can be observed in more and more countries, for example Germany or France. However today, also developing countries and emerging markets such as South Africa, Kenya or the Philippines reveal the **significance of adequate policy frameworks for favorable market conditions**. Investments in RE markets, in particular by the private sector, very much depend on the existence of these national or regional framework conditions, incentives and financing options on the one hand, but also on sufficient **transparency and knowledge about these conditions**, which are thus part of the bottleneck for the deployment of RE.

OBJECTIVE

Current and accurate information and data availability are – as stated above – important prerequisites for the development of RE energy markets and a broader dissemination of commercial activities – particularly in markets where information is scarce and where framework conditions are under transition. **The Regional Reports on Renewable Energies comprising 30 country analyses on RE potentials and markets in West Africa, East Africa and Central Asia** are a substantial contribution to the dissemination of comprehensive and precise knowl-

edge on RE markets and related investment options and thus help to further pave the way for the promotion of RE in these regions.

As such the publication **addresses potential businesses and investors** – including manufacturers, technology providers, wholesalers, suppliers, project developers, operators, services companies, planning offices, consultancy firms, as well as financing institutions. The Regional Reports are both meant for those who are already active in the assessed RE markets, but also for those exploring new markets for their business activities. Of course, the publication also serves as a database with country-specific insights into the assessed African and Central Asian regions for interested actors from the public and civil sector.

The **geographical scope** of this publication is twofold: the **Regional Reports on Renewable Energies** focus on **West Africa and East Africa** which are mainly represented by developing countries and economies, and on **Central Asia** as a region predominantly characterized by **countries in transition**. All of these regions are promising markets for the RE industry and for potential investors as they offer remarkable, but still largely untapped RE potentials. Although market conditions which spur the promising RE potentials still need to be improved in almost all of the assessed countries, positive trends for the promotion and deployment of RE can be observed in many cases. Even in those countries, where the policy level still needs to be convinced of RE, political reformers more and more commit to take action for RE on the rise.

DELIVERABLES

The **Regional Reports on Renewable Energies** showcase comprehensive, but still selective information on the specific characteristics of the energy sectors of the **30 assessed countries** – **17 in West Africa, 5 in East Africa and 8 in Central Asia**. Key facts and figures on these energy markets and their RE potential is given in the **executive summary** of each regional report.

Each country analysis comprises an **introduction to the socio-economic, geographical and political background** of the country. It also includes an **overview on the national energy sectors**, including figures on power generation capacities, energy consumption and price levels as well as information on relevant market structures. This is followed by a presentation of the respective energy policy framework conditions. The chapter on **the status quo of RE** presents data on country-specific technical and economic RE potentials, as well as and on current RE investment projects and possible **RE business opportunities**. In addition, the report gives information on market challenges and risks. A snapshot of the **relevant actors of the energy sector** (private, as well as public, civil and scientific) is also included and serves as a source for identifying potential (business) partners for RE projects. Finally, each country analysis includes a **bibliography** and an **annex** containing additional graphs and figures on RE sources and technologies.

The presented regional reports series is part of the Energy-policy Framework Papers of the “Energy and Transport” section of Deutsche Gesellschaft für Technische Zusammenarbeit (gtz) GmbH.

The Regional Reports are also available for free of charge download on the GTZ website:

<http://www.gtz.de> > Themes > Sustainable Infrastructure > Energy > Renewable Energy > Further information > Downloads; or
<http://www.gtz.de/de/themen/umwelt-infrastruktur/energie/4552.htm>

The editorial team – Eschborn, December 2009

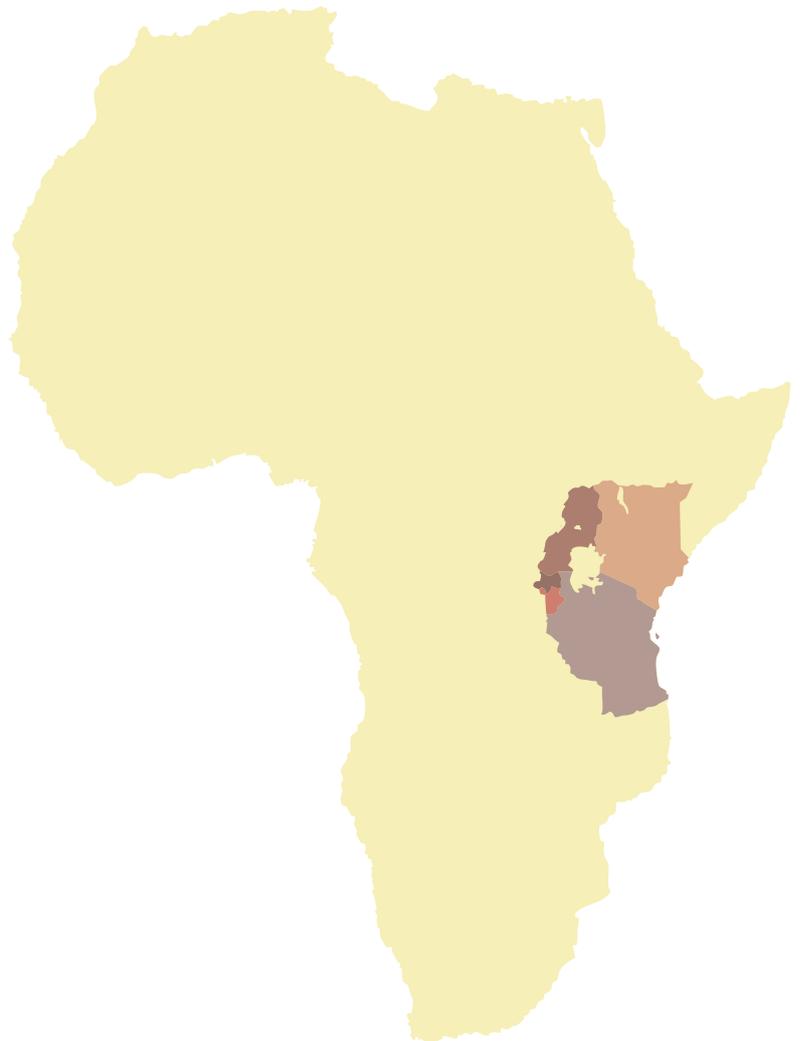
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REGIONAL REPORT SUMMARY –
BASED ON THE 5 COUNTRY CHAPTERS
BURUNDI, KENYA, RWANDA,
TANZANIA, UGANDA



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Report Summary**

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ACRONYMS AND ABBREVIATIONS

REGIONAL REPORT SUMMARY

ACP	African, Caribbean and Pacific Group of States
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
DGHER	Directorate General of Hydraulics and Renewable Energies
EAC	East African Community
ERA	Electricity Regulatory Authority
EU	European Union
GDP	Gross Domestic Product
IPP	Independent Power Producer
KenGEN	Kenya Electricity Generating Company
KPLC	Kenya Power and Lighting Company
MDG	Millennium Development Goals
MEM	Ministry of Energy and Minerals
PPP	Purchasing Power Parity
PREEEP	Promotion of Renewable Energy and Energy Efficiency Program
RE	Renewable Energy
REA	Rural Energy Agency
REF	Rural Energy Fund
REGIDESO	Régie de Production et de Distribution d'Eau et d'Électricité (Urban Burundian Electricity Utility)
RURA	Rwanda Utilities Regulatory Authority
SIDA	Swedish Development Agency
TANESCO	Tanzania Electric Supply Company Limited
UEB	Uganda Electricity Board
UETC	Uganda Electricity Transmission Company
USD	United States Dollar
VAT	Value Added Tax

MEASUREMENTS

GWH	gigawatt hour
KM ²	square kilometer
KWH	kilowatt hour
KWP	kilowatt peak
MW	megawatt
WP	Watt-peak

1 INTRODUCTION TO THE EAST AFRICAN COMMUNITY (EAC) REGION

1.1 REGIONAL STATISTICS EAST AFRICA COMMUNITY: GEOGRAPHY AND ECONOMICS¹

The East African Community (EAC) is an intergovernmental organization comprising the five East African countries of Burundi, Kenya, Rwanda, Tanzania and Uganda. The East African region covers an area of 1.8 million square kilometers with an overall population of about 122 million (based on census in 2007) with an average annual growth rate of 3%. The annual child mortality in the region ranges from 103 to 137 per 1,000 births, while literacy rate is estimated between 62 and 74 % (as of 2007).

The EAC countries established a Customs Union in 2005 and are working towards the establishment of a Common Market by 2010, a subsequent Monetary Union by 2012 and ultimately a Political Federation of the East African States.

The EAC recorded an overall average real growth of 6.8% in 2007. The per capita income varies between 119USD in Burundi and 725USD in Kenya. The average annual inflation rate increased to 7.6% in 2007. The highest increase was on food prices. On average, the main export products of the EAC region are coffee and tea. Coffee production in the region has been on the decline since 2003, while tea production has increased.

The heterogenic geographical and social situation between Rwanda and Burundi on the one hand and Kenya, Tanzania and Uganda on the other hand is reflected in the following statistics:

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Population 2007 (million)	8.2	9.7	36.5	38.7	31.4
Total area (km ²)	27,834	26,340	583,000	945,087	241,020
Density (km ²)	280	369	64,7	41	130
Total households (million)	n.a.	1.7	7.2	7	5.1
Households – rural (%)	90%	83%	19%	82%	85%
Households – urban (%)	10%	17%	81%	18%	15%
Main export goods	Tea, coffee	Tea, coffee	Tea, coffee, horticulture	Gold, coffee, nuts	Coffee, fish
GDP 2007 (millionUSD)	864	1,973	19,842	10,154	9,123
GDP per capita 2007 – at PPP (USD)	346	813	1,700	1296	963
GDP growth rate 2007 (%)	3.6%	7.9%	7%	6,2%	9%
Poverty rate/persons living below 1 USD/day (MDG 30%, as of 2007)	60%	40%	48%	33,4%	35%
Infant mortality rate (MDG 36/1,000)	165 (2005)	83 (2008)	10 (2007)	77 (2007)	66 (2006)

¹ SEE EAC, AS OF 2008

2 ENERGY MARKET OF THE EAST AFRICAN COMMUNITY REGION

2.1 ENERGY SITUATION OVERVIEW

The EAC region relies primarily on biomass. It is used in rural and urban settlements mainly for cooking purposes. The primary energy supply is based on 90% or more of informally collected wood. Only Kenya has a significant share in primary energy by petroleum at 22% and electricity at 9%.

The electrification of rural areas in the EAC region stands very poor at a 1–5% level. The urban electrification rate is above 30–50%.²

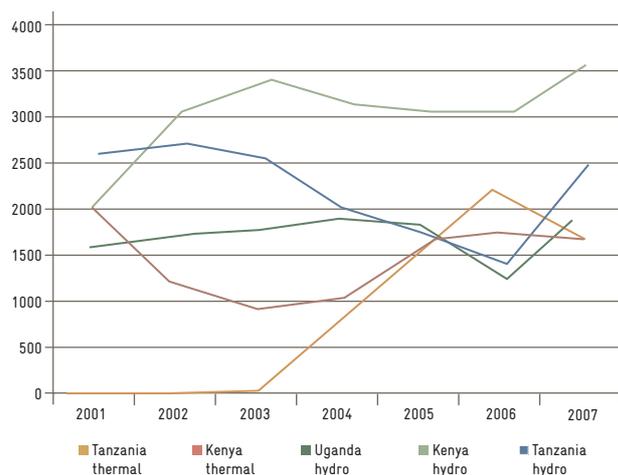
The following tables give an overview on the general energy situation. The data are gathered from the five country reports as part of this overall study and based on own calculations or numbers found in the most recent EAC reports.³

TABLE 1
Energy Situation in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Main source of primary energy supply	Biomass 96%	Biomass 95%	Biomass 68%	Biomass 90%	Biomass 92%
Main purpose	Cooking	Cooking	Cooking	Cooking	Cooking
Total electrification rate	1.0%	6.0%	15.4%	10.8%	11.0%
Rural electrification rate	n.a.	1.0%	4.0%	2.0%	5.0%
Urban electrification rate	n.a.	35.0%	51.0%	30.0%	42.0%
Average electricity consumption per capita per year	17 kWh	19,5 kWh (2005) 25,3 kWh (2006)	154 kWh	82 kWh	57 kWh

Source: table compiled by the author (PSE AG) based on data from EAC, as of 2008, and UNCTAD, as of 2005

FIGURE 1
Hydro and Thermal Electricity Generation in Kenya, Uganda and Tanzania



Source: graph compiled by the author (PSE AG)

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The total generated electricity in the EAC region is 12,849 GWh. Hydro power was accounting for 65% of the produced electricity in 2007, while thermal power had a 28% share. The electricity grid in all EAC countries suffers from high transmission and distribution losses.

The region is very much depended on rainwater. The 2001–2007 period has witnessed a decline in hydro power generation and an increase in thermopower generation. The following graph shows the correlation of hydro and thermal power of the EAC region.

Only Kenya is using geothermal power with a production of 989 GWh or 7,5% of the electricity production in the EAC (as of 2007). In Kenya, Tanzania and Burundi, cogeneration power plants from the sugar cane industry are currently feeding into the national grid with a marginal electricity contribution. The feed-in tariff structure remains currently unregulated and is subject to bilateral negotiations.

² SEE REFERENCES ON PRIMARY ENERGY SOURCES AND ELECTRIFICATION RATES GIVEN IN THE 5 COUNTRY CHAPTERS

³ SEE EAC, AS OF 2008, AND UNCTAD, AS OF 2005

TABLE 2
Electricity Capacities, Production and Consumption in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Total electricity consumption	188.0 GWh (2007)	210.0 GWh	5,067.0 GWh (2007)	3,288.0 GWh (2007)	1,797.0 GWh (2007)
Nationally produced electricity	94.0 GWh (2006)	138.0 GWh (2007)	6,868.8 GWh (2007)	4,156.0 GWh (2007)	1,609.0 GWh (2006)
Of which in 2007					
Hydro	117.0 GWh	96.6 GWh	3,592.0 GWh	2,576.0 GWh	1,190.0 GWh
Thermal	0	111.0 GWh	1,738.0 GWh	1,580.0 GWh	369.0 GWh
Geothermal	0	0	989.0 GWh	0	0
Capacity in operation	37.0 MW (2008)	54.0 MW (2007)	1,197.0 MW (2007)	1,226.0 MW (2007)	496.0 MW (2006)
Of which in 2007					
Hydro	37.0 MW	24.0 MW	677.0 MW	591.0 MW	380.0 MW
Thermal	0	30.0 MW	389.0 MW	658.0 MW	150.0 MW
Geothermal	0	0	128.0 MW	0	0
Other	0	0	4.0 MW solar 0.4 MW wind 2.0 MW bagasse cogeneration	0	16.0 MW small hydro 22.0 MW bagasse cogeneration

Source: table compiled by the author (PSE AG)

TABLE 3
Energy Prices in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Average Petroleum at filling station in €/l (2007)	Diesel 1.35	Kerosene 0.80	Diesel 0.69	Diesel 0.78	Diesel 0.92
Electricity residential tariff in €/Cent/kWh (<1,000 kWh/year)	5.2	14.0	8.5	7.0	16.0

Source: table compiled by the author (PSE AG)⁴

2.3 ENERGY PRICES

All EAC countries depend on the international crude oil price fluctuations, but also on the exchange rates. Especially the landlocked countries are faced with high transport costs for petroleum fuels. Burundi diesel prices are twice as high as in Kenya. On the other hand, electricity prices in Burundi are only one third of the prices in Uganda. This indicates that the energy tariffs are still determined by political and social aspects which hinder a leveled playing field towards the use of Renewable Energies (RE). Power supply suffers from unreliability, forcing investors to maintain back-up generators which increase their costs of doing business.

Kenya

Electricity generation, transmission and distribution are handled by the two state companies of KenGEN and the Kenya Power and Lighting Company (KPLC). KenGEN deals with power generation, while KPLC deals with transmission and distribution. A few Independent Power Producers (IPPs) have been registered.

Tanzania

The electricity sub-sector is largely dominated by the state-owned Tanzania Electric Supply Company Limited (TANESCO), which has a vertically integrated monopoly in the generation, transmission and distribution of electricity in the country that is now being unbundled. Two independent IPP have been licensed: Independent Power Tanzania Ltd. and Songas Ltd.

Uganda

Generation, transmission and distribution were unbundled in 2001, ending the monopoly of the Uganda Electricity Board (UEB) with respect to these services. Generation and distribution were concessioned in 2003–2004, while transmission is still the responsibility of the state-owned Uganda Electricity Transmission Company (UETC). The Electricity Regulatory Authority (ERA) has also been created.

Rwanda

The public utility of ELECTROGAZ is entirely owned by the Government of Rwanda and offers all electricity services. The Rwanda Utilities Regulatory Authority (RURA) was established in 2001 for the regulation of certain public utilities including energy.

Burundi

The Urban Electricity Utility (REGIDESO) is the national power authority that owns all the country's power plants and operates the transmission distribution network. The Directorate General of Hydraulics and Renewable Energies (DGHHER) is independently developing rural electrification projects.

⁴ NOTE: IN THE INDIVIDUAL COUNTRY CHAPTERS THE ENERGY PRICES ARE PARTLY INDICATED IN LOCAL CURRENCY (INSTEAD OF €).

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

All EAC countries are committed to facilitate the increased use of various types of RE as important sources in their energy mix. They aim to support the national development goals by increased access to energy in general and to RE in specific. So far, however, there is no clear roadmap or milestone definition in the EAC region to develop the RE sector.

3.1 DONOR AID ACTIVITIES AND GOVERNMENTAL RENEWABLE ENERGY PROGRAMS

Various RE support programs exist or are in planning stage. Some are driven by the national Governments, but most of them are funded by international donors. The following overview shows the business opportunities for RE companies.

TABLE 4
RE Promotion Programs in the EAC Region

PROGRAM	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Tax and duty	Zero custom duty, zero tax on imported RE equipment	Zero VAT on imported capital goods and raw material	Income tax holidays and exemption from tax and duty during implementation of RE projects; zero custom duty, zero tax on imported RE equipment	Zero import duty on wind and solar technology products	Zero import duty on unsealed solar deep cycle batteries
SIDA/MEM Project (2005–2010, 3 million €)				Business development services	
REA/REF				Subsidy of 2 USD/Wp	
ERT Phase II (2009–2011, 316 million USD)					Grants for small hydro power in independent grid; PV systems for 500 schools, 375 health centers and 15 water pumps
PREEEP (2008–2011, 5.9 million €)					Support of dissemination of improved stoves, micro hydro power and PV systems
ACP-EU Energy Facility (2009–2011)					Grants for PV systems in schools and clinics, 50% grant for 10 sites small hydro

Source: table compiled by the author (PSE AG)⁵



⁵ DONOR ACTIVITIES/PROGRAMS ARE PARTLY INDICATED IN MORE DETAIL IN THE 5 COUNTRY CHAPTERS.

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

In the following, only the most important existing business opportunities for private companies are highlighted. More detailed information can be found in the 5 country chapters.

4.1 BIOMASS/BIOGAS

It seems that cogeneration of bagasse in large sugar cane industries in Kenya, Tanzania and Uganda is becoming more viable. All industries have recently started to feed into the national grid as IPPs. The tariff structures are not clear or only fixed on a preliminary stage. They are subject to bilateral negotiations between the IPP and the national utility and/or regulator.

In some countries, research and tests with small biogas digesters were made, but with no commercial success was achieved so far. In Rwanda, biogas plants are used in prisons for example. Several private companies, which are planning to develop biofuel plantations, have recently purchased or rented land in Tanzania and Kenya.

TABLE 5
PV Market Data in the EAC Region (as of 2008)

PROGRAM	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Installed capacity	72 kWp	n.a.	4,000 kWp	1,800 kWp	n.a.
Market size per year	n.a.	n.a.	n.a.	200 kWp	200 kWp
No of solar companies	3	< 5	20	18	17
Remark, special local condition	n.a.	250 kWp Kigali Solaire ACP-EU Energy Facility	No financial support scheme available	Well-established trainings and awareness	ERT II program as main driver

Source: table compiled by the author (PSE AG)

4.2 SOLAR ENERGY

The solar energy sector is the most developed sector in the EAC region due to a decade of international support programs in capacity building, training and subsidy programs. Thus a few hundred of well-trained solar technicians exist in the region. As the number of PV system integrators and wholesalers is limited to about 50 companies in the entire EAC region, it is obvious that the private sector is underdeveloped. The companies are mainly situated in the capitals or commercial cities and have poor distribution channels into the targeted rural areas.

The miracle self-running PV market in Kenya is a niche market dominated by cash and carry sales as it can also be found in the other EA countries. Although a lot of attempts within the international programs were made to increase the awareness towards higher quality and after-sales services, PV market lacks of technical and commercial professionalism. The table below summarizes the current RE market.

4.3 WIND POWER

Wind energy is not exploited in the EAC region due to the lack of wind data or the non-compliance between resources and grid availability (especially in Kenya). 70 MW are under construction in two wind farms in Kenya.

4.4 GEOTHERMAL POWER

The huge potential of geothermal sources in the Rift valley is about to be explored, especially with the support of the German Development Cooperation and commissioned by the German Federal Institute for Geosciences and Natural Resources (BGR). Only Kenya is currently using 128 MW.

4.5 HYDRO POWER

The wide availability of lakes and running waters in the EAC region entails a huge potential of small and large hydro power. Large-scale hydro power is used to a greater extent in the region. Burundi has a 99% hydro power share in electricity. The average was 65% in 2007 as compared to 73% in 2001. The potential for small hydro power plants are estimated as follows:

TABLE 6
Estimation of Geothermal Potential in the EAC Region

	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Geothermal potential	n.a.	170–300 MW	2,000 MW	600 MW	450 MW

Source: table compiled by the author (PSE AG)

TABLE 7
Small Hydro power Potential in the EAC Region

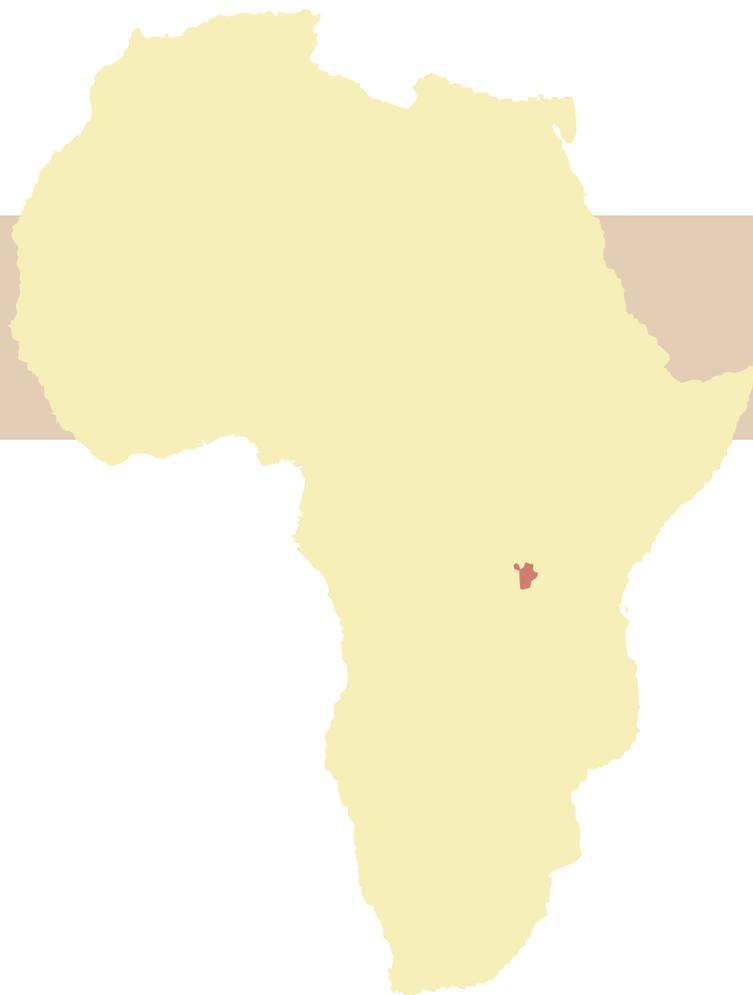
	BURUNDI	RWANDA	KENYA	TANZANIA	UGANDA
Small hydro power potential	300 MW	10 MW	3,000 MW	315 MW	210 MW

Source: table compiled by the author (PSE AG)

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⁶ NOTE: OTHER MAIN REFERENCES AND INDICATIONS OF SOURCES ARE PROVIDED IN THE RESPECTIVE COUNTRY CHAPTERS AND NOT IN THIS SUMMARY OF THE COUNTRY CHAPTERS.



COUNTRY CHAPTER: BURUNDI

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ACRONYMS AND ABBREVIATIONS

BURUNDI

AfDB	African Development Bank
AIDS	Acquired Immune Deficiency Syndrome
BIF	Burundi Franc (1 BIF = 0.00056 €, as of November 2009)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
CD	Contractual Demand
CEBEA	Centre d'Études Burundais en Énergies Alternatives (Burundian Center of Renewable Energies)
CRE	Crédit Régénération Économique (Economic Recovery Credits)
CSLP	Cadre Stratégique de Croissance et de Lutte Contre la Pauvreté (Strategic Master Plan of Growth and Fight against Poverty)
DGEE	Directorat Général d'Eau et d'Énergie (Directorate General of Water and Energy)
DGHER	Directorat Général de Hydrauliques et d'Énergie Renouvelable (Directorate General of Hydraulics and Renewable Energies)
DR Congo	Democratic Republic of the Congo
EAC	East African Community
EIRP	Electricity Infrastructures Rehabilitation Project
FCBN	Forum de la Société Civile du Bassin du Nil (Nile Basin Burundian Civil Society)
F.O.B.	Free On Board
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HIPC	Heavy Indebted Poor Countries
HIV	Human Immunodeficiency Virus
ICRC	International Committee of the Red Cross
IDA	International Development Agency
IMF	International Monetary Fund
ISN	Interim Strategy Note
KfW	Kreditanstalt für Wiederaufbau (German Banking Group - including KfW Entwicklungsbank as German Development Bank)
MDG	Millennium Development Goals
MEFCD	Ministère de l'Économie, des Finances et de la Coopération au Développement (Ministry of Economy, Finance and Development Cooperation)
MELM & PW	Ministry of Environment, Land Management and Public Works
MIA	Ministry of Internal Affairs
MWEM	Ministry of Water, Energy and Mines
N.a.	Not applicable
NBI	Nile Basin Initiative
O & M	Operation and Maintenance
ONATOUR	Office National de la Tourbe (Peat National Utility)
PAP	Priority Action Program
PREBU	Programme pour la Réhabilitation du Burundi (Program for Rehabilitation of Burundi)
PRSP	Poverty Reduction Strategy Papers
PTPCE	Projet des Travaux Publics et de Création d'Emplois (Public Works and Employment Creation Project of IDA – International Development Association)
RDC	République Démocratique du Congo (Democratic Republic of Congo)
REGIDESO	Régie de Production et de Distribution d'Eau et d'Électricité (Urban Burundian Electricity Utility)
RE	Renewable Energy
PSE	Programme Spécial de l'Énergie (Special Energy Program)
SHS	Solar Home Systems
SINELAC	Société Internationale des Pays des Grands Lacs (International Society of Electricity of the Great Lakes Countries)
SNEL	Société Nationale d'Électricité (Congolese National Electricity Utility)
SOSUMO	Société Sucrière du Moso (Sugar Cane Industry of MOSO)
UNICEF	United Nations Children's Fund
USD	United States Dollar



MEASUREMENTS

AC	alternative current
bbl	barrel
°C	degree Celsius
DC	direct current
€	Euro
ha	hectare
HV	high voltage
kV	kilovolt
kWh	kilowatt hour
LV	low voltage
m	meter (1 m = 1,000 mm)
m ²	square meter
MV	medium voltage
MW	megawatt (1 MW = 1,000 kW)
Wp	Watt-peak (1kWp = 1,000 Watt-peak)
toe	tons of oil equivalent (1 toe = 1,000 kgoe (kilogram of oil equivalent))



SUMMARY

ECONOMICAL STATUS AND DEVELOPMENT OF BURUNDI

Burundi was one of the poorest countries in the world even before the severe civil crisis and the ethnic conflict of the 1990s. An internationally brokered power-sharing agreement between the Tutsi-dominated Government and the Hutu rebels in 2003 paved the way for a transition process. A new Constitution was established in 2005 and ethnic quota was formed for determining positions in Burundi's Government. To this day, conflicts between the Hutu and the Tutsi continue¹.

Poverty in rural areas, where 91% of the population live, rose from 35% to 58% in the decade between 1992 and 2002, standing now at 60%. For the period of 1986 to 1992, Burundi knew a relatively constant real growth with an average rate of 3,7% without the structure of the productive apparatus changing. With the crisis of 1993, the Gross Domestic Product (GDP) dropped cumulatively by 20%, the income per head, which was 210USD in 1990, dropped to 110USD in 2004 and 88USD in 2007, placing Burundi in the third rank of the poorest countries².

STRUCTURE OF ENERGY SUPPLY IN BURUNDI

Nearly all of Burundi's gross energy demand is met by wood, charcoal or peat. Thus 95% of the total primary energy supply in Burundi is met by biomass³.

Electricity

Only 1% of the population has access to electricity, which is mainly supplied to the capital city of Bujumbura and some other cities. Hydro power is the only source of electricity supply with an operative capacity of 38MW (as of 2008). The total electricity consumption of 188 GWh (as of 2007) was covered by national hydro power stations (58%) and derives from imports. Transmission losses are high and average at around 24%⁴.

Oil

As Burundi has no oil reserves of its own, it is importing oil through the land corridor mainly from Mombasa. Since 2006, the prices for oil products have been jumping from 1.10 USD per liter of gasoline in 2006 to 2.00 USD in 2008⁵.

The national thermal power stations with a total capacity of 5.5 MW are not in operation due to low maintenance and high oil prices (that cannot be covered by the local plants' operators).

STATUS OF RENEWABLE ENERGIES IN BURUNDI

Renewable Energy (RE) utilization is negligible in Burundi. Although there are huge potentials, the private and public RE sector is underdeveloped. Solar energy radiation is constant at 4–5 kWh/m² throughout the year⁶, but only three private companies⁷ are actively selling small Solar Home Systems (SHS) and facilitating a current PV program targeting schools and clinics.

In total, only 24 small and medium size hydro power stations⁸ are currently in operation, rehabilitation or in planning status. Hydro power is the only source of electricity in the country so far. Other sources have not yet been exploited.

1 INTEGRATED BUREAU OF THE UNITED NATIONS IN BURUNDI, AS OF 2007

2 IMF, AS OF 2007

3 REPUBLIC OF BURUNDI, AS OF 2006

4 REPUBLIC OF BURUNDI, AS OF 2007

5 MINISTRY OF INFRASTRUCTURE OF RWANDA, AS OF 2007

6 SEE ANNEX 7 - AFRICA SOLAR MAP

7 SEE CHAPTER 6.1 OF THIS REPORT - RENEWABLE ENERGY (RE) COMPANIES

8 SEE ANNEX 7.12 - LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES



1 COUNTRY INTRODUCTION

1.1 BURUNDI OVERVIEW

Burundi is a landlocked country that straddles Central and East Africa, with a total area of 27,834 km² and approximately 8.2 million inhabitants⁹. Burundi has one of the highest population densities in Africa with about 280 inhabitants per km², about 10.6% of them living in urban areas. Burundi's frontiers are formed by natural borders, namely Lake Tanganyika, the Rusizi River in the West and the Kagera and Kanyaru Rivers in the North (see Map of Burundi in annex 8.1).

Burundi is bordered by Rwanda in the North, Tanzania in the South and East and the DR Congo on the West. Although the country is landlocked, much of its western border is adjacent to Lake Tanganyika. The country's modern name is derived from its language Kirundi. Burundi is a mountainous country. Its climate is favorable to agriculture with precipitations ranging from 1,000 to 2,000 mm/year and temperatures from 12° to 25°C¹⁰.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The country is divided into 17 provinces, with Bujumbura Mayor hosting the capital city of Bujumbura. The other provinces are Bubanza, Bujumbura Rural, Bururi, Cankuzo, Cibitoke, Gitega, Karuzi, Kayanza, Kirundo, Makamba, Muramvya, Muyinga, MWaro, Rutana and Ruyigi. The provinces are sub-structured into 117 communes and 2,638 collines (hills)¹¹.

Of the 8.2 million people, about 700,000 (9.75%) live in Bujumbura and 250,000 (0.3%) in other urban and peri-urban centers (Gitega, Ngozi, Rumonge, Kayanza, Muyinga, Kirundo, Muramvya, Bururi, Rutana).

An ethnic-based war that lasted for over a decade between Tutsi and Hutu resulted in more than 200,000 deaths, forced more than 48,000 refugees into Tanzania and displaced 140,000 others internally. Today, the Constitution lays down a shared political power between Tutsi and Hutu (40% for Tutsi and 60% for Hutu). In the army and the police, the share is 50% for each group¹².

LAND AREA:	27,834 square kilometers
POPULATION:	8.2 million, growth rate 3,4%
DENSITY:	280 inhabitants/km ²
SHARE URBAN/RURAL POPULATION:	10%/90%
BIGGEST CITIES AND POPULATION:	700.000 (9.3%) in Bujumbura
LANGUAGE:	Kirundi (official), French (official)
CLIMATE:	12–26°C; two rainy seasons (February–Mai, September–November)
ALTITUDE:	772 to 2,670 m
MAIN WATER BODIES	Ruzizi and Kagera rivers, Tanganyika and Rweru lakes
VEGETATION	Much of natural vegetation has been cut for cultivation (high deforestation)
GDP PER CAPITA (AT PURCHASING POWER PARITY)	346 USD (as of 2007)
INFLATION RATE:	8,4% (as of 2007)
AGRICULTURAL PRODUCTS:	Coffee, cotton, tea, corn, sorghum, sweet potatoes, bananas, manioc, beef, milk, hides
ELECTRICITY – PRODUCTION:	94 million kWh (as of 2006)
ELECTRICITY – CONSUMPTION:	188 million kWh (as of 2007)
NATIONAL ELECTRICITY CAPACITY IN OPERATION:	37,63 MW (as of 2008)
ELECTRIFICATION RATE:	1%
OIL – PRODUCTION:	0 bbl/day (as of 2007)
OIL – CONSUMPTION:	2,900 bbl/day (as of 2005)
OIL – PROVEN RESERVES:	None
NATURAL GAS – PRODUCTION:	None
NATURAL GAS – PROVEN RESERVES:	None
EXPORTS:	44 million USD F.O.B. (2007)
EXPORTS – COMMODITIES:	Coffee, tea, sugar
EXPORTS – PARTNERS:	Germany (25.3%), Switzerland (20.5%), Pakistan (5.5%), Belgium (4.6%) (as of 2006)
IMPORTS:	272 million USD F.O.B. (as of 2007)
IMPORTS – COMMODITIES:	Capital goods, petroleum products, food
IMPORTS – PARTNERS:	Saudi Arabia (15.4%), Kenya (10.4%), Belgium (7.8%), France (5.5%), Uganda (4.9%), Germany (4.9%), India (4.3%), Russia (4.2%) (as of 2006)
EXCHANGE RATE:	1 Burundi-Franc (BIF) = 0.00056 € (as of November 2009)

Source: data compiled by the author from different sources, e.g. CIA, as of 2009

9 REPORT ON STATISTICS OF THE POPULATION OF BURUNDI, AS OF 2008
10 GEOGRAPHICAL INSTITUTE OF BURUNDI, AS OF 2007

11 SEE ANNEX 7 – MAP OF BURUNDI

12 ARUSHA PEACE AGREEMENT BETWEEN THE G10 (TUTSI POLITICAL PARTIES) AND G7 (HUTU POLITICAL PARTIES) GROUPS OF POLITICAL PARTIES OF BURUNDI



The Burundian economy depends on coffee and tea exports, which account for 90 % of foreign exchange earnings. The socio-political crisis during the last ten years resulted in a considerable decrease of the interior production and a serious imbalance of the state account.

2 ENERGY MARKET IN BURUNDI

2.1 OVERVIEW OF THE ENERGY SITUATION

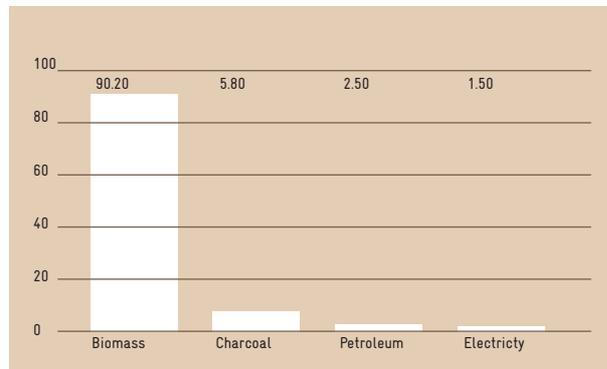
Overall, 96 % of Burundi's energy requirements are met by traditional biomass. The biomass energy is composed of 70.80 % of fuel wood, 18.36 % of agricultural residues, 5.80 % of charcoal, 1.00 % of bagasse and 0.04 % of peat 0.04 %¹³.

Only 1 % of the population has access to electricity, which only accounts for about 1.5 % of energy requirements. Burundi's energy sector and its problems have to be understood in light of the special conditions of this small, landlocked country. Energy consumption in Burundi is very low. The demand and use of energy is based on the location as well as the types of economic activities and local habitat.

The shares of energy supply are shown in the following figure 1.

FIGURE 1

Shares of Total Primary Energy Consumption



Source: Graph by PSE AG, based on data from Ministry of Water, Energy and Mines, as of 2008, and from AfDB, Rehabilitation Project of Electrical Infrastructures in Burundi, as of 2007;

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

Burundi faces severe constraints in electricity supply, either national or imported. Most of the electricity supply is generated by 24 hydroelectric plants with a combined installed capacity of 37.63 MW (as of 2008). These plants generated about 91 GWh in 2006 or nearly 100 % of the total national electricity production.

The utility REGIDESO (Régie de Production et de Distribution d'Eau et d'Électricité) exploits nine power stations with a working installed capacity of 30.9 MW (around 90 GWh every year). The power stations of Rwegura with 18 MW and Mugere with 8 MW account for 82 % of the total capacity installed. The Directorate General of Hydraulics and Renewable Energies (DGER) exploits five micro power sta-

tions with a total of 0.5 MW. In addition, private producers have ten micro power stations with 0.65 MW capacity¹⁴. An overview of all 24 hydro power stations is given in the annex (List of Actual and Planned Hydro Power Sources).

During the years of civil conflict, the electricity access rate in connected areas halved as the urban population doubled, while the number of REGIDESO's customers barely increased to 41,074 by the end of 2007¹⁵. The average electricity consumption per citizen in Burundi is among the lowest in Africa and averages at around 20 kWh/year.

Burundi also benefits from imports from the regional hydro plants of Rusizi I and II operated by Société Internationale des Pays des Grands Lacs (SINELAC) and Société Nationale d'Électricité (SNEL) respectively. The supply deficit currently varies between 12.9 MW during the wet season and 23.5 MW during the dry season when the country's main hydro power plants are running at reduced capacity. Assuming that the economic growth continues at the current pace, the supply deficit may reach 22 MW and 34 MW (during the wet and dry seasons, respectively) by 2014. At this point, substantial generation capacity could be added through the commissioning of the Mpanda and Kabu 16 (Burundi), Rusumo Falls and Rusizi III (Regional) hydro power plants.

The impact of power cuts was identified in the Interim Strategy Note (ISN, 2006–2007) as one of the major hurdles to economic growth. Demand for electricity is expected to continue to rise steadily as the economy improves, returning refugees re-establish themselves and standards of living increase. Peak demand occurs during the evening hours and emanates mainly from household lighting needs. Due to the lack of maintenance and the supply deficit described above, the quality of service and operations is currently insufficient, with an estimated 48 GWh in combined technical and non-technical losses for 2007, representing nearly 25 % of total supply.

Technical losses are deemed to make up a large portion of these losses given the poor condition of the network, of the high voltage and medium voltage stations and of the low voltage distribution posts. The numbers of power interruptions are high both on LV and on the HV/MV backbone network. The quality of the electricity delivered suffers from poor frequency and significant voltage deviations estimated to be in excess of the normal 10 % below and above 220 V.

2.3 ELECTRICITY PRICES

Despite the 2007 tariff revision, the tariff structure remains inadequate to address issues of efficiency, financial viability and social equity among service users. A revised tariff regime is needed to adjust the tariff structure and its levels. The household electricity tariffs currently in place include subsidized pricing for up to 750 kWh per two-month billing cycle with an average of 5.2 Eurocent /kWh. In order to return to financial and operational viability, REGIDESO will need to:

13 SEE ANNEX 7.9 – STRUCTURE OF GROSS ENERGY SUPPLY IN BURUNDI 2002–2007

14 SEE ANNEX 7.12 – LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES IN BURUNDI

15 REGIDESO, 2002–2007



- Execute the financial restructuring before 31 December 2008 as agreed by the Government prior to negotiations
- Have the tariff structure revised so that it is efficient, covers at least operation and maintenance costs and is fair and equitable
- Improve its technical and commercial performance through the execution of a performance contract between REGIDESO and the State

REGIDESO, with the Government's support, has already taken a number of steps in these directions. As indicated above, tariffs were recently increased and the Government has authorized REGIDESO to apply for a 4% surcharge to electricity tariffs when the thermal generation plant is in use. In April 2007, the Ministry of Finance and REGIDESO also signed an agreement for the settlement of approximately 50% of the State's debt to the utility by means of bonds.

The power tariff¹⁶ is going to be revised with the proposed Financial Restructuring Plan of REGIDESO financed through the World Bank's Multisectoral Water and Electricity Infrastructure Project.

Small thermal diesel generating sets are operated by REGIDESO with subsidies from the Government. A calculation made by REGIDESO shows that a thermal kWh is worth 350 BIF while the kWh is sold only at 41 BIF for customers with a social status that is based on consumption of up to 150 kWh.

This is the reason why thermal diesel generating sets are used only for towns located far from the national grid. Stand-alone diesel generator sets and inverters are also in use, but are mainly limited to hotels and lodges or public institutions like military camps, hospitals and schools.

Oil Products

In a normal period, the oil products are mainly imported from the refineries of Mombasa, the oil terminal of Nairobi or directly from the Middle East. These products arrive in Burundi by two corridors: the northern corridor (Kenya-Uganda-Rwanda-Burundi) and the central corridor (through Tanzania). Importation and distribution of the oil products are carried out by national companies. Since the period of 1996–1999, the price has not ceased to increase, rising from 0.35 USD in 1999 to 1.10 USD per liter of gasoline in 2006 and 2.00 USD in 2008¹⁷. Oil research in the Lac Tanganyika and the plain of Rusizi, which had been started with the Amoco American Company in the Eighties, was stopped, but has been taken up again by Streamoil at block D¹⁸ in the South of the country.

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

The public services DGEE, CEBEA, REGIDESO, DGHHER, SINELAC, ONATOUR are under the authority of the Ministry of Water, Energy and Mines (MWEM).

MWEM, DGEE, MEFCO, MELM & PW

The Ministry of Water, Energy and Mines (MWEM), through the Directorate General of Water and Energy (DGEE), is responsible for the planning and regulations of the energy sector. The Ministry of Economy, Finances and Development Cooperation (MEFCO), through the Deputy Ministry of Planning, is responsible for the programming of the energy projects within the National Plan of Priority Actions. The Ministry of Environment, Land Management and Public Works (MELM & PW) is responsible for the environmental aspects.

CEBEA

During the Eighties, CEBEA (Centre d'Études Burundais en Énergies Alternatives – Burundian Center of Renewable Energies) as a testing institute installed a number of PV systems and had a production schedule for solar cookers, solar heaters and solar dryers. Unfortunately, the national crisis blocked the project.

REDIGESCO

The urban electricity utility (Régie de Production et de Distribution d'Eau et d'Électricité – REGIDESO) is the national power authority that owns all of the country's power plants, excluding those below 150 kW. REDIGESCO is responsible for power distribution in urban areas.

Moreover, REGIDESO operates Burundi's thermal power stations, most of which are located in Bujumbura and the surrounding areas, and a small amount of hydro capacity in the form of small units in rural areas. REGIDESO also operates the transmission system and the distribution network in Burundi.

REGIDESO in the capital Bujumbura purchases electricity from the SINELAC site at RUSIZI via a 110 kV transmission line operated by RD Congo.

DGHHER

The rural electricity utility of DGHHER (Directorate General of Hydraulics and Renewable Energies) independently develops rural electrification projects.

SINELAC

The regional electricity utility of SINELAC (Société Internationale des Pays des Grands Lacs – International Society of Electricity of Great Lakes Countries) was established by Burundi, Rwanda and Zaire to develop international electricity projects of 40 MW. SINELAC pursues several other hydro projects presently in the study stage. RUSIZI III-145 MW and RUSIZI IV-205 MW are located between RD Congo and Rwanda. These projects include the 28 MW RUSIZI I hydro power plant, operated by RD Congo (SNEL).

¹⁶ SEE ANNEX 7.11 – POWER TARIFFS FOR PRIVATE AND INDUSTRIAL USES, P.37. LATEST INFORMATION ON POWER TARIFFS CAN BE CHECKED ON THE WEBSITE OF REGIDESO (WWW.REGIDESORDC.COM/)

¹⁷ SAIC, AS OF 2008

¹⁸ THERE ARE 4 BLOCKS OF RESEARCH OF PETROLEUM IN BURUNDI (BLOCK A, B, C AND D).



ONATOUR

The national peat utility of ONATOUR (Office National de la Tourbe) is responsible for the exploitation of the peat in highlands of Burundi (Gisozi, Matana, Gitnga, Buyongwe).

SOSUMO

The sugar cane utility of SOSUMO (Société Sucrière du Moso) is operating a cogeneration power station for bagasse (5 MW).

Biomass Sector

The biomass sector of Burundi is mainly administrated by the Ministry of Environment that focuses on the sustainable production of firewood and charcoal. The Ministry of Trade regulates the transport of these commodities as well as related tax issues. The Ministry of Energy plans and regulates the firewood and charcoal demand in urban areas of Burundi.

services, however, requires considerable investments and an improved financial and operational management. Regarding the production of electricity, the MWEM favors hydroelectricity, while acknowledging that thermal power production needs to be utilized in the short run to bridge the gap between demand and supply. In addition, the MWEM would like to:

- Restructure the energy sector by merging the electricity activities of REGIDESO and DGER
- Encourage private sector participation in electricity production
- Fully enact the regulatory framework

The MWEM considers the direct subsidy of operation and maintenance (O & M) costs as inadequate and inefficient and adheres to a tariff policy of fully covering at least O & M costs.

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

It must be noted that Burundi's energy sector is dominated by the traditional sources of energy such as wood and charcoal accounting for nearly 96% of the energy balance. Consumption far exceeds sustainable annual production if the forestry cover is to be reconstituted. As to the other energy forms, petroleum products (2.50%) predominate consumption, followed by electricity accounting for only 1.50% of the energy balance and peat accounting for 0.04%¹⁹.

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

In the short and medium term, the Government of Burundi is planning to carry out the following actions for extending energy supply by RE:

- Doubling the capacities of the hydro power stations of Nyemanga and Buhiga
- Feasibility and implementation studies for the hydro power stations of Kabu 23, Ruzizi III and Mule 34
- Development of rural electrification by the construction of mini hydro, solar and wind-power as well as of the use of biogas
- Renovation of the hydroelectric power stations and electricity transmission and distribution networks
- Construction of the power generation plant of Mpanda
- Extension of urban and rural electric networks and maintenance of existing power stations and networks
- Organizational audit and financial turnaround of REGIDESO

The Government has given high priority to rehabilitating and extending electricity services. The MWEM recognizes that the provision of these services constitute a crucial factor for economic development of the country. Developing sustainable

3.2 DONOR AID ACTIVITIES

Although limited investments took place during the period of conflict, REGIDESO and DGER have indirectly benefited from donor-funded multisectoral activities to support the reconstruction. Those activities included:

- The Program for Rehabilitation of Burundi (PREBU) financed by the European Union and the IDA-financed Economic Recovery Credits (CRE)
- The Social Funds and the IDA Public Works and Employment Creation Project (PTPCE)
- The Emergency Activities conducted by the ICRC (International Committee of the Red Cross) and United Nations Children's Fund (UNICEF)
- The Chinese cooperation financing the rehabilitation of the hydroelectric power plants of Mugere (8 MW) in 2003 and the rehabilitation of the micro hydro power plants Ruvyironza (1.28 MW) and Gikonge (0.85 MW) in 2005 for which work was completed in 2008.

For the period of 2007–2010, some donors have already agreed to finance the projects mentioned above. Those donors are:

- World Bank
- AfDB
- Chinese Exim Bank
- Government of Denmark

The rationale for donors' involvement is registered, for example, in line with the World Bank's Interim Strategy Note (ISN) dated 11 April 2005 and the Poverty Reduction Strategy Paper (PRSP) of September 2006 and carries strategic importance in light of the Bank's focus on poverty reduction and post-conflict assistance in IDA countries.

The proposed World Bank Multisectoral Project, the AfDB Electricity Infrastructures Rehabilitation Project (EIRP), the support of Chinese Government to manage the power generation of Mpanda and the Government's solar

¹⁹ HAKIZIMANA, AS OF 2008



rural electrification activities will contribute to both aspects by improving access to electricity, which has been identified in the ISN as requirements to achieve higher and sustained growth performance. These goals also coincide with those of the PRSP, which aims to promote sustainable economic growth and to develop human capacities. The scope of the projects is mainly focusing on rural water supply contributing to achieve the Millennium Development Goals (MDGs) on water supply. In the case of electricity, the projects also seek to improve Burundi's capacity to participate in a regional integrated network as well as to explore alternative sources of energy that would be less costly and more environmentally sustainable. There is an urgent need for investments in the electricity sector because electricity will play a crucial role in accelerating industrial and commercial activities and hence contribute to the country's economic growth.

3.3 MARKET RISKS

The conditions to lead businesses in Burundi are currently favorable. As a matter of fact, all rebel movements signed the agreement of cease-the-fire, and the latest to date will enter in the political and administrative institutions. That made it possible for the donors of Burundi to organize a Round Table in May 2007 to financially support the country in order to leave poverty and to rehabilitate the economic infrastructures of production. Thus, legal certainty is also given for foreign investors to employ local experts and trained technical personnel for the techniques of RE.

Intellectual property rights are acknowledged and protected by Burundi's legislation. This legal basis makes it possible for investors to sell their equipment at lower risks. In addition companies investing in Burundi have now the right to transfer their margins, in accordance with the Code of Investments (which in particular gives a guarantee of non payment of taxes for a certain period). The research institutes in the sector of energy (e. g. the University of Burundi/ Faculty of Applied Sciences) are prepared to actively support research for rural development. The barriers hindering to promotion of the RE as identified recently were:

- Missing capacities
- Low awareness of the purchasers of the equipment and of the population in general
- Lack of policy attention and institutional framework
- Lack of quality and consistency in the RE technology made available, extending from the equipment itself right through to installation, operation and maintenance
- Lack of incentives to promote technology transfer

3.4 CUSTOMS DUTIES AND TAXES RELATED TO RENEWABLE ENERGY PRODUCTS

In addition to the law liberalizing the electricity sector, the field of RE was declared as a priority for both the social and rural development. It is the reason why the Government of Burundi decided to reduce tax for all imported RE components. Within this framework, the companies WATEL, ECOGEER and ENESCO, which are facilitating the electrification of

health centers and the secondary schools pay neither customs duties nor other taxes for imported solar equipment.

SHORT BUSINESS INFO

Zero custom duty and zero tax on imported RE equipment.

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

Traditional biomass-based fuels for cooking and heating are currently the most important source of primary energy in Burundi with wood and charcoal consumption accounting for 96% of the total consumption (rural 76%, urban 24%);²⁰. The total sustainable firewood biomass supply from all sources was estimated at 6,400,000 m³ in 2007.

Firewood comes from three main areas: the rangelands, Government forests and small farmlands. Before the civil war, the rangelands covered about 131,636 hectares and the Government forests 74,024 hectares, but now they are together about 188,000 hectares, which means that Burundi lost about 17,660 hectares.

According to a survey carried out by DGEE (as of 2004), 320 biogas plants for cooking and lighting purposes were in operation in Burundi by end of 1993. Most of these systems are between 4–16 m³ with a maximum gas capacity of 3 m³, which is considered sufficient to meet the cooking and lighting needs of a family of five persons²¹.

Peat offers an alternative to increasingly scarce firewood and charcoal as a domestic energy source. The Government is promoting peat production.

Cogeneration from bagasse, a waste product of the sugar cane industry, is used in two 2.5 MW power plants operated by SOSUMO. As the unit runs 300 hours per month and over a period of six months, the energy production in 2007 was 9 MWh. The electricity and heat is not fed into the national grid, but is used to power the SOSUMO sugar production facilities.

SHORT BUSINESS INFO

Biomass commercial energy is used in cogeneration in the sugar industry (5 MW, 9 MWh).

4.2 SOLAR ENERGY

Burundi has an estimated insolation of about 4–5 Wh/m²/day²². Solar radiation has been used traditionally for drying of crops, animal products and clothes. There is a large potential for PV electricity generation in rural parts of Burundi as most regions are not grid-connected. But application of PV in these areas is not very common. Actually, the MWEN is installing solar PV equipment in 60 health centers and colleges in rural areas. This

²⁰ DGEE, AS OF 2006

²¹ GTZ/DGEE, AS OF 2004

²² SEE ANNEX 7 - AFRICA SOLAR/PV MAP

²³ DIRECTORATE GENERAL OF WATER AND ENERGY, AS OF 2008



program will be implemented in the next two years to electrify 90 clinics and 90 schools²³.

Health services are equipped with waiting rooms, consultation units, laboratories, administration and registration areas, family planning and maternity facilities, store rooms, sanitary facilities and housing for staff. Now the health centers have lighting and sterilization facilities. Personnel working at the health centers have access to TV and lighting in their residences. At the community colleges, examination results have improved since students have had electric lighting for longer study hours.

The electrical installations in the health centers are in alternative current (AC) to allow not only lighting but also electricity supply for refrigerators, electron microscopes, computers and distillers. 2 kWp systems cost 21,000 USD per installation. The school systems are for lighting with an installed direct current (DC) capacity between 600–700 Wp per school. Each PV installation costs between 10,000 and 11,000 USD²⁴.

In Burundi, there is a lack of PV equipment in local markets. An intensive awareness-raising campaign is being implemented to gain support for the project from stakeholders who were initially reluctant to participate because they were unfamiliar with PV systems. The Government has released all taxes on the imported materials and equipment needed for the PV systems. Currently, mainly small (12–30 Wp) SHS are sold on a small commercial market. Until 1993, 1,678 PV kits with 72 kWp were installed for telecommunication systems²⁵ (56%), water pumping (30%), lighting²⁶ (13%) and refrigeration of medicine and vaccines²⁷ (1%), but 60% were destroyed during the civil war. According to the ENESCO Report, 17% were functional in 2002²⁸.

SHORT BUSINESS INFO

- Current solar electrification program for 90 schools (0,7 kW DC) and 90 clinics (2 kW AC)
- 72 kW installed countrywide, 56% telecom systems, 30% water pumping, 13% lighting, 1% refrigeration

4.3 WIND POWER

The wind energy potential has not been explored so far in Burundi. No reliable data is available to estimate wind velocities and to locate potential sites for electricity production. No small-scale wind turbines have been installed in the country²⁹.

4.4 GEOTHERMAL POWER

Geothermal resources have been identified in the West Rift Valley region in neighboring eastern DR Congo. Several geothermal indicators exist in Burundi, but very little useful data is available to assess their commercial viability. There is, however, a strong need to carry out detailed exploration to quantify the available resource capacity.

4.5 HYDRO POWER

In Burundi, 24 large and small hydro plants are currently in operation with a total national capacity of 37.63 MW (as of 2008). In 2006, the recorded electricity production was 152 GWh³⁰.

Hydro power provides about 99% of the country's electricity power supply. The resource, however, is not fully exploited yet. There is considerable potential for further development, including micro, mini and small hydro power.

REGIDESCO exploits nine power stations with an installed capacity of 30.9 MW producing around 90 GWh every year. The power stations of Rwegura with 18 MW and Mugere with 8 MW account for 82% of the installed capacity. DGHER exploits five micro power stations for a total of 0,5 MW, and private producers have ten micro power stations for a power of 0,65 MW.

The Lahmeyer International Studies of the Development of the Hydroelectric Resources of Burundi (as of 1983) showed that there is 1,700 MW of theoretical capacity of which 300 MW (from sites with capacities above 1 MW) could be economically installed³¹.



SHORT BUSINESS INFO

- Currently, there are 24 small and large scale hydro power units with total of 38 MW produce 152 GWh per year.
- The economically viable potential is about 300 MW of medium and large hydro stations.



24 NUMBERS OBTAINED FROM THE DGEE FOR IMPLEMENTATION OF SOLAR ENERGY IN RURAL AREAS IN BURUNDI

25 THESE TELECOMMUNICATION SYSTEMS WERE PROVIDED BY THE COMPANIES/ORGANIZATIONS ONATEL, NATIONAL RTV-RTNB, CONTROL OF THE AERONAUTICAL SERVICES-RSA, ENERGY OF GREAT LAKES-EGL AND CARITAS.

26 REPORTS OF DGEE AND DGHER

27 REPORTS OF THE MINISTRY OF PUBLIC HEALTH

28 ENESCO, AS OF 2002

29 AS COUNTRY SPECIFIC WIND MAPS FOR BURUNDI ARE STILL MISSING PLEASE SEE GENI, 2010 FOR A GENERAL OVERVIEW ON WND ENERGY POTENTIAL IN AFRICA>

[HTTP://WWW.GENI.ORG>LIBRARY>RENEWABLE ENERGY RESOURCE MAPS>AFRICA>WIND](http://www.geni.org/library/renewable-energy-resource-maps/afrika/wind)

30 SEE ANNEX 7.12 - LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES

31 SEE ANNEX 7.13 - LIST OF POTENTIAL LARGE SCALE HYDRO POWER PROJECTS



5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

The following information is mainly supplied by Dismas Nditabiriye, Ir. Godefroy Hakizimana and Marie-Ange Kigeme in ‘Comparative Study on the Ecological and Economic Advantages of the Various Sources of Energy exploited in Burundi, NBI-FCBN’, as of 2008.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

NAME	ADDRESS	PROFILE	ESTIMATED RELIABILITY
CHARCOAL			
Associations of Women and Artisans	c/o ACVE Hotel Novotel Bujumbura – Burundi Phone: +257 2222 2600	Sale and manufacture of improved stoves	Associations of women are promoting and selling improved stoves in rural areas in cooperation artisans
AGRICULTURAL AND URBAN WASTE			
BRICOOP	Q. Industriel Bujumbura – Burundi (around SODECO) Phone: +257 22 22 5909	Densified agricultural waste	BRICOOP produces 40 tons per day of densified briquettes from coffee parch, sawdust, rice straw, cotton scrap, fibers of palm and dung as binder for the Army Force barracks
ADLP	Q. Nyakabiga Bujumbura – Burundi (around SOS School) Phone: +257 22 22 9555	Densified urban household waste	ADLP manufactures 500 kg per day of densified briquettes produced from household wastes (including household refuse in the peripheral districts of Bujumbura) for the National Police Force
SOLAR ENERGY PARTNERS			
WATEL	Q. Industriel Bujumbura – Burundi, Avenue de l’Imprimerie CHANIC House Phone: +257 22 22 6579	Import and sale of PV solar equipment	Contract for the electrification of health centers and communal colleges in the rural off-grid environment, awarded in October 2006 at WATEL by the Government
ECOGEEER	Bujumbura – Burundi Phone: +257 79 916110	Import and sale of PV solar equipment	Contract for the electrification of health centers and communal colleges in the rural off-grid environment, was awarded in October 2006 at ECOGEEER by the Government
ENESCO	Rue des Eucalyptus, Bujumbura – Burundi, Phone: +257 79 934 212	Import and sale of PV solar equipments	Engineering and design office also working in PV solar electrification
ENVIRONMENTAL LEADERS			
ACVE	Hotel Novotel Bujumbura – Burundi Phone: +257 2222 2600	Association for green reforestation	Association dealing with programs of reforestation and protection of the environment via micro projects (in particular protection of banks in cities and promotion of improved stove cookers)
FCBN	Avenue de l’Amitié Building Radio Isanganiro – Burundi Phone: +257 22 21 7991	Burundian forum of the Civil Society for the Nile Basin	Grouping of associations dealing with the protection of the environment by promoting projects of micro appropriations related to reforestation and popularization of improved stove cookers within the framework of the Basin of the Nile

5.2 LOCAL INSTITUTIONS RELATED TO RENEWABLE ENERGY BUSINESS

NAME	ADDRESS	PROFILE	ESTIMATED RELIABILITY
MINISTERIAL INSTITUTIONS			
Ministry of Water, Energy and Mines (MWEM)	B.P. 745 Bujumbura – Burundi Phone: + 257 22 22 5909 Fax: + 257 22 22 3337	Governmental	Promotion of RE
Ministry of Environment, Land Management and Public Works (MELM & PW)	B.P. Bujumbura – Burundi Fax: +257 22 22 8902 dp_enviro@cbinf.com	Governmental	Protection of environment
Ministry of Internal Affairs (MIA)	B.P. Bujumbura Phone: + 257 22 22 4573 Fax: +257 22 22 4678	Governmental	Mobilization
PUBLIC UTILITIES			
Urban National Power Utility (REGIDESO)	B.P. 660 Bujumbura – Burundi Phone: +257 22 3412	Para-stately	Production, distribution and sale of electricity in urban centers
Rural National Power Utility (DGHER)	B.P. 1192 Bujumbura – Burundi Phone: +257 22 22 5909 E-Mail : dgherbdi@yahoo.fr	Personalized administration	Sales, production and distribution of electricity in rural areas
Alternatives Energies Burundian Centre (CEBEA)	-	Governmental project	Research in thermal solar energy
OTHERS			
University of Burundi	B.P. 906 Bujumbura – Burundi Phone: + 257 22 6220, Mobile: + 257 79 925701, 77 750200, Fax: + 257 22 3288	Personalized administration	Research and training in local material for utilization of thermal solar energy



5.3 GOVERNMENTAL AND MULTILATERAL DONORS PROJECTS

GOVERNMENTAL PROJECTS AND PROGRAMS	TYPE OF PROJECT	DONORS			FINANCING AMOUNT (USD)	DURATION OF THE PROJECT
		NATIONAL ANNUAL BUDGET	BILATERAL	MULTILATERAL		
Multisectoral Water and Electricity Infrastructure Project (HV switchyard and electric lines)	National	-	-	World Bank	31 million	2008-2012
Electric Infrastructures Project (MV Switchyard and electric lines)	National	-	-	African Development Bank	11 million	2008-2012
Construction of Mpanda Hydroelectric Power Station (10.6 MW)	National	-	Chinese Exim Bank	-	42 million	2009-2011
Construction of Kabu 16 Hydroelectric Power Station (20 MW)	National	-	-	Burundi/South African Public-Private Partnership	Under evaluation	-
Construction of Mule 34 Hydroelectric Power Station (15 MW)	National	-	-	Burundi/South African Public-Private Partnership	Under evaluation	-
Annual projects of electrification of health centers and communal colleges by PV solar energy	National	Extraordinary budget of investment	-	-	1 Million	Every year
Construction of Ruzumbe Hydroelectric Power Station	Regional	-	-	World Bank/AfDB Public-Private Partnership	Under evaluation	2012-2017
Construction of Ruzizi III Hydroelectric Power Station	Regional	-	-	European Union	Under evaluation	-
Construction of Eldoret-Kampala-Kigali-Bujumbura Pipeline	Regional	-	-	Public-Private Partnership	Under evaluation	-
Search for hydrocarbons along Lake Tanganika	Bi-Lateral with DRC	-	-	Public-Private Partnership	Under evaluation	-
EAC Energy Master Plan	Regional	-	-	AfDB	Under evaluation	-
EAC Refineries Master Plan	Regional	-	-	AfDB	Under evaluation	-



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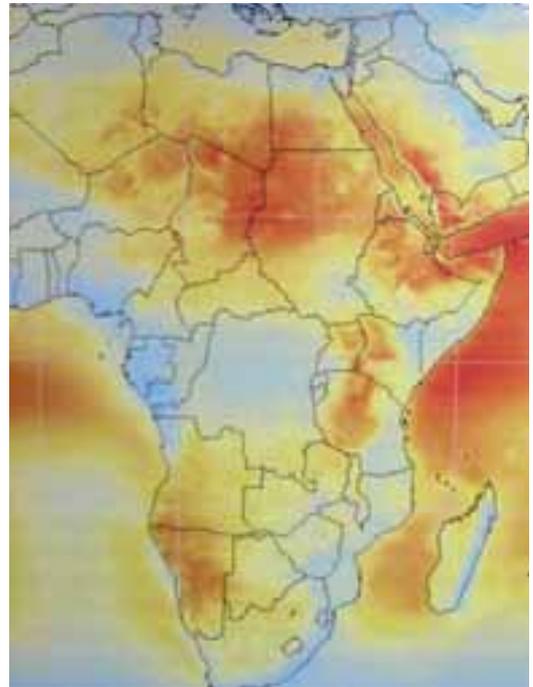
7 ANNEX

Burundi Electrical National Grid Map

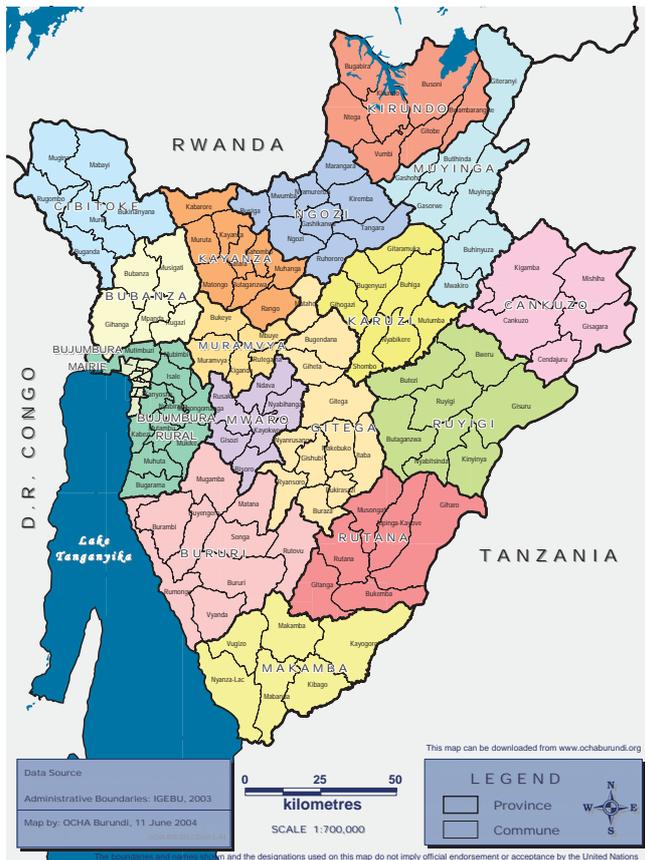


Note: The map also contains net connections to Rwanda, DRC and Tanzania.
Source: REGIDESO, as of 2007

Africa Solar/PV Map



Note: Burundi is negotiating with KfW to realize a National Solar Map.
Source: extracts from PVGIS/European Communities, 2001-2007; Tele Atlas/Europe Technologies 2010





7.6 GOVERNMENTAL AND MULTILATERAL DONORS PROJECTS

TYPE OF ENERGY	2002	2003	2004	2005	2006	2007	TOE (2007)	% (2007)
Biomass								
Firewood (m ³)	5,881,060	5,749,775	5,922,539	6,105,303	6,278,067	6,400,000	1,216,000	70.80
Agricultural residues (tons)	n.a.	n.a.	n.a.	n.a.	n.a.	900,000	315,000	18.35
Charcoal (tons)	327,674	336,521	346,617	355,500	364,650	375,55	100,000	5.82
Bagasse (tons)	n.a.	42,757	47,579	48,283	46,526	48,000	16,800	0.98
Waste wood (tons)	n.a.	0.04						
Petroleum products (tons)	37,500	39,230	41,880	41,150	38,750	40,500	42,000	2.50
Hydroelectricity (GWh)	167	161	163	171	152	188	45	1.50
Peat (tons)	6,816	6,977	4,581	4,642	4,840	8,000	2,276	0.04
Solar and biogas	n.a.	0.01						
Total								100

Source: Report on the Project Profiles prepared for the Round Table on External Aid, as of 2007

7.7 DEVELOPMENT OF POWER GENERATION IN BURUNDI

	POWER (MW)	2002	2003	2004	2005	2006	2007	SHARE (%)
		GWH						
Interconnected hydro power stations								
National power stations (Rwegura, Mugere, Ruvyironza, Gikonge)	27.27	118	94	85	89	85		
Regional power stations (Rusizi I, Rusizi II)	22.00 (share Burundi)	40	57	72	71	58		
Total production of interconnected hydro power stations		158	153	157	165	145		
Isolated hydro power stations								
(Nyemanga, Gikonge, Kayenzi, Marangara, Buhiga)		8	7	6	6	6		
Total hydro power energy		167	161	163	171	152	188	99.99999
National thermal power stations								
Bujumbura, Kirundo and Musinga	5.50	0	0	0	0	0	0.015	0.00001
Total Energy Supply		167	161	163	171	152	188	

Source: Reports of National Electricity Utility (REGIDESO), 2002-2007

7.8 SALES AND PRODUCTION FORECAST FOR POWER GENERATION

GWH	2008	2009	2010	2011	2012	2013	2014
Electricity sales	143	152	183	188	205	207	207
Losses %	24.4	24	23	21	19	18	18
Total production	189	200	238	238	253	253	253
Hydro	189	200	238	238	253	253	253
Existing Regideso hydro plants	189	200	238	238	253	253	253
Small hydro plants					26	26	26
Thermal	0	11.44	11.44	11.44	0	0	0
- Diesel	0	11.44	11.44	11.44	0	0	0
- HFO	0	0	0	0	0	0	0

Current production: 189 GWh (100%). Rehabilitation and additional production from Mpanda and small run-of-the-river hydro power plants are expected to increase capacity by 4.31 MW, 10.6 MW and 3 MW respectively.

Source: Reports of National Electricity Utility (REGIDESO), 2002-2007



7.9 SHARE OF NATIONALLY GENERATED AND IMPORTED ELECTRICITY IN BURUNDI

OPERATING PERFORMANCE	2002	2003	2004	2005	2006	2007	SHARE (%)
Total electricity available (GWh)		161	164	171	152	188	100
of which electricity produced nationally (GWh)		131	90	100	94	110	58.5
% growth (annual)	n.a.	n.a.	1.7%	4.5%	-11.3%	24.2%	n.a.
Electricity purchased from SINELAC (GWh)	n.a.	30	42	51	41	52	n.a.
Electricity purchased from SNEL (GWh)	n.a.	n.a.	31	20	17	26	n.a.
Total electricity purchased/imported (GWh)	167	161	163	171	152	188	

Source: Reports of National Electricity Utility (REGIDESO), 2002-2007

7.10 EVOLUTION OF NATIONAL ELECTRICITY CONSUMERS BY REGION

	2002	2003	2004	2005	2006	2007	RATE OF INCREASE (%)
Bujumbura	19,466	20,754	21,025	20,576	21,510	24,774	4.5
South Region	2,061	2,208	2,366	2,494	2,754		10.4
North Region	3,351	3,707	3,932	4,039	4,409		9.1
West Region	2,183	2,304	2,422	2,492	2,905		16.5
East Region	2,618	2,906	3,124	3,257	3,558		9.2
Large-scale consumers				64	64		0
Total	29,674	31,915	32,889	32,986	35,200	41,074	6.7
LV			34,800	35,335	37,946	37,660	
MV			468	445	452	412	

Source: Reports of National Electricity Utility (REGIDESO), 2002-2007

7.11 POWER TARIFFS FOR PRIVATE AND INDUSTRIAL USERS

CATEGORIES OF CUSTOMERS	SLICE 1		SLICE 2		SLICE 3		SLICE 4		SLICE 5	
	INVOICED QUANTITIES (KWH)	PRICE/KWH	INVOICED QUANTITIES (KWH)	PRICE/KWH	INVOICED QUANTITIES (KWH)	PRICE /KWH	INVOICED QUANTITIES	PRICE/KWH	INVOICED QUANTITIES	PRICE/KWH
Households	0-150	41 BIF	151-300	46 BIF	301-750	85 BIF	751 kWh and more	127 BIF	-	-
Trade	0-300	116 BIF	301-1,000	127 BIF	1,001	137 BIF	-	-	-	-
Administration	All consumption	127 BIF	-	-	-	-	-	-	-	-
Medium Voltage	*CD (kW/month) *extra premium (kW/month)	3,231 BIF 6,462 BIF	CD + the peak (0-150 h/month)	122 BIF	CD + the peak (151-450 h/month)	77 BIF	451 h and more	52 BIF	Without peak and CD	138 BIF
DGHER (Rural Electricity Utility)	All consumption	53 BIF	-	-	-	-	-	-	-	-
Public lighting	All consumption	127 BIF	-	-	-	-	-	-	-	-

Source: Reports of National Electricity Utility (REGIDESO), 2002-2007

Note: The source from National Electricity Utility (REGIDESO) really reflects the daily market prices/tariffs. REGIDESO is one important of the two electricity utilities (REGIDESO, DGHER). Regarding the quantities of electricity (kWh) a household, trade or administration etc., consumes pay the price in accordance of the indicated slices (1-3) they are corresponding to. Source: National Electricity Utility (REGIDESO), as of 2009



7.12 LIST OF ACTUAL AND PLANNED HYDRO POWER SOURCES

	DENOMINATION OF THE POWER STATION	OWNER	YEAR OF START	INSTALLED POWER (MW)	POWER SUPPLY (MW)				
					2008	2010	2012	2015	2020
Regideso Thermo-power Plant	Bujumbura	REGIDESO		5.50	5.50	5.50	5.50	5.50	
	Reinforcement Bujumbura	REGIDESO							
	Subtotal I			5.50					
Regideso Hydro Power Plant	Rwegura	REGIDESO	1986	18.00	18.00	18.00	18.00	18.00	18.00
	Mugere	REGIDESO	1982	8.00	8.00	8.00	8.00	8.00	8.00
	Nyemanga	REGIDESO	1988	1.44	1.44	2.88	2.88	2.88	2.88
	Ruvyironza	REGIDESO	1980/1984	1.50	1.50	1.50	1.50	1.50	1.50
	Gikonge	REGIDESO	1982	1.00	1.00	1.00	1.00	1.00	1.00
	Kayenzi	REGIDESO	1984	0.85	0.85	0.85	0.85	0.85	0.85
	Marangara	REGIDESO	1986	0.24	0.24	0.24	0.24	0.24	0.24
	Buhiga	REGIDESO	1984	0.24	0.00	0.80	0.80	0.80	0.80
	Sanzu	REGIDESO	1983	0.07	0.00	0.07	0.07	0.07	0.07
	Mpanda	REGIDESO		10.60	0.00	10.60	10.60	10.60	10.60
	Kabu 16	REGIDESO	2012	20.00	0.00	20.00	20.00	20.00	20.00
	Mule 34	REGIDESO	2012	20.00	0.00	20.00	20.00	20.00	20.00
Subtotal II			81.94	31.03	83.48	83.48	83.48	83.48	
DGHER Hydro Power Plant	Kigwena	DGHER	1986	0.05	0.05	0.05	0.05	0.05	0.05
	Butezi	DGHER	1990	0.24	0.24	0.24	0.24	0.24	0.24
	Ryarusera	DGHER	1984	0.02	0.02	0.02	0.02	0.02	0.02
	Nyabikere	DGHER	1990	0.14	0.14	0.14	0.14	0.14	0.14
	Muroro	DGHER	1987	0.02	0.02	0.02	0.02	0.02	0.02
	Subtotal III			0.45	0.45	0.45	0.45	0.45	0.45
Private Hydro Power Plant	Mugera	Church	1962	0.03	0.03	0.03	0.03	0.03	0.03
	Kirembe	Church	1981	0.06	0.06	0.06	0.06	0.06	0.06
	Masango	Church	1979	0.03	0.03	0.03	0.03	0.03	0.03
	Musongati	Church	1981	0.01	0.01	0.01	0.01	0.01	0.01
	Mutumba	Church	1982	0.05	0.05	0.05	0.05	0.05	0.05
	Mpinga	Church	1983	0.02	0.02	0.02	0.02	0.02	0.02
	Kiganda	Church	1984	0.04	0.04	0.04	0.04	0.04	0.04
	Gisozi	Church	1983	0.02	0.02	0.02	0.02	0.02	0.02
	Burasira	Seminary	1961	0.03	0.03	0.03	0.03	0.03	0.03
	Teza	Tea Leaf Factory	1971	0.36	0.36	0.36	0.36	0.36	0.36
Subtotal IV			0.65	0.65	0.65	0.65	0.65	0.65	
National power supply				37.63	90.08	90.08	90.08	90.08	
Import to Burundi	Rusizi I	SNEL		27.8	9				
	Rusizi II	SINELAC		40	7		12	12	12
	Rusumo Falls	NELSAP		60	0		20	20	20
	Rusizi III	CEPGL		250	0				
Total import supply				16	83.48	32			

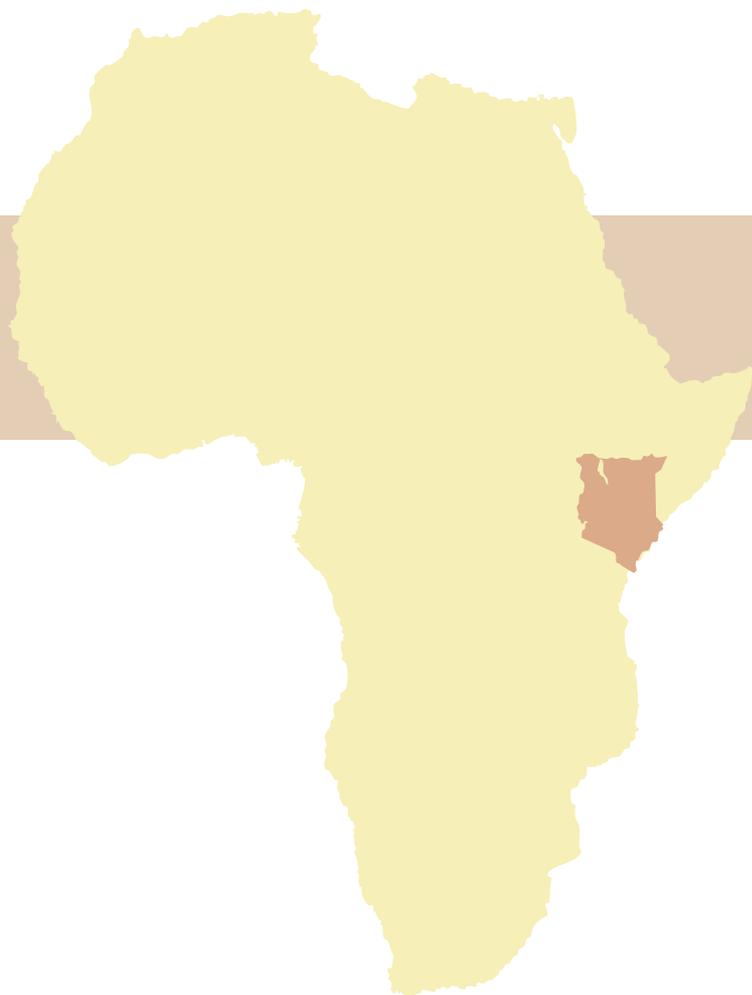
Source: Lahmeyer International Report, as of 1983



7.13 LIST OF POTENTIAL LARGE SCALE HYDRO POWER PROJECTS

PROJECTS	PINST (MW)	PGAR (MW)	EPRIM (GWH)	COSTS (1 BN USD)	SPECIFIS COSTS	
					(USD/KWH)	(USD/MWH)
STORAGE PROJECTS (8 H)						
KITE 011 (Rushiha)	15.3	15.2	46.4	44.3	2,906	106
KITE 020 (Masango)	9.3	9.3	27.1	28.9	3,112	118
KAGU 006 (Kagunuzi B)	6.7	6.7	21.4	20.8	3,115	106
MPAN 049 (Mpanda A)	14.6	13.9	40.9	44.1	3,186	119
KAGU 010 (Kagunuzi A)	10.7	10.2	29.8	33.8	3,316	126
KAGU 016 (Kabulantwa V)	36.1	31.3	111.7	108.3	3,455	107
MUYO 029 (Muyovozi III)	6.0	5.7	18.0	21.4	3,746	131
KABU 023 (Kabulantwa IV)	21.5	16.8	61.6	69.6	4,136	125
CHAINS OF STORAGE PROJECTS (12 H)						
KABULANTWA (023-016-009)	67.0	62.2	201.3	156.1	2,510	86
KITENGE-KAGUNUZI (020-011-010-006)	42.0	41.3	124.7	127.8	3,094	113
RUZIBAZI (028-021-014-012)	40.6	39.8	119.9	130.6	3,279	121
NYAMUHENDE/KIRASA (013-009-006-003)	38.3	36.7	111.0	126.0	3,437	126
KANYOSHA/KANIKI (016-010)	8.4	8.1	24.9	34.0	4,172	150
MUYOVOZI	8.2	7.7	24.0	37.8	4,920	174
PONDAGE PROJECTS (12 H)						
LUA 035 (Lua)	10.8	10.8	47.4	40.5	3,745	95
KIKU 002 (Kikuka)	3.0	2.9	13.1	11.5	3,911	97
KABU 016 (Kabulantwa V)	15.4	14.3	67.3	58.3	4,085	96
RUZB 014 (Ruzibazi C)	3.6	3.6	15.7	16.3	4,571	116
RUVU 216 (Murongwe/Kunyanga)	6.2	4.7	25.9	21.7	4,632	93
RUZB 012 (Ruzibazi D)	3.2	3.2	13.8	15.6	4,935	125
CHAINS OF PONDAGE PROJECTS (12 H)						
KABULANTWA (016-009)	16.9	15.8	74.0	65.7	4,159	99
RUZIBAZI (014-007)	11.8	11.8	57.2	39.5	3,347	79
RUN-OF-RIVER -PROJECTS (24 H)						
JJI 003 (Jiji)	7.5	7.5	65.8	18.3	2,430	31
SIKU 008 (Nyemanga)	2.5	2.5	21.9	6.4	2,539	32
MULE 034 (Mulembwe)	5.3	5.3	46.3	18.7	3,544	45
RUZB 007 (Ruzibazi E)	4.7	4.7	41.4	18.0	3,801	48
KABU 016 (Kabulantwa V)	7.3	7.3	64.0	28.7	3,919	50
KABU 023 (Kabulantwa IV)	2.7	2.7	23.5	12.5	4,658	59
NDAH 013 (Ndahangwa)	1.3	1.3	11.1	7.3	5,799	73
SIKU 011 (Sikuvyaye)	2.4	2.4	20.6	13.9	5,934	75
LUVI 012 (Ruvironza)	1.3	1.3	11.8	8.3	6,202	78
NYHE 006 (Nyamuhende/Kirasa C)	1.2	1.2	10.8	7.7	6,234	79

Source: Lahmeyer International Report, as of 1983



COUNTRY CHAPTER: KENYA

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ACRONYMS AND ABBREVIATIONS

BURUNDI

AC	Alternating Current
ACP	African, Caribbean and Pacific States
AfDB	African Development Bank
AFD	Agence Française du Développement (French Development Agency)
AFREPREN/FWD	African Energy Policy Research Network Limited
ATIA	African Trade Insurance Agency
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Development and Cooperation)
CDC	Capital For Development (UK government-owned fund)
CDM	Clean Development Mechanism
CI	Commercial/Industrial
COMESA	Common Markets of East and Southern Africa
DFID	Department for International Development of the UK
DGCD	Direction Générale de la Coopération au Développement (Directorate-General for Development Cooperation)
DGCS	Direzione Generale per la Cooperazione allo Sviluppo (Directorate-General Development Cooperation in Italy)
DGEF	Division of Global Environment Facility Coordination
DGIS	Dutch Ministry of Foreign Affairs
DC	Domestic Consumers
EAC	East African Community
EDF	Électricité de France (Electricity of France)
EE	Energy Efficiency
EIB	European Investment Bank
ELCI	Environment Liaison Center International
EPA	Energy Policy Act
ERC	Energy Regulatory Commission
FIPA	Foreign Investment Protection Act
GDC	Geothermal Development Company
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoK	Government of Kenya
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
IBRD	International Bank for Reconstruction and Development
ICO	Instituto de Crédito Oficial (state-owned corporate entity of the Spanish Ministry of Economy and Finance)
ICSID	International Centre for Settlement of Investment Disputes
IDA	International Development Association
IEET	Institute for Energy and Environmental Technology
IFC	International Finance Corporation
IPC	Investment Promotion Centre
IRSEAD	Institute of Research in Sustainable Energy and Development
IPP	Independent Power Producers
IT	Interruptible off-peak supplies
JBIC	Japan Bank for International Cooperation
JKUCAT	Jomo Kenyatta University of Agriculture and Technology
KEBS	Kenya Bureau of Standards
KNBS	Kenya National Bureau of Statistics
KES	Kenyan Shilling
KenGen	Kenya Electricity Generating Company
KfW	Kreditanstalt für Wiederaufbau (German Banking Group including KfW Entwicklungsbank as German Development Bank)
KPC	Kenya Pipeline Company
KPLC	Kenya Power and Lighting Company
LCPDP	Least Cost Power Development Planning
LPG	Liquefied Petroleum Gas
MSTQ	Metrology, Standards, Testing and Quality Management



MFA	Ministry of Foreign Affairs
MHI	Mitsubishi Heavy Industries
MIGA	Multilateral Investment Guarantee Agency
NEMA	National Environmental Management Authority
NGO	Non-Governmental Organization
NOCK	National Oil Corporation of Kenya
NORAD	Norwegian Agency for Development Cooperation
NZG	New Zealand Government
PPA	Power Purchase Agreements
PPP	Private-Public Partnership
PV	Photovoltaic
R&D	Research and Development
RE	Renewable Energy
REA	Rural Electrification Authority
REECON	Renewable Energy Engineering Contractors
REP	Rural Electrification Program
SC	Small Commercial
SHS	Solar Home Systems
SIDA	Swedish International Development Cooperation Agency
SME	Small and Micro Enterprise
SL	Street Lighting
SWERA	Solar and Wind Energy Resource Analysis
TBT	Technical Barriers to Trade
TDA	Tea Development Authority
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USD	United States Dollar
WTO	World Trade Organization

MEASUREMENTS

°C	degree Celsius
GWh	gigawatt hours
km	kilometer
km ²	square kilometer
kV	kilovolt
kW	kilowatt
kVA	kilovolt ampere
kWh	kilowatt hour
m	meter
MW	megawatt
MWp	megawatt peak
s	second
V	volt
Wp	Watt-peak



SUMMARY

ECONOMICAL STATUS AND DEVELOPMENT OF KENYA

Kenya is a major powerhouse in East and Central Africa. The capital of Nairobi is an important commercial and communication hub for the East African Community (EAC) region and hosts a United Nation (UN) office and different UN programs, e. g. the United Nations Environment Program (UNEP) and the United Nations Human Settlements Program (HABITAT) as well as 22 other multinational bodies. Although the Gross Domestic Product (GDP) per capita is high (1,700 USD) with a stable growth rate of 6%, the rate of poverty stands at 48%. Tea and coffee are the main export commodities.

Kenya has developed its Vision 2030 Program, which aims to transform Kenya into a newly industrialized, “middle-income country providing a high quality life to all its citizens by the year 2030”. The program is an all-inclusive and participatory stakeholder consultative process and includes various business opportunities for private investment, which have been highlighted in the following paragraphs¹.

STRUCTURE OF ENERGY SUPPLY IN KENYA

Over two thirds of the population still rely on biomass like wood, animal waste and agricultural residues as primary energy source (68%), which is mainly used for cooking. Commercial energy resources are petroleum (22%), electricity (9%) and other sources (1%). The electricity demand of 5,000 GWh is fully met by national hydro power stations, thermal oil-fired stations and geothermal sources. The total installed capacity is 1,200 MW.

Around 80% of the population live in rural areas, where the electrification rate is 4%, while in the urban areas around 51% are connected to the national grid².

STATUS OF RENEWABLE ENERGIES IN KENYA

Hydro

Kenya has a technical potential for large-scale hydro power stations of 1,300 MW. Half of it (currently 677 MW) is already used. The small-scale hydro power potential is estimated at 3,000 MW, only a fraction of it is already developed. Currently, micro and pico hydro power stations are implemented in the off-grid area around Mt. Kenya, 140 km North East of Nairobi.

Solar

Around 4 MW_p of small PV systems are installed in Kenya. The commercial sale and distribution network is well established with wholesalers in the commercial centers and small shops and retailers with access to off-grid areas. Thus the market is mainly driven by small residential systems for lighting and communication. Currently there is no solar support program in place.

Wind

The highest wind potential is in the district of Marsabit, which cannot be developed due to the lack of electricity grid. Currently, two wind farms (a 40 MW wind farm at Ngong Hills and a 30 MW wind farm at Kinangop) are under construction. Additionally, around 100 small wind turbines (400 MW) are in operation. Reliable wind measurements are not available, but the Solar and Wind Energy Resource Analysis (SWERA) database for Kenya is providing basic information for further investigations³.

Geothermal

Kenya is the only EAC country using geothermal power. A 128 MW station is providing electricity to the national grid. The potential in Kenya's Rift Valley is estimated at over 2,000 MW. The Government of Kenya has established entities for test drillings and further development of geothermal resources. Funds of about 5 million € were made available for this development.

Biomass

Biomass is mainly sold and used in the informal sector to supply wood and charcoal to rural and urban households. The German Technical Cooperation Agency (GTZ) on behalf of the German Government has implemented agro-industrial biogas pilot projects for electricity generation with 160 kW and 20 kW capacities. The most important contribution of biomass for commercial energy supply is seen in cogeneration of bagasse. It has a potential of 340 MW provided by four state-owned sugar factories that are going to be privatized in the next two years.

¹ FOR FURTHER INFORMATION SEE WEBSITE OF KENYA'S VISION 2030 (NATIONAL ECONOMIC & SOCIAL COUNCIL OF KENYA, AS OF 2008)

² GVE/UNDP, AS OF 2005

³ UNDP, AS OF 2008



1 COUNTRY INTRODUCTION

1.1 KENYA OVERVIEW⁴

Kenya is a major powerhouse in East and Central Africa. Nairobi, the administrative and commercial capital, is an important business and communication hub for the region and head quarter of several multinational companies and international bodies including the United Nations. The city hosts a large number of diplomatic offices in Africa.

The country extends from 5° North to 4°76' South and from 34° East to 41°6' East over the equator. It covers an area of approximately 583,000 km² with a 470 km long coastline on the Indian Ocean. It borders Somalia, Ethiopia, Sudan, Tanzania and Uganda. The Indian Ocean lies to the East.

Kenya's landscape varies from low coastal plains to plateaus with altitudes of over 3,000 m in inland regions. The highlands, which are characteristically wet and densely populated, cover only 25 % of the landmass. The country shares a small portion of the Lake Victoria with Uganda and Tanzania.

Kenya became a republic in 1964 after attaining independence from Britain. Kenya is a major player in the East African Community (EAC). The Government is a parliamentary democracy modeled along the Westminster System of Government. The official languages are English and Swahili, the latter being spoken widely in Eastern Africa.

Poverty in Kenya is widespread with some 48 % of the population living below the poverty line.

1.2 KENYA STATISTICS: GEOGRAPHY AND ECONOMICS⁵

Kenya's Vision 2030 is the country's new development blueprint covering the period 2008–2030⁶. It aims to transform Kenya into a newly industrialized, middle-income country providing a high quality life to all its citizens by the year 2030'. The Vision has been developed through an all-inclusive and participatory stakeholder consultative process and has three main pillars:

- The economic pillar aims to put in place mechanism for a sustained economic growth targeting 10 % per annum over the next 25 years.

LAND AREA:	582,600 km ²
POPULATION:	36.5 million (as of 2007), growth rate 2.8%
DENSITY:	64.7 inhabitants/km ²
SHARE URBAN/RURAL POPULATION:	19% urban and 81% rural
BIGGEST CITIES AND POPULATION:	Nairobi (2.8 million), Mombasa, (0.695 million) and Kisumu (0.3 million)
CLIMATE:	Two rainy seasons (March–April, October–November), average temperatures in Nairobi 28°C, the North 34°C and at the coast 32°C, February and September are the hottest months
ALTITUDE:	The coastal plains and the Nike plateau lie low (generally < 300 m above sea level); the highlands East and West of the Rift Valley constitute the highest altitudes ranging from 1,400 m to 3,000 m above sea level; Mt. Kenya is Kenya's highest and Africa's second highest mountain reaching 5,200 m above sea level; Nairobi is at 1,700 m, Mombasa is at sea level on the Indian ocean; Kisumu on Lake Victoria is 1,131 m above sea level.
MAIN WATER BODIES	Lake Victoria, Lake Turkana, Lake Naivasha, Lake Baringo and Lake Nakuru
VEGETATION	The mountains and high rainfall areas have tropical forests which comprise wet mountain forests found in parts of Mt. Kenya, the Abardare ranges, the Mau forest, Mt. Elgon and the Cherangani hills; the lee wind sides of these mountains enjoy dry mountain vegetation; along the coast are remnants of the once widespread tropical lowland forest around Malindi; other parts of the country are arid and semi arid with the vegetation being largely the Nyika ecosystems dominated by camphor and acacia woodlands
GDP PER CAPITA (AT PURCHASING POWER PARITY)	USD 1.700 (as of 2007)
GDP GROWTH RATE:	6.8 % (as of 2007)
INFLATION RATE:	12.2% (as of 2007), 2008 expected to peak at 18%
AGRICULTURE:	Tea, coffee and horticulture
INDUSTRIES:	Cement, agro processing, refining and construction
ELECTRICITY – PRODUCTION:	6,868.8 GWh (as of 2007)
ELECTRICITY – CONSUMPTION:	5,067 GWh (as of 2007)
OIL – CONSUMPTION:	3,508 metric tons of oil equivalent per annum (as of 2006)
OIL – PROVEN RESERVES:	None
EXPORTS:	4.08 billionUSD (as of 2007)
EXPORTS – COMMODITIES:	Tea, coffee and horticultural products including cut flowers, processed products including refined petroleum
EXPORTS – PARTNERS:	East African Community, COMESA countries, Pakistan, Egypt, Europe and East Asia
IMPORTS – COMMODITIES:	6.77 billionUSD
IMPORTS – PARTNERS:	Gulf countries, China, Western Europe and COMESA countries
EXCHANGE RATE:	1 KES = 0,00912 € (as of 2009)

Source: data compiled by the author from different sources, e.g. CIA, as of 2009

⁵ SEE ALSO CIA, AS OF 2009

⁶ SEE ALSO OFFICIAL WEBSITE OF KENYA'S VISION 2030:

NATIONAL ECONOMIC & SOCIAL COUNCIL OF KENYA, AS OF 2008

⁴ CIA, AS OF 2009



- The social pillar addresses an agenda for a just and cohesive society enjoying equitable social development in a clean and secure environment
- The political pillar provides that the country’s development is people-centered, result-oriented, and based on an accountable democratic political system.

These three pillars are anchored on the thematic subjects of macro-economic stability, continuity in governance reforms, enhanced equity and wealth creation opportunities for the poor, infrastructure, energy, science, technology and innovation, land reform, human resources development, security and public sector reforms.

This long-term development plan will directly depend on the availability of energy and the provision of energy services and therefore offers enormous opportunities for investment in the energy sector.



RE Business Opportunity

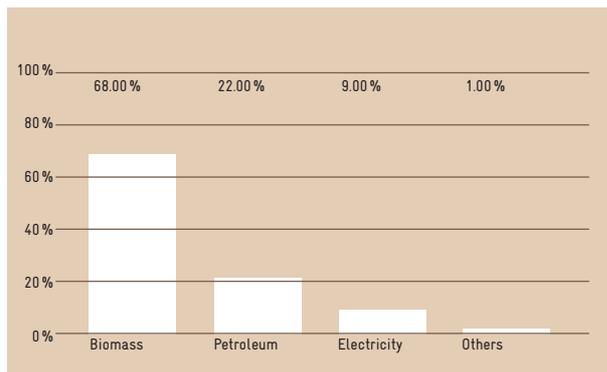
2 ENERGY MARKET IN KENYA

2.1 ENERGY SITUATION OVERVIEW

The Kenyan Government recognizes that without adequate and affordable energy services, the above-mentioned „Vision 2030“ cannot be achieved. Kenya targets a GDP growth rate of over 10% per annum over the next 25 years with increased energy demand and high investments in the energy sector.

Today, wood fuel and other biomass account for 68% of the total primary energy consumption, followed by petroleum with 22%, electricity with 9% and others with about 1%⁷.

FIGURE 1
Shares of Total Primary Energy Consumption in Kenya



Source: data from GVEP/UNDP, as of 2005; graph compiled by PSE AG

Petroleum and electricity dominate the country’s modern energy sector and supply primarily the commercial energy needs. Wood fuel supplies the energy needs of the largely non-commercial and informal sectors as well as of the rural and poor urban households. Other sources of energy include solar electricity, solar thermal and wind power, of which much is still untapped.

The anticipated growth of demand requires specific efforts to generate more energy at a lower cost and increased efficiency in energy consumption, which are expected to be met through continued institutional reforms in the energy sector (encouraging more private sector participation in power generation) and through separating transmission from distribution.

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The energy market can be divided in the four major sub-sectors of biomass, petroleum and electricity and others.

Biomass

Biomass⁸ energy consumption constitutes 68% of primary energy consumption. This sub-sector is the largest within the energy sector and remains largely unregulated and underdeveloped. Fuels include firewood, charcoal, wood waste and farm residues. The sector is dominated by households and small business.

For a majority of the population wood fuel remains the predominant fuel for cooking with 68.3% households using firewood and charcoal. Of that 80% of the rural households use firewood compared with 10% for urban residents. Charcoal, derived from fuel wood, is the second most popular cooking fuel used by 13.3% of the households in the country, mostly in urban centers. Firewood is increasingly supplied by large private tree plantations, which offer a wide scope for commercial biomass businesses.

Petroleum

Petroleum⁹ is Kenya’s major source of commercial energy accounting for about 80% of the country’s requirements. Petroleum, being the number one driver of the economy, reflects a consumption pattern corresponding to the economic activities.

Kerosene is the third of the predominant cooking fuels and the most common in urban areas. Other fuels used in Kenya include Liquefied Petroleum Gas (LPG) employed by 3.5% of the population, mainly urban dwellers. Kerosene is the most popular lighting fuel across the country used by over 75% of the population. It is employed for lighting in off-grid rural locations and for lighting and cooking in urban settings without access to grid electricity.

Kenya has no known reserves of petroleum. Crude oil is imported and refined in Mombasa. Domestic consumption of petroleum products has progressively increased from 2.2 million tons in 2003 to 2.7 million tons in 2007, accounting for 25.7% of the country’s total import bill.

Electricity

The national electrification rate averages at 15.4%, but 51% of urban households are connected to the national grid as compared to only 4% of the rural households. Electricity¹⁰ is mainly used for lighting. Only 1.6% of mainly off-grid households in Kenya use solar photovoltaic (PV) for lighting.

8 GVEP/UNDP, AS OF 2005

9 DATA COMPILED BY THE AUTHOR FROM DIFFERENT SOURCES

10 DATA COMPILED BY THE AUTHOR FROM DIFFERENT SOURCES;

SEE ALSO KPLC 2004–2007

7 GVEP/UNDP, AS OF 2005



Electricity consumption in rural areas is on average 544 kWh per household or 115 kWh per capita per year. In urban areas, the consumption is higher, amounting to 217 kWh per capita per year.

Electricity as sub-sector is second to petroleum in terms of commercial value and comprises power generation, transmission and distribution. The Electricity Act of 1999 set the prerequisites for separating the electricity sector in the two categories (i) generation and (ii) transmission and distribution.

Plans are underway to separate transmission and distribution in single entities. The electricity demand is covered mainly by hydro power, thermal and geothermal power stations (see also the following table).

TABLE 1
Installed Capacity and Generation of Electricity 2002–2007

SOURCE	2004		2005		2006		2007	
	Installed MW	Net Gen. GWh						
Hydro Power (local)	677.3	3,169.0	677.3	3,039	677.3	3,025.0	677.3	3,592.0
Hydro Power (imports)	–	162.0	–	28	–	10.8	–	22.6
Thermal (oil)	392.0	1,038.0	351.0	1,506	370.0	1,487.0	389.0	1,738.0
Solar PV							4.0	4.0
Wind	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.2
Geothermal	128.0	987.0	128.0	1,002	128.0	1,046.0	128.0	989.0
Thermal (emergency)	–	–	–	–	–	–	105.0	523.0
Total power generated	1,198.0	5,564.0	1,156.0	5,57.4	1,177.0	5,568.2	1,303.7	6,868.8

Source: Kenya Power and Lighting Company, 2004–2007

Hydro power remains the largest single source. The total installed capacity as of June 2007 was 1,197 MW with an effective capacity of 1,153 MW. Peak demand reached 1,053 MW confirming a growth rate of 8.3% up from 6.5% in 2002, which was caused by grid extension to rural areas.

With 58% of grid connected electricity being generated by hydro, power cuts are common during the dry seasons when the river regimes are at their lowest. In recent times, as the reserve margins have decreased with increased demand and more erratic rains, the seasonal breakdowns have become more frequent. Furthermore, the recipients at the end of the lines often suffer voltage drops that trigger power outages. This has caused the need for standby generators in the country, which in 2007 were estimated at approximately 100 MW in capacity.

Most of the line losses are attributed to the distances between generators and transformer stations and the low rate of maintenance. Transmission losses are estimated at 15%, while theft of electricity is estimated at 2%.

Grid extension is part of the Government’s strategy to increase access to electricity and is carried out in connection with the rural electrification projects. During 2007, the expansion and upgrading of the distribution system led to about 22% of network growth. About 500 km of distribution were projected to be constructed in 2008. The construction and upgrading of transmission lines and associated substations for other rural towns include a 122 km 132 kV transmission line between Kamburu and Meru and a 61 km 132 kV transmission line between Chemosit and Kisii.

TABLE 2
Total Power Generation and Interconnected Power Purchase by Utility

SOURCE	INSTALLED CAPACITY (MW)	ENERGY SUPPLIED TO GRID (GWH)	SHARE OF TOTAL ENERGY (%)
Hydro (including imports)	697.2	3,290.0	54.2
Geothermal	128.0	1,013.0	16.7
Thermal (including IPPs)	390.2	1,763.0	29.0
Wind	0.4	4.0	0.1
Total	1,215.8	6,070.0	100.0

Source: KPLC, as of 2007



2.3 ELECTRICITY PRICES

Grid electricity prices are set through a tariff process administered by the Kenyan Energy Regulatory Commission. The tariffs are set to reflect the long-run marginal cost of energy services that allow the generation and distribution utilities to remain solvent. The table below summarizes the current electricity tariffs and rates. For an average consumption of 150 kWh per year, the private consumer price is 11.6 KES/kWh (12 € Cent/kWh) due to the high fixed monthly charges¹¹.



TABLE 3
Schedule of Retail Electricity Tariffs and Rates

TARIFF	TYPE OF CUSTOMER	SUPPLY VOLTAGE (V)	CONSUMPTION (kWh/MONTH)	FIXED CHARGE (KES/MONTH)	ENERGY CHARGE (KES/kWh)	DEMAND CHARGE (KES/kVA/MONTH)
DC	Domestic consumers	240 OR 415	0-50	120.00	2.00	-
			51-1,500		8.10	
			> 1,500		18.57	
SC	Small commercial	240 OR 415	≤ 15,000	120.00	8.96	-
CI1	Commercial/ industrial	415 3 PHASE	> 15,000	800.00	5.75	600.00
CI2			11,000	2,500.00	4.73	400.00
CI3			33,000/40,000	2,900.00	4.49	200.00
CI4			66,000	4,200.00	4.25	170.00
CI5			132,000	11,000.00	4.10	170.00
IT			Interruptible off-peak supplies	240 OR 415	≤ 15,000	240.00 (WHEN USED WITH DC OR SC)
SL	Street lighting	240	-	120.00	7.50	-

Source: Kenya Gazette Notice, as of 2008

In March 2008, the Ministry of Energy published a feed-in tariff policy for electricity generation from wind, small hydro and biomass. The tariff allows IPPs to sell and oblige distributors to buy on a priority basis all RE sources generated electricity at a fixed tariff for a given period of time. No project has been established in 2008, but the Agakhan Foundation is planning to scale down a planned 70 MW wind farm in Ngong Hills near Nairobi to 50 MW so that they can benefit from the tariff.

The tariffs are consistent with Section 103 of the Energy Act No. 12 of 2006¹² and shall apply for 15 years. Its objectives are to:

- Facilitate resource mobilization by providing investment security and market stability for investors in RE electricity generation
- Reduce transaction and administrative costs by eliminating the conventional bidding processes
- Encourage private investors to operate the power plant prudently and efficiently so as to maximize its returns

TABLE 4
Schedule of Retail Electricity Tariffs and Rates

TECHNOLOGY TYPE	PLANT CAPACITY (MW)	MAXIMUM FIRM POWER TARIFF (USD/kWh) AT THE INTERCONNECTION POINT	MAXIMUM NON-FIRM POWER TARIFF (USD/kWh) AT THE INTERCONNECTION POINT
Wind power (single wind farm)	0-50	0.090	0.090
Any individual capacity	≥ 50	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS
Biomass derived electricity	0-40	0.070	0.045
Any individual capacity	≥ 40	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS
Small hydro power	0.50-0.99	0.120	0.100
	1-5	0.100	0.080
	5.1-10	0.080	0.060
Any individual capacity	≥ 10	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS	TARIFF TO BE NEGOTIATED ON COMMERCIAL BASIS

Source: Kenya Gazette Notice March, as of 2008

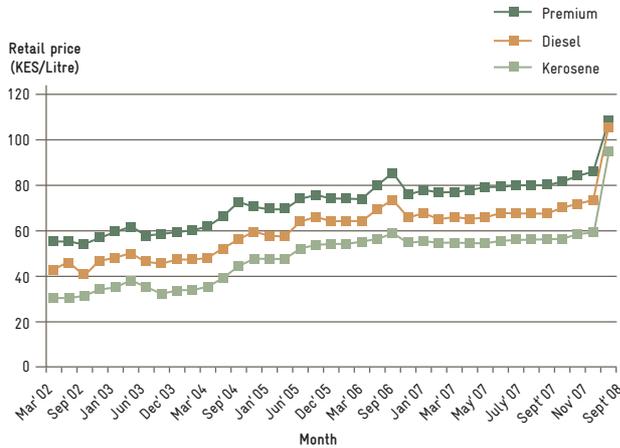
11 ELECTRICITY REGULATORY BOARD, AS OF 2005

12 PARLIAMENT OF KENYA, AS OF 2006



The development of retail prices for petroleum products between 2002 and 2008 shows a substantial price increase for diesel from 40 KES/l to over 100 KES/l within the last six years. The fuels are subject to excise duty, petroleum development levy and road levy for diesel and petrol.

FIGURE 2 Evolution of Retail Prices for Petroleum Fuels 2002–2008



Source: graph compiled by the author with data from KNBS, Leading Economic Indicators 2002–2008 and Economics Survey, as of 2009

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

The Ministry of Energy is responsible for the overall energy sector planning and investment. The primary objective is to ensure the cost effective and affordable supply of energy in adequate quality to meet the national demand for development. Planning for grid-based electricity is done in partnership with Kenya Power and Lighting Company (KPLC).

KPLC

The Kenya Power and Lighting Company (KPLC) is 48% state-owned. It is the sole electricity utility in Kenya responsible for transmission and distribution.

KenGen

Kenya Electricity Generating Company (KenGen) is 70% state-owned. It is the largest generator of electricity in Kenya operating an array of hydro, geothermal and thermal generators. The company generates more than 65% of all electricity fed into the national grid.

ERC

The Energy Regulatory Commission (ERC) is responsible for regulatory and tariff processes of the energy sector including negotiations with IPP.

NEMA

ERC is mandated by the National Environmental Management Authority (NEMA) to be the leading institution on environmental matters related to energy including environmental impact assessments and mitigation measures as well as the supervision of Clean Development Mechanism (CDM).

IPP

Kenya's private sector IPPs include Iberafrika Power, Tsavo Power, Simba Power and Agrekko Power (thermal) and Or Power (geothermal).

REA

The Rural Electrification Authority (REA) manages the Rural Electrification Program and privatization or concessions for isolated systems.



3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

Kenya has put greater emphasis on Renewable Energy (RE) resources through the Sessional Paper No. 4 of 2004 (see annex 7, Bibliography). It recognizes the importance of RE as well as the importance of energy efficiency (EE) and lays the policy framework for the development and provision of cost-effective, affordable and adequate quality energy services on a sustainable basis in the short to long term.

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

Kenya's key policy aspects, amongst others, comprise the following¹³:

Legal and Regulatory Framework

- Establishment of an independent energy regulator, the ERC, to facilitate prudent regulation, enhance stakeholder interests and boost investor confidence. The policy was consolidated in the Energy Policy Act (EPA) 97 and the Petroleum Act Cap. 116.

Institutional Arrangements

- Creation of the REA to accelerate rural electrification
- Promotion of privately or community-owned energy service entities operating RE power plants
- Establishment of a state-owned Geothermal Development Company (GDC) to conduct geothermal resource assessment and sale of steam

Energy Trading Arrangements

- Creation of a domestic power pool with provision for a wholesale and retail market to create competition and hence reduce cost of electricity
- Streamlining of biomass energy trading arrangements
- Increasing of lifeline tariff to recover the cost of electricity generation

Energy Security

- Encouragement of wider adoption and use of RE technologies to enhance their role in the energy supply matrix
- Formulation of plans for biomass energy development
- Development of a national energy research agenda
- The strategies proposed under the Energy Act 2006 to promote the development and use of RE technologies include the following:
 - Formulation of a national strategy for coordinating research in RE
 - Provision of an enabling framework for the efficient and sustainable production, distribution and marketing of biomass, solar, wind, small hydro, municipal waste, geothermal energy and charcoal
 - Promotion of fast-growing trees for energy production including biofuels and the establishment of commercial woodlots including peri-urban plantations

- Promotion of the production and use of gasohol and biodiesel
- Promotion of energy production with municipal waste (not specified in detail)
- Promotion of cogeneration of electric power by sugar millers for sale to the national grid and directly to the consumers
- Development of appropriate local capacity for the manufacture, installation, maintenance and operation of basic RE such as bio-digesters, solar systems and hydro turbines
- Promotion of international cooperation on programs focusing on RE sources
- Harnessing of opportunities offered under the CDM and other mechanisms including carbon trading

Financial incentives¹⁴ supporting the RE policy include income tax holidays for RE projects as well as exemption from duties and taxes during the implementation of generation and transmission projects.

Exclusive RE products are exempt from customs and import duties. Depending on the expected benefits to the economy, however, specific projects may attract preferential treatment from the Treasury. Documentation and permits for tax holidays and other exemptions for energy projects can be obtained from the permanent Secretary of the Ministry of Energy. A comprehensive customs classification for goods can be obtained from the Commissioner of Customs at the Kenya Revenue Authority.

SHORT BUSINESS INFO

- **Income tax holidays and exemption from tax and duty during implementation of RE projects**
- **Zero custom duty, zero tax on imported RE equipment**

13 PARLIAMENT OF KENYA, AS OF 2004

14 KRA, AS OF 2009



3.2 DONOR AID ACTIVITIES

The following table shows the contribution of donor aid activities in the energy sector. It lists donor funded energy projects, including their lifeline total budget and the donors funding the project. As shown below, donor activity in the RE market in Kenya is limited.

TABLE 5
Donor Funded Energy Projects in Kenya

PROJECT TITLE	DONOR	LIFELINE	TOTAL BUDGET	OBJECTIVES
The Energy Sector Recovery Project	World Bank through IBRD/IDA	2004–2010	80.00 million USD	Enhancing of the policy as well as the institutional and regulatory environment for private sector participation and sector development for efficient reliability and quality of services
Market Transformation for Efficient Biomass Stoves for Institutions and Small- and Medium-Scale Enterprises	GEF through UNDP	2006–2010	1.00 million USD	Removing of market barriers for the adoption of sustainable biomass energy practices and technologies by institutions
The Rural Electrification Master Plan Stud	Finnish Government through MFA	2005–2010	9.94 million USD	Upgrading of the rural electrification master plan prepared in 1997 with emphasis on the pro-poor rural electrification master plan
Reinforcement Distribution Elec	French Government through AFD	2005–2010	31.00 million USD	The AFD Energy Program includes the French Rural Electrification Project Phase II (rehabilitation of KPLC sub-stations etc.). AFD is present and highly active in the development of all energy sectors in Kenya. Through the AFD, France is a lead donor in Kenya's energy sector and chairs the energy donor coordination group.
Olkaria II Extension (Electrical Distribution and Transmission)	European Commission through EIB	2005–010	40.00 million USD	The loan contributes to the financing of a grid development project including the upgrading and construction of transformer sub-stations, the rehabilitation and extension of distribution lines and will allow to connect 320 000 new consumers. The project also includes the replacement of outdated network control and radio communication facilities.
KPLC Grid Development	European Commission through EIB	2005–2010	53.00 million USD	Enhancement of electrical distribution and transmission
Sondu/Miri Hydro Power Project II	Japan Government through JBIC	2005–2010	13.00 million USD	Construction of hydro power station
No title	Japan Government through JBIC	2005–2010	2.82 million USD	Hydroelectric power plants
Tea Development Authority Integrated Energy Management	United States through TDA	2005	342,000 USD	Feasibility sector study
No title	United States through TDA	2005	396,000 USD	Hydroelectric power plants
No title	United States through USAID	2005	123,000 USD	Assistance in energy policy and administrative management
No title	United States through USAID	2005	2.64 million USD	Electrical transmission and distribution
No title	United States through AID	2005	397,000 USD	Electrical transmission and distribution
No title	United States through USAID	2005	398,000 USD	Coal-fired power plants
No title	United States through USAID	2005	388,000 USD	Energy policy and administrative management
No title	United States through USAID	2005	315,000 USD	Energy policy and administrative management
No title	Sweden through SIDA	2005	38,000 USD	Power generation/non-renewable sources
No title	Sweden through SIDA	2005	24,000 USD	Power generation/non-renewable sources
No title	United States through USAID	2005	4.70 million USD	Energy policy and administrative management
No title	Germany through KfW	2005	247,000 USD	Power generation/renewable sources
Bonification d'Intérêts Électricité, AF	Belgium through DGCD	2005	249,000 USD	Electrical transmission and distribution
Promotion of Private Sector Development in Agriculture	Germany through GTZ	2005–2012	6.9 million USD	The project aim is to support small and medium-size agricultural entrepreneurs in making use of their market opportunities by implementing economically viable and environmentally sound practices. Particular consideration is given to the poorer segments of the population



PROJECT TITLE	DONOR	LIFELINE	TOTAL BUDGET	OBJECTIVES
Windenergienutzung Afrika	Germany through BMZ	2005	97,000 USD	Wind power
Jpo Fugelsnes	Norway through MFA	2005	103,000 USD	Energy policy and administrative management
SMYRNA Community Development Program – SMYRNA Clinic	Norway through NORAD	2005	6,000 USD	Funding for the costs related to access to the electricity net
Jpo Fugelsnes	Norway through MFA	2004	214,000 USD	Energy policy and administrative management
Awareness Raising on Sustainable Energy Issues	United Kingdom through DFID	2004	5,000 USD	To influence the GoK, the Parliament, the civil society and the private sector to develop a sustainable policy for energy use in Kenya
Natural Resources	Sweden through SIDA	2004	66,000 USD	Power generation/non-renewable sources
Training Support	Norway through NORAD	2004	32,000 USD	Power generation/renewable sources
No title	Norway through NORAD	2004	214,000 USD	Energy policy and administrative management
Not title	Italy though DGCS	2004	16,000 USD	Technical cooperation for power generation/renewable sources
Olkaria Geothermal Power Plant	Germany through KFW	2004	1.24 million USD	Geothermal energy
Olkaria Geothermal Power Plant	Germany through KFW	2004	9.47 million USD	Geothermal energy
Olkaria II Geothermal Power Plant	Germany through KFW	2004	858,000 USD	Equipment for geothermal power plant
Windenergienutzung Afrika – Dezentrale Energieversorgung und Windparks am Netz'	Germany through BMZ	2004	29,000 USD	Wind power generation
Bonification d'Intérêts Électricité, AF	Belgium through DGCD	2004	292,000 USD	Electrical transmission and distribution
Olkaria Geothermal Power	European Commission though EDF	2004	1.64 million USD	Geothermal energy
No title	Japan through JBIC	2004	1.99 million USD	Hydroelectric power plants
No title	Italy through DGCS	2004	263,000 USD	Pilot plant for using solar energy to favor fishery in Kerio Valley
Tsavo Power Co Ltd.	United Kingdom through CDC	2004	1.69 million USD	Power generation/non-renewable sources
Extension of the Rural Electrification Network	Spain through ICO	2003	779,000 USD	Electrical distribution net for several rural districts
No title	Japan through JBIC	2003	1.596 million USD	Hydr-electric power plants
No title	New Zealand through NZG	2003	11,000 USD	Geothermal energy
No title	Japan through JBIC	2002	7.023 million USD	Hydroelectric power plants

Source: EUEI, as of 2009
 (http://ec.europa.eu/development/policies/9interventionareas/waterenergy/energy/initiative/bkcp/related_project.htm > Projects Database > Choose a beneficiary country > Kenya > Find project)



3.3 MARKET RISKS

Establishing a Business

In order to conduct business in Kenya, a company must be registered with the Registrar of Companies as branch office of an overseas company or a locally incorporated company. Where the investment may have adverse impact on security, health or environment, clearance from the competent authorities (such as National Environment Management Authority (NEMA), Public Health authorities etc.) will be required before approval is granted. Clearance is required from parent ministries for investments in restricted areas before approval can be granted. Investments in energy and petroleum products require clearance from the Ministry of Energy. Apart from that, no specific restrictions apply to energy businesses in Kenya.

Corruption

Kenya ranks number 142 out of 163 in the corruption index of Transparency International. Kenya Bribery Index is pointing out that corruption causes damage to the economy worth 1 billion USD¹⁵.

The GoK is undertaking the following measures to mitigate corruption:

- Zero-tolerance to corruption
- Establishing an anti-corruption police unit
- Emphasizing on the rule of law
- Enhancing transparency in the licensing process through enactment of an Investment Act
- Streamlining Government procurement procedures (Procurement act enacted)
- Enhancing accountability in the judicial system

Protection of Investments

Kenya is a liberalized market in both trade and currency and does not limit the repatriation of business profits. Other aspects of the investment climate include the Foreign Investment Protection Act (FIPA) (Cap. 518). Under FIPA regulations, investors can repatriate the after tax profits including retained profits which have not been capitalized. Investors can also repatriate proceeds of investment after payment of the relevant taxes.

Kenya has concluded agreements with the EU and Germany, Belgium, Switzerland and India among other countries. Other earlier agreements are being revised and/or negotiated. The original agreements were concluded between the African, Caribbean and Pacific States (ACP) under the Lome convention I to IV¹⁶.

The constitution of Kenya provides guarantees against expropriation of private property, which may only be executed for reasons of security or public interest. In this case, a fair and prompt compensation is guaranteed. Kenya is a member of the World Bank or more precisely of the affiliated Multilateral Investment Guarantee Agency (MIGA). MIGA issues guarantees for non-commercial risks to enterprises that invest in member countries. Kenya is also a member of the Interna-

tional Center for Settlement of Investment Disputes (ICSID) and of the African Insurance Agency (ATIA).

Investment risks in Kenya are low given the stability of the economy. This was demonstrated by the speed with which the economy recovered from the post-election stalemate. With vision 2030 driving the economic development, the stability of the Kenyan economy has never been better.

The Kenya Intellectual Property Organization polices and regulates intellectual property.

Awareness and Security

Kenya is a cosmopolitan society where diverse cultures and nationalities do business together across the country. In fact, Kenya as an entrepreneur society has a high awareness for international business and investment opportunities and is sometimes said to be too welcoming to foreigners.

The security situation in Kenya is satisfactory and not worse than in many parts of the world. Adequate health facilities of international standards are available, particularly in urban areas. High-quality education for investors relocating to Kenya is available for their families with overseas curriculums available in most of the international schools. Adequate transport and communication channels by air, road, sea, post and telecommunications are available to any destination in the world.

Staff

Investors must acquire class H work permits for directors and class A work permits for expatriate employees. Entry into Kenya will require visitors to obtain either business visa or visitors' visas. Expatriate professionals, engineers or technicians who are required to install machineries or train local employees for a short period of time are issued with special passes. Local RE experts are available, but limited, while trained engineers and technicians are readily available. More than four technical universities are established in the country offering sufficient scope for cooperation and research.

Minimum wages defined by the Government depend on skills. Workers are allowed to join trade unions related to their sectors of work and receive wages negotiated through tripartite agreements (between trade unions, Government and employers.) Labor disputes are settled through the industrial court.

Kenya has a well-developed professional services sector with a number of multinational professional companies operating regional offices in Nairobi. Most major insurance companies, banks and other private sector-related institutions have a presence in Kenya.

15 TI, KENYA, AS OF 2009

16 FOR FURTHER INFORMATION SEE EU AID: ACP - LOME CONVENTION, AS OF 2009. THE REVISIONS AND NEGOTIATIONS CAN BE FOUND AT ACP, AS OF 2000.



4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

With the exception of biomass, which is largely consumed in its raw form, the utilization of RE in Kenya in contrast to its potential is extremely low. Commercial RE is dominated by large hydro and geothermal power, which also constitutes the largest percentage of grid-connected power at 58 % and 13 % respectively. The geothermal potential in Kenya is the biggest in the EAC.

Solar PV is, however, the most widely used off-grid source of RE and provides electricity especially to rural households. About 2.2% or 200,000 mainly off-grid households in Kenya use solar PV for lighting. A total capacity of 4 MW is installed with an average system size of 25 Wp. While more than 500,000 small PV systems have been sold, a large number of these are replacements for faulty a-Si PV modules and batteries. Small and Micro Enterprise (SME) private sector businesses dominate the RE sector.

4.1 BIOMASS/BIOGAS

Despite heavy reliance on biomass, especially on firewood and charcoal, minimal planning and regulatory measures have been put in place by the Government. For example, even though the production of charcoal so far remains illegal while the consumption is legal, the 'illegal' trade is estimated to have a turnover of 320 million € annually¹⁷.

Traditional biomass energy supplies come from four distinct sources: natural vegetation (closed forests, woodlands and bush-lands), trees on farms, plantations and residues from crops and industrial wood. Firewood and residues are consumed largely for household cooking at or near source. The total sustainable biomass supply from all sources is estimated at 15 million tons with approximately 21 % from natural vegetation, 60 % from farms, 5 % from plantations and 14 % from crop and wood residues.

Industries requiring thermal energy have on their own initiative as demonstrated by the use of raw biomass for energy provision in their operations. Examples include tea, clay works, cement, edible oils and some small-scale furnace operators. Industrial solid biomass provides the largest opportunity for investment in the biomass sector.

At the Kilifi Plantations, a pilot installation for biogas production was installed by the German company agriKomp in cooperation with GTZ as part of a cooperation project under the Private-Public Partnership (PPP) program of German Development Cooperation¹⁸. Two cogeneration plants with total 160 kW are fed with animal dung and sisal. The electricity and heat is supplied to a nearby milk farm. GTZ also worked on PPP base with a slaughterhouse in Kiserian Nairobi to install a 20 kW biogas digester.

Cogeneration

An estimated 43 MW of electricity cogeneration is currently installed in the five sugar factories operating across Kenya. Development of a 35 MW sugar bagasse cogeneration project by Mumias Sugar is ongoing as a CDM project.

A further potential of 340 MW of sugar bagasse cogeneration is estimated at the state corporations of Chemelil, Sony Sugar, Nzoia and Muhoroni. These companies are expected to be privatized by the Government within the next two years. This proves an opportunity for private investment by local and international players in the cogeneration business.



SHORT BUSINESS INFO

- Most of biomass products are sold in the informal sector
- Cogeneration of bagasse has a potential of 340 MW in four state-owned sugar factories which are going to be privatized

Various jatropha plantation initiatives are ongoing with an estimated cultivation area of over 4,000 hectares. The biggest groups involved are Better Globe Forestry, an international commercial forestry developer, and Green Africa, a local Non-Governmental Organization (NGO). The Kenyan component of the Africa Biogas Initiative financed by the Dutch Ministry of Foreign Affairs (DGIS) targets at 10,000 domestic biogas digesters (4–16 m³) over the next 10 years. The Africa-wide project targets 2 million digesters in Africa. The Ministry of Energy invites bids from local companies and joint ventures to provide the development and installation services.

Biofuels

The development of biofuels in Kenya is currently hampered by lack of policy framework. Measurements have, however, been taken to develop a comprehensive biodiesel strategy and a draft has been developed, which is awaiting cabinet approval. The initiative is coordinated by the Ministry of Energy through a National Biofuels Committee that incorporates stakeholders from all relevant Government ministries as well as civil society and private sector players. In addition, GTZ has completed and released a study on biofuels potentials and risks in Kenya in cooperation with the Kenyan Ministry of Agriculture in 2008¹⁹. Much research, however, still needs to be done on the sub-sector as information is still inadequate.

4.2 SOLAR ENERGY

Kenya has relatively high insolation rates with an average of 5 peak sunshine hours in the most of the country. However, areas in the highlands are affected by cloud cover with significant variations in radiation²⁰. The most widely used applications for solar energy in Kenya are small domestic PV systems.

The installed PV capacity is estimated at more than 4 MW, mainly delivered by small PV systems of 14–120 Wp. An estimated 120,000 rural households use small Solar Home Systems (SHS). Larger PV systems for telecommunications and health institutions of typically 2–5 kW are also to be

17 DATA COMPILED BY THE AUTHOR FROM DIFFERENT SOURCES AND OWN RESEARCH

18 FOR MORE INFORMATION ON THE GERMAN DEVELOPMENT COOPERATION PPP PROGRAM (DEVELOPPP) AND GTZ SERVICES IN THIS FIELD SEE WWW.GTZ.DE/EN/LEISTUNGSANGEBOTE/2362.HTM.

19 GTZ/GOVERNMENT OF KENYA, AS OF 2008

20 UNEP, AS OF 2008



found in remote locations across the country. Around 50 PV installations for schools and health institutions with an average power of 400 Wp were installed in 2007 in arid and semi-arid areas through grants from the GoK as part of the Arid Lands Development Program.

The Kenyan solar energy market is a fairly well developed and mature commercial market. The existing companies sell systems to homeowners and institutions. In some cases, institutional systems were financed by donor programs. Financing is either in cash or through microfinance or savings and credit groups.

SHORT BUSINESS INFO

- 4 MWp installed capacity with an average system size of 25 Wp
- No financial support scheme available
- Retailer network for cash sale of PV is well established in a well developed commercial market
- Around 20 solar companies, mainly based in Nairobi

4.3 WIND POWER

Use of wind turbines and wind pumps in Kenya is marginal. The current installed capacity of wind turbines is 750 kW, 150 kW of which are small isolated wind turbines and 600 kW of medium size grid connected wind turbines. Two of them are located at the Ngong Hills and one is in Marsabit operated by the Kenya Power and Lighting Company on behalf of the Ministry of Energy. These turbines were installed in 1982 by the Ministry with funding from the Belgian Government under a pilot scheme to study the wind resource potential for the two possible areas. With the company that produced these turbines going under in the mid 2000s, lack of spare parts and technical support has led to only one turbine at NGong being still operational.

The Marsabit district located in the North of Kenya offers the best wind regime with more than 10.0 m/s. The project development in this district is constrained due to inaccessibility to the national grid. This, however, will change once the planned grid interconnection with Ethiopia is in operation.

The GVEP/UNDP Energy Atlas²¹ points out about 10–13 good sites with wind speeds of above 7 m/s with a total potential of 100 MW. A wind resource assessment and mapping was completed in 2008 under the SWERA project of UNEP²². Current developments include the following:

- A feasibility study being undertaken for the Turkana Wind project in West Marsabit by a Dutch Consortium
- The development of a 40 MW wind farm at the Ngong Hills by the Kenyan Investment Promotion Centre (IPC) and a 30 MW wind farm at Kinangop by KenGen
- A planned feasibility for the development of wind farms in Lamu and Mpeketoni²³

An estimated 100 small wind turbines (with an average ca-

capacity of 400 W) have been installed to date, often as part of a PV/wind hybrid system with battery storage. Wind pumps are more common than wind turbines. Two local companies manufacture and install wind pumps. To date, wind pumps installations range about 300–350.

SHORT BUSINESS INFO

- No reliable data for wind potential mapping available
- Marsabit district with the highest potential, but no grid available
- 40 MW Wind farm at Ngong Hills and 30 MW wind farm at Kinangop under construction
- Around 100 small wind turbines (400 W) in operation
- Accessibility to the national grid in Northern Kenya will be improved when planned grid interconnection with Ethiopia is in operation

4.4 GEOTHERMAL POWER

Given the high cost of geothermal exploration, the Government has set up a Geothermal Development Company (GDC) to quickly track the prospecting and drilling of geothermal wells for development by private sector investors. Investment in the country's geothermal resources as major source for electricity generation should inject a much-needed element of stability and diversification into the generation mix.

Currently, only 128 MW of an estimated geothermal potential of over 2,000 MW has been developed, accounting for about 10% of the total installed grid connected capacity. KenGen owns 115 MW of this capacity while the company Or Power owns 13 MW. These plants are located in the Olkaria geothermal field (in the South of the country) and produce on average 989 GWh annually²⁴.

KenGen is building a third unit at its Olkaria II geothermal power station. The plant is located about 100 km North West of Nairobi²⁵. It taps the geothermal field in Kenya's Rift Valley. The 35 MW turnkey expansion is being built by Mitsubishi Heavy Industries (MHI) and should go on-stream by the end of 2009. It will cost around 100 million USD.

The GoK plans to spend about 5 million € to drill geothermal power wells in the Menengai crater. The geothermal energy potential of this area is estimated at about 740 MW. The area covers about 29 by 30 km² and extends from Nakuru town in the South to Kisanana in the North. The main objective is to prove availability of geothermal steam for construction of a 140 MW Menengai geothermal power plant. It is planned to be commissioned in 2013 and will provide 15% of the country's total installed electrical capacity.

4.5 HYDRO POWER

The economical viable potential for large-scale hydro power is estimated at 1,500 MW of which, according to a technical feasibility study, 1,310 MW is for projects with a 30 MW capacity or bigger. Of these, only 677 MW have so far been developed²⁶ comprising the following stations:



21 SEE GVEP/UNDP, 2005, P 29 F.

22 SEE ALSO UNEP, 2008

23 UNEP, AS OF 2008

24 EMERGING AFRICA, AS OF 2009

25 SEE ALSO AFREPREN/GTZ, AS OF 2007

26 GVEP/UNDP, AS OF 2005



- Seven Forks Hydro Stations have an installed capacity of 543 MW. They are situated along the lower part of the Tana River and comprise Masinga Power Station, Kamburu Power Station, Gitaru Power Station, Kindaruma Power Station and Kiambere Power Station.
- Masinga Power Station has an installed capacity of 40 MW.
- Kamburu Power Station has an installed capacity of 94.2 MW.
- Gitaru Power Station has an installed capacity of 225 MW.

The hydro power project of Sondu Miriu (60 MW) has been completed, but has not been commissioned yet due to low water levels. The development of the 20 MW Sangoro power project (also on the Sondu Miriu River) is ongoing. Both projects are threatened by the destruction of the Mau Forest, which is the main catchment zone of the Sondu Miriu River. Three other hydro power projects have been identified as feasible for development within the next 15 years. These are Ewaso Ngiro South (220 MW), Mutonga (60 MW) and Low Grand Falls (70 MW).

Micro Hydro Power

The potential for small hydro is estimated at 3,000 MW countrywide. The actual capacity available is, however, declining due to depletion of forests in key water catchment areas and the changing climate. While small hydro schemes are economically feasible for off-grid electrification, only a few have been developed mainly by private individuals and community groups. Small hydro remains largely underdeveloped with less than 15 MW connected to the grid²⁷.

Over the past 3–4 years, 60 pico and micro hydro systems have been installed in the region of Mt. Kenya. This is driven mainly by availability of technical know-how and equipment following a pilot project in the area implemented

by the NGO of Practical Action through a community micro hydro scheme. Other sector players are involved in implementing small hydro projects in central Kenya including Clean Air Kenya and Greenpower Ltd.

The systems vary between 1–100 kW, the specific costs are around 4,000–6,000 USD/kW for pico systems and 3,500 USD/kW for micro systems. Systems are owned by local communities, which form associations or companies that own and operate them. The communities through their associations fully finance the systems and work with private sector developers to realize the projects. Two of the largest developers and suppliers are Q-Energy Ltd. and Numerical Machines (K) Ltd. Households pay a standard monthly charge of 60–100 KES to cover maintenance and additionally contribute to the installation costs.

There is a remarkable scope for small, micro and pico hydro in all the drainage basins across Kenya. Independent SME and the NGO Practical Action (formerly Intermediate Technology Development Group – ITDG) as well as other international NGOs have completed over 35 projects (2 MW in total).

Major barriers to development include limited local capacity to develop schemes as well as capacity for local production of turbines. This offers business opportunities for foreign producers.



SHORT BUSINESS INFO

- Large-scale hydro potential: only 677 MW out of 1,300 MW exploited
- Small-scale hydro potential estimated at 3,000 MW
- Micro and pico hydro market around Mt. Kenya

The table below summarizes the financing opportunities and investment potential for RE in Kenya.

TABLE 6
Economic Potential for RE Investments in Kenya

RENEWABLE RESOURCE	ECONOMIC POTENTIAL	BUSINESS OPPORTUNITY	INVOLVED AND INTERESTED PROJECT FINANCIERS
Large hydro	1,400 MWe	Not attractive as most of the remaining sites are outside the economic merit	Very few
Small hydro	1,000 MWe	Attractive for off-grid power generation, especially targeting the tea industry and households, mechanical application also possible	Local and international RE development financing (IFC, KfW, AfDB, TRIODOS, GROFIN, K-REP, Equity, EADB etc.)
Geothermal	> 2,000 MWe	Investment open to IPPs and other thermal applications once prospecting is complete and wells drilled	International financing (IFC, AfDB, EDB)
Wind	> 500 MWe	Mapping shows high potential for grid-connected wind, mechanical use in water pumping demonstrated	International financing (IFC, AfDB, EDB)
Cogeneration	360 MWe	Availability of bagasse, demand for steam and connectivity of plants to grid network	International financing (IFC, AfDB, EDB)
PV and solar thermal	Not quantified	Large off-grid market, mainly liberalized with high customer awareness	Local bank finance (Equity, GROFIN, K-REP etc.)
Biomass	Not quantified	Demand for cleaner and cost-effective thermal energy for industrial fuel switch	International and local finance, potential for CDM

Source: table compiled by the author, as of 2009



5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

The overview names only potential partners for international business contacts. Besides these, there are numerous other smaller companies involved in retail and installation of small RE systems across Kenya.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

COMPANY	CONTACT ADDRESS	PRODUCTS AND SERVICES
Chloride Solar	Dunga Rd., Industrial Area P.O. Box: 20553 00200 Nairobi – Kenya Phone:+ 254 20 553322 Fax: +254 20 547865 Website: www.chlorideoxide.com	Design, supply, installation, repair and maintenance of automotive batteries, solar systems, wind generators, power backup systems and solar water heating
Kenital Solar Ltd.	Off Ngong Rd. P.O. Box 19764 00202 Nairobi – Kenya Phone: +254 20 2715960 Fax: +254 20 27145514 Website: www.kenital.com	Design, supply, installation, repair and maintenance of hybrid solutions, power backup, solar hot water systems, solar lighting kits, solar street lighting, water pumping, wind energy solutions
Davis and Shirtliff Ltd.	Dundori Rd. P.O. Box 41762 00100 Nairobi – Kenya Phone: +254 20 6968 000, 558 335 d&s@dayliff.com Website: www.dayliff.com	Design, supply, installation, repair and maintenance of pumps, swimming pools, water treatment, water supply equipment, solar equipment
Sollatek Electronics Kenya Ltd.	Bamburi Off Malindi Rd. P.O. Box 34246 80118 Mombasa – Kenya Phone: +254 41 5486250/1/2/3 Fax: +254 41 5486259 sales@sollatek.co.ke Website: www.sollatek.co.ke	Supply, installation, repair and maintenance of power control, wind and solar equipment
PHONEESALES Solar	Bruce House, Kaunda Str. P.O. Box 45525, Nairobi – Kenya Phone: +254 22 13143/336027 Fax: +254 2 745 655 Phonesales@insightkenya.com	Retail sales, wholesale supplier of PV systems and components, solar water pumping systems, wind energy systems (small), emergency power back-up systems, rural communications and energy systems, energy efficient cookers, refrigerators and freezers, consulting, installation and project development services, site survey and assessment services, maintenance and repair services
Chardust	Langata Hardy P.O. Box 24371 Karen, 00502 Nairobi – Kenya Phone: +254 020 270 0316, 353 89957, 350 5576 Website: www.chardust.com	Consultancy services on the salvage, recovery and conversion of charcoal waste to fuel briquettes including installation of machinery and training of operators
Bob Harries Engineering Limited – Kijito Wind Pump	Karamaini Estate P.O. Box 40 01000 Thika – Kenya Phone: + 254 733723401 Contact: Mike Harries revcap@africanonline.co.ke	Manufacture, installation, repair and maintenance of Kijito wind pumps
Winafrique Technologies	3rd Floor Soin Arcade, Westlands P.O. Box 73193 00200 Nairobi – Kenya Phone: +254 2 4453898/949 Fax: +254 2 4453988 info@winafrique.com Website: www.winafrique.com	Design, supply, installation, repair and maintenance of hybrid remote alternative power systems, wind power solutions, solar power solutions, water pumping solutions, power enhancing solutions and energy storage systems
ASP Ltd.	Old Airport Road Nairobi P.O. Box 556038 Nairobi – Kenya Phone: +254 20 823901, 823411/6 Fax: +254 29 823905/10 asp@Net2000ke.com	Manufacture, distribution and installation of pipes, penstocks, solar water heaters and PV equipment
CAT Center for Alternative Technologies	Jos Hansen & Soehne Building Baba Dogo Road P.O. Box 64921 Nairobi – Kenya Phone: +254 20 8562034/-8561253 Fax: +254 20 8562310 info@cat.co.ke	Wholesale distributors and system integrators of RE specializing in the sale of power backup solutions, wind electric turbines and equipment, DC energy efficient appliances, solar & wind powered water pumping solutions, solar water heating, solar pool water heating and filtration
Solar World EA Ltd.	P.O. Box 78516-00507, Ring Road Parklands and General Mathenge Rd. Junction, Westlands Nairobi – Kenya Phone: +254 20 3599699 Fax: +254 20 3751998 Website: www.solarworldea.com	Retail sales, wholesale supplier of solar electric power systems, backup power systems and batteries lead acid deep-cycle, solar water heating components, PV module components, LED lighting, solar torches, solar lanterns, solar caps, radios, solar mobile chargers, wind turbines, consulting, design, installation, engineering, contractor services, maintenance and repair services



COMPANY	CONTACT ADDRESS	PRODUCTS AND SERVICES
Adept Pacesetters Ltd.	Cargen Hse, Harambee Ave. P.O. Box 55672 00200 Nairobi – Kenya Phone: +254 20 315117/-315116	Wholesale supplier, exporter, importer of solar electric power systems, wind energy system components (small), wind energy systems (large), air cooling systems, solar water heating systems, air heating systems
Dial A Battery	P.O. Box 27517– 00506 Nairobi – Kenya Phone: +254 20 550715/ –20 6750692/+254 725 775555 Fax: +254 20 530413	Retail sales of automotive starting batteries, emergency backup batteries, deep cycle batteries, battery chargers, DC to AC power inverters and solar lighting systems
Digi Communication Systems Ltd.	P.O. Box 56366 –00200 Nairobi – Kenya Phone: +254 20 609240 Mobile: +254 73 3604668 Fax: +254 20 604216	Retail sales, wholesale supplier, importer of solar water heating systems, solar water heating components, water heating systems, PV systems, VHF & HF Radio Networks, consulting, design, installation, engineering, maintenance and repair services
Renewable Energy Engineering Contractors (REECON)	Ngara Rd. 00600 P.O. Box 31620 Nairobi – Kenya Phone: +254 20 3752136 Fax: +254 20 3751201 Mobile: +254 722 306276 rencon@clubinternetk.com	Wood burning stoves and furnaces, biomass energy systems, composting systems, energy efficient homes and buildings, hydro energy system components (small), solar cooking systems, biogas plant, waste water, incineration, energy efficiency
CAMCO (formerly Energy for Sustainable Development Africa)	Muringa off Elgeyo Marakwet Rd. P.O. Box 76406 – 00508 Nairobi – Kenya Phone: +254 20 37851 Website: www.esd.co.uk	RE Consulting, project development, management and evaluation, carbon asset development



5.2 LOCAL INSTITUTIONS RELATED RENEWABLE ENERGY BUSINESS

INSTITUTION	CONTACT ADDRESS	ROLE	SERVICES
Petroleum Institute of East Africa	Bruce House 4th Floor Standard Street P.O. Box 8936 – 00200 Nairobi – Kenya Phone: +254 20 249081 Fax: +254 20 313048 Website: www.petroleum.co.ke/	Provides a forum for expertise and excellence in the oil industry in the East African region with the aim of promoting professionalism and free enterprise in petroleum business supported by the highest business and operating standards, adherence to environment, health and safety ideals	Development of petroleum standards, capacity building and policy, creation of public and consumer awareness on basic environment, health and safety issues touching on handling and use of petroleum products
Ministry of Energy	22-24 Floor Nyayo House, off Uhuru Highway P.O. Box 30334 – 00100 Nairobi – Kenya Phone: +254 20 310112 Fax: +254 334567 Website: www.energy.go.ke	Planning and management of national energy demand and supply to ensure adequate, qualitative, cost effective and affordable supply of energy to meet development needs, while protecting and conserving the environment	Energy policy and energy sector development
Kenya Industrial Research and Development Institute	Dunga/Lusaka Road P.O. Box 30650 Nairobi – Kenya Phone: +254 20 535966/84/90 Fax : +254 20 555738 Website: www.kirdi.go.ke	Enhances the national industrial technology innovation process as a strategy towards rapid socio-economic development, facilitates access by local enterprises to business development services, including cleaner production and industrial information	R&D and consultancy
Kenya Bureau of Standards (KEBS)	Kapiti Road, Off Mombasa Road P.O. Box 00200 – 54974 Nairobi – Kenya Phone: +254 20 605506 Fax: +254 20 604031 Website: www.kebs.org	Ensures that no technical barriers to trade are created while providing services in standardization and conformity assessment	Trade facilitation services in metrology, standards, testing and quality management (MSTQ) including the WTO/TBT National Enquiry Point, certification and accreditation
National Environmental Management Authority (NEMA)	Kapiti Road off Mombasa Road P.O. Box 30839 – 00200 Nairobi – Kenya Phone: +254 20 605522 Fax: +254 20 608997 Website: www.nema.go.ke	Exercising general supervision and coordination over all matters relating to the environment and to be the principal instrument of Government in implementing all policies related to the environment	Coordination, research, facilitation and enforcement
Energy Regulatory Commission	Integrity Centre 1st floor, Valley RD P.O. Box 42681 – 00100 Nairobi – Kenya Phone: +254 20 2717627 Fax: +254 20 2717603 Website: www.erb.go.ke/	Economic and technical regulation of power, RE and downstream petroleum sub-sectors	Setting, review and adjustment of tariffs, licensing, approval of power purchase and network service contracts, enforcement of environmental and safety regulations in the power sub-sector, complaint investigation and dispute settlement
Practical Action (ITDG)	Practical Action East Africa AAYMCA Building P.O. Box 39493 Nairobi – Kenya Phone: +254 20 2719313 Fax: +254 20 2710083 Website: www.practicalaction.org	Support of poor communities to help them choose and use technology to improve their lives for today and generations to come	Campaigning, technical information service, education, consultancy and publishing
Jomo Kenyatta University of Agriculture and Technology (JKUCAT) – Institute for Energy and Environmental Technology (I.E.E.T)	Juja–Main Campus P.O. Box 62000–00200 Nairobi – Kenya Phone: + 254 06752711 Fax: + 254 0672164 Website: www.jkuat.ac.ke/	Research and training on energy and environmental technologies with emphasis on transfer of technology for efficient energy use	Consultancy services, waste treatment, environmental impact assessment and environmental and energy audit as well as biogas technology, research activities on development of biofuels/ biodiesel, biomass biogas, small hydro power
Nairobi University	Off Harry Thuku Road P.O. Box 30197 – 00100 Nairobi – Kenya Phone: + 254 (020) 318262 Ext. 28483 Fax: + 254 (020) 245566 inst@uonbi.ac.ke Website: www.uonbi.ac.ke	Development of knowledge in nuclear sciences and technology and their application for enhancement of life in our society	RE research and training as well as consultancy services
Kenyatta University –Department of Environmental Services	P.O. Box 43844–00100 Nairobi – Kenya Phone: +254 20 810901–19 Fax: +254 20 811575 info@ku.ac.ke Website: www.ku.ac.ke/	Study of the environment, incorporating its structure and functioning in order to better evaluate the impacts of human activities on surrounding ecosystems	Training and research related to energy and environmental topics
United Nations Environmental Program (UNEP) – Division of Global Environment Facility Coordination (DGEF)	UNEP/Division of GEF Coordination P.O. Box 30552 Nairobi 00100, Kenya Phone: +254 20 7623424 Fax: +254 20 7624041 Website: www.dgef.unep.org/	Catalyzing of the development of scientific and technical analysis and advancing environmental management in GEF-financed activities	Guidance on relating the GEF-financed activities to global, regional and national environmental assessments, policy frameworks and plans, and to international environmental agreements
AFREPREN/FWD	House, Elgeyo Marakwet Close P.O. Box 30979 GPO 00100 Nairobi – Kenya Phone: +254 20 3866032 Fax: +254 20 3861464 Website: www.afrepren.org		Registered NGO with vast expertise on energy in East and Southern Africa and some experience in West and North Africa, brings together over 300 African energy researchers and policy makers from Africa with long-term interest in energy research and the respective policy-making process



INSTITUTION	CONTACT ADDRESS	ROLE	SERVICES
Institute of Research in Sustainable Energy and Development (IRSEAD)	David Yuko, Executive Director Kabarnet Road P. O. Box 3576-00100 Nairobi – Kenya Phone: +254 722 846260 Fax: +254 20 3870938 irsead@yahoo.com, David.yuko@reep.org		
Climate Network Africa	Wood Avenue, Kilimani, P. O. Box 76479 00508 Nairobi – Kenya Phone: +254 20 3864040 Fax: +254 20 3873737 cnaf@cnaf.or.ke, gakumu@yahoo.com Website: www.cnaf.or.ke		Tackle climate change, desertification, biodiversity loss, ozone depletion, energy, poverty and other environmental and development issues affecting the communities in which it operates
Environment Liaison Centre International (ELCI)	Environment Liaison Center International Kasarani Road P. O. Box 72461-00200 Nairobi – Kenya Phone: +254 20 8566172/3/4 Fax: +254 20 8566175 info@elci.org Website: www.elci.org		Global coalition of more than 800 NGOs working on issues of environment and sustainable development in more than 80 countries
International Finance Corporation (IFC)	IFC Kenya, Hill Park Building Upper Hill Road Phone: +254 20 322-6340/400 Fax: +254 20 322-6383 Website: www.ifc.org/	Promote open and competitive markets in developing countries, support companies and other private sector partners, generate productive jobs and deliver basic services, create opportunity for people to escape poverty and improve their lives	Project finance: financial products and services that enable companies to manage risk and broaden their access to foreign and domestic capital markets; Advisory services: advisory services in support of private sector development in developing countries
United nations Industrial Development Organization (UNIDO)	UNIDO Office Kenya P. O. Box 41609, United Nations Avenue, Gigiri, Block Q, Room 118 Nairobi – Kenya Phone: +254 20 7624369 Fax: +254 20 7624368 office.kenya@unido.org Website: www.unido.org/	Mobilizes knowledge, skills, information and technology to promote productive employment, a competitive economy and a sound environment	De-linking intensity of energy use from economic growth, reducing the environmental damage that occurs with energy use
The K-Rep Group	K-Rep Bank Limited Naivasha Road P. O. Box 25363-00603 Lavington, Nairobi – Kenya Phone: +254 20 3873229 Fax: +254 20 3873178 Website: www.k-rep.org	Development of appropriate microfinance products and services to create economic opportunities for low income people and contribute to eliminating poverty	Developing, testing and promoting the adoption of appropriate microfinance models for improving the accessibility of financial services to people with low incomes
GROFIN	CIC Plaza Mara Rd, Upper Hill P. O. Box 19447 KNH 00202 Nairobi – Kenya Phone +254 20 273 0280 Fax: +254 20 273 0279 info.kenya@grofin.com Website: grofin.com/	Business development and finance company focused on providing business support and risk capital to small- and medium-sized enterprises in emerging markets underserved by traditional sources of capital	Advisory, financing and project development
Commissioner of Customs (at the Kenya Revenue Authority)	Times Tower, P.O. Box 40160 00100 Nairobi – Kenya Phone: + 254 20 310900, 2810000 Fax: + 254 20 316872 Email: cic@kra.go.ke Website: www.kra.go.ke		



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- Better Globe Group (www.betterglobegroup.com)
- Kenya Revenue Authority (www.kra.go.ke)
- Transparency International – TR, Kenya (www.tikenya.org/)



7 ANNEX

7.1 COUNTRY MAP



The boundaries and names of these places do not imply any official endorsement or acceptance by the United Nations

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Source: Depha, as of 2009



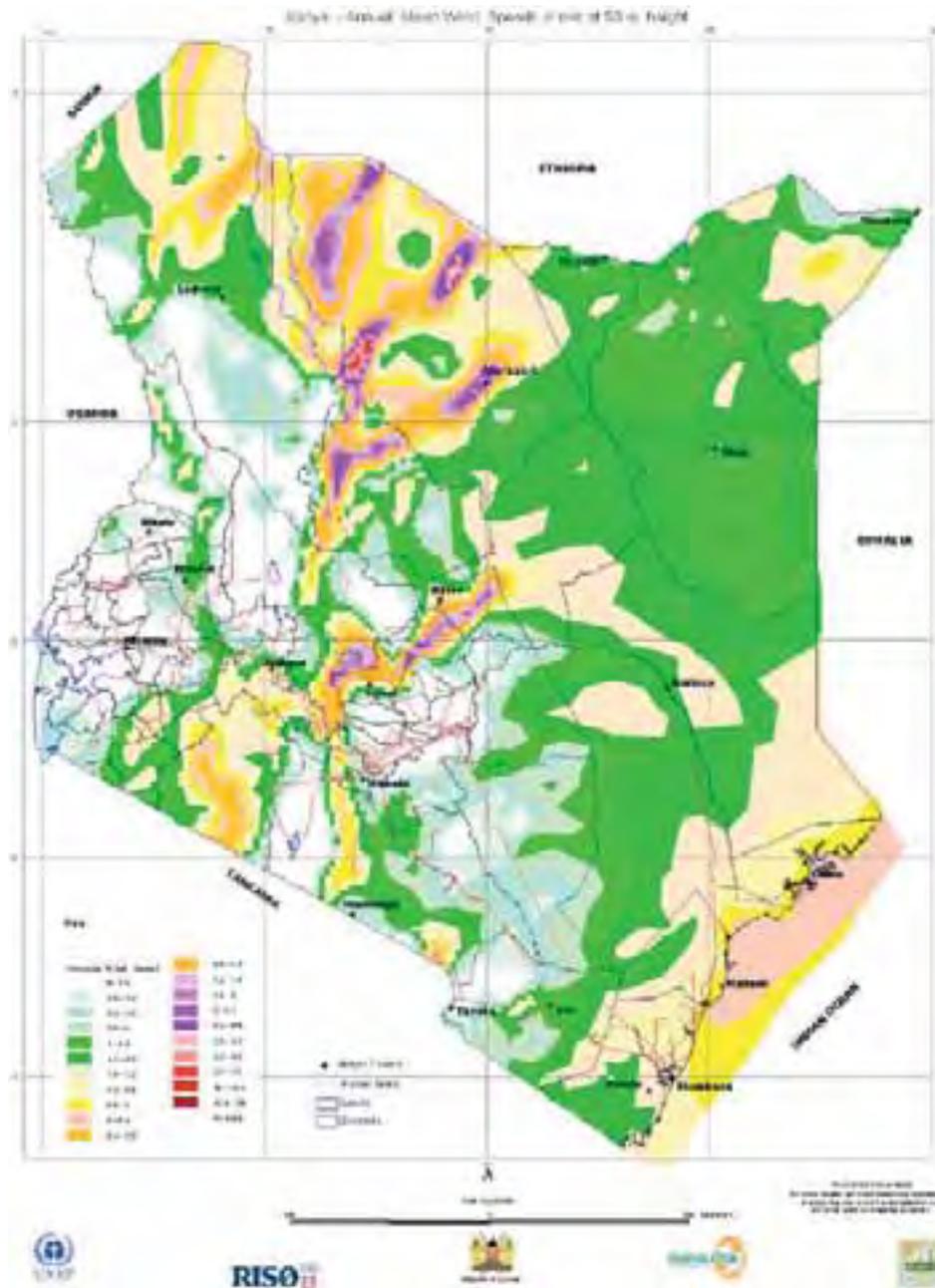
7.2 MAP OF THE NATIONAL GRID SYSTEM



Source: unknown



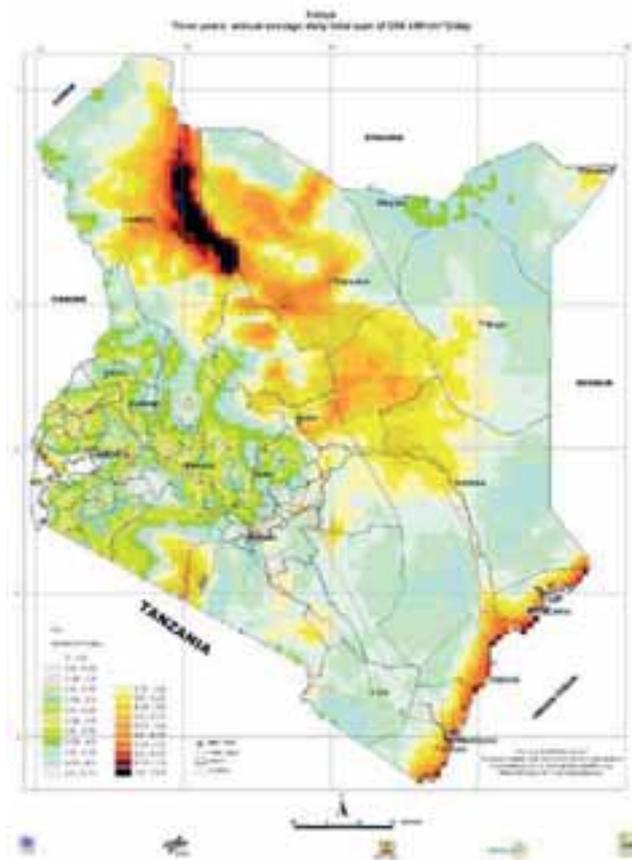
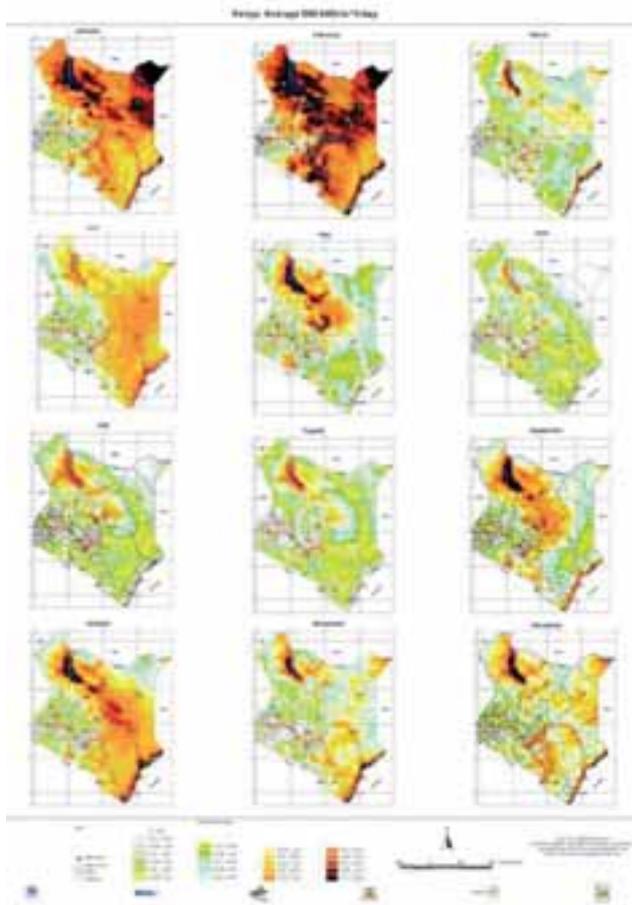
7.3 MAP OF WIND ENERGY SOURCES IN KENYA



Source: UNEP, as of 2008



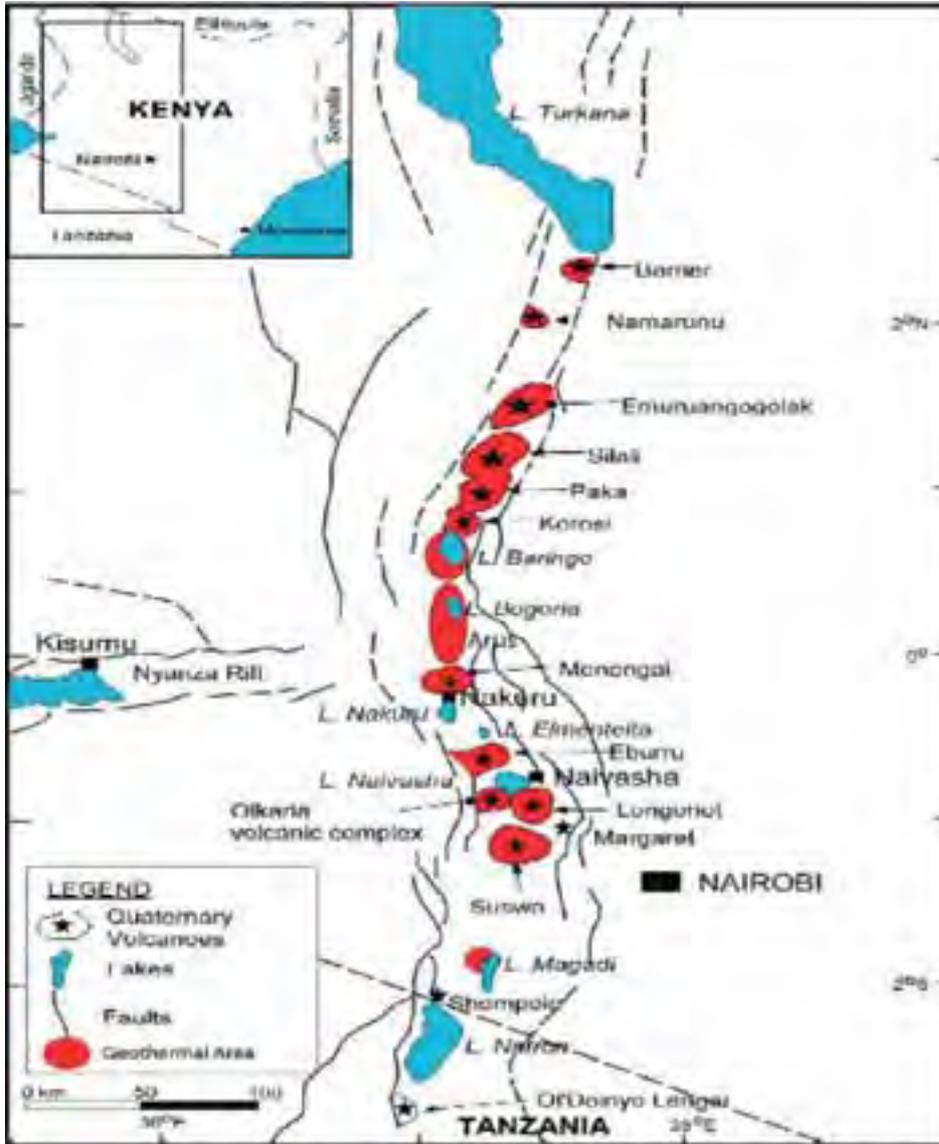
7.4 SOLAR RADIATION OF KENYA



Source: UNEP, as of 2008



7.6 MAP OF GEOTHERMAL SOURCES IN KENYA



Source: Meseret Teklemariam, as of 2006



7.7 ONGOING POWER SECTOR DEVELOPMENT PROJECTS

PROJECT AND TIME FRAME	DESCRIPTION	FINANCIER	CONTACT
Rural Electrification Program (various) Grid Extension ongoing	Extension of the national grid primarily to trading centers for water supplies to schools and health facilities	Governments of Kenya, France and Spain	REA
Rural Electrification Master Plan 2004–2008	Upgrading the national rural electrification master plan	Government of Finland	Ministry of Energy
Geothermal Resource Appraisal 2004–2008	Assessment of the readily available steam resources for power generation up to 2028	Governments of Kenya and China	Ministry of Energy and KenGen
KenGen Geothermal Olkaria Power Plant 2006–2009	Installation and commissioning of a 35 MW grid-connected geothermal plant	World Bank	KenGen
Or Power Geothermal Olkaria Power Plant 2006–2009	Installation and commissioning of a 35 MW grid-connected geothermal plant		Or Power Inc
KenGen Wind Kinangop 2006–2009	Development of a grid-connected 20 MW wind farm	World Bank	Ministry of Energy
Coal Resource Appraisal Drilling 2007–2009	Prospecting for coal deposits in Mwingi district for economic exploitation	Government of Kenya	Ministry of Energy
Energy Sector Recovery Program 2004–2008	Grid system upgrade, rehabilitation and reinforcement	World Bank	Ministry of Energy
Mumias Sugar Bagasse Cogeneration 2006–2009	Development and installation of grid connected 35 MW bagasse cogeneration plant	Mumias Sugar, Japan Carbon Finance	Mumias Sugar

Source: data compiled by the author

7.8 SHARE OF ENERGY SOURCE IN TOTAL POWER GENERATION

SOURCE	CAPACITY IN MW	% OF TOTAL CAPACITY
Hydro (including imports)	697.2	57.340
Geothermal	128.0	10.530
Oil thermal generation	133.5	10.980
IPPs (thermal)	174.0	14.310
Gas turbine	73.5	6.050
Wind	0.4	0.033
Isolated diesel plants	9.2	0.760
Total	1,215.8	100

Source: KNBS, as of 2007

7.9 POWER CONSUMPTION BY INDUSTRY SECTORS

	2002	2003	2004	2005	2006	2007
Demand	GWh	GWh	GWh	GWh	GWh	GWh
Domestic and small commercial	1,262.9	1,325.5	1,416.6	1,507.7	1,572.4	1,741.8
Large commercial and industrial	2,277.9	2,368.8	2,587.00	2,753.5	2,919.8	3,140.6
Off-peak	60.5	55.6	66.8	52.9	44.8	49.2
Street lighting	6.4	7.0	7.2	8.5	10	12.2
Rural electrification	134.3	153.2	156.5	175.8	205.6	212.8
Total	3,742	3,807.2	4,234.1	4,498.4	4,752.4	5,156.6
Transmission losses and unallocated demand	943.6	855.1	960.3	1,024.2	1,095.8	1,109.7
Total demand = total supply	4,685.6	4,662.3	5,194.5	5,547	5,894.9	6,324.6
Imports of that from Uganda	238.4	189.4	161.9	27.9	10.8	22.6
Net generation	4,447.2	4,472.9	5,032.6	5,519.1	5,884.1	6,302

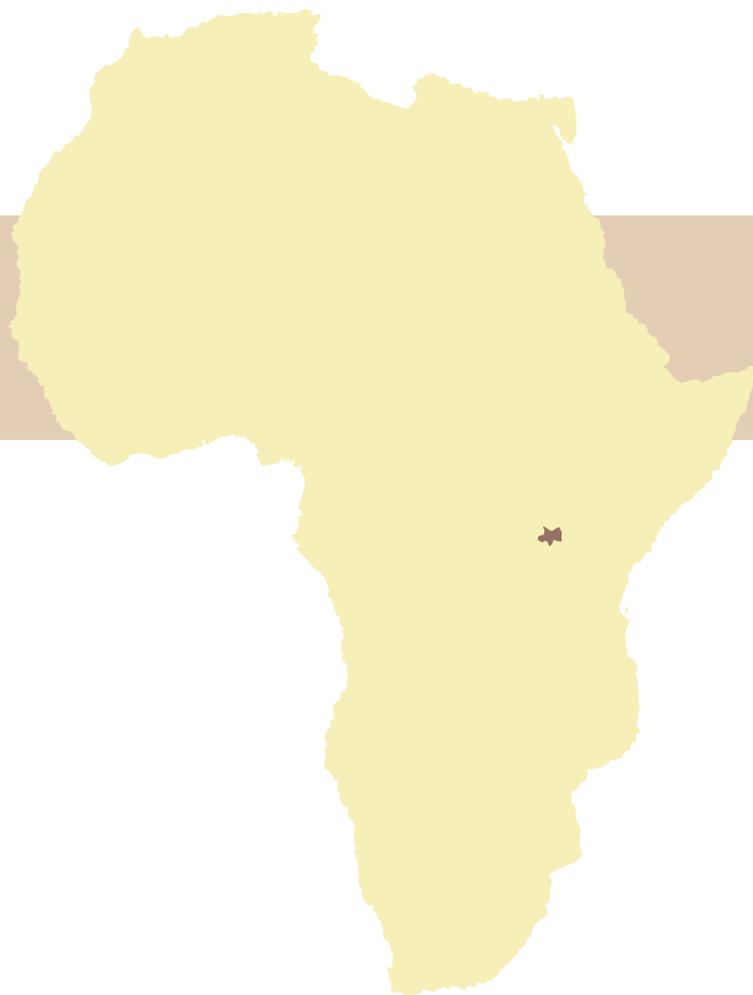
Source: Data compiled by the author from different sources; see also GVEP/UNDP, as of 2005



7.10 POWER TARIFFS FOR PRIVATE AND INDUSTRIAL USERS

TARIFF	TYPE OF CUSTOMER	SUPPLY VOLTAGE (V)	CONSUMPTION (kWh/MONTH)	FIXED CHARGE (KES/MONTH)	ENERGY CHARGE (KES/kWh)	DEMAND CHARGE (KES/kVA/MONTH)
DC	Domestic consumers	240 or 415	0-50	120.00	2.00	-
			51-1,500		8.10	
			> 1,500		18.57	
SC	Small commercial	240 or 415	≤ 15,000	120.00	8.96	-
CI1		415-3 phase	> 15,000	800.00	5.75	600.00
CI2	Commercial/industrial	11,000	No limit	2,500.00	4.73	400.00
CI3		33,000/40,000		2,900.00	4.49	200.00
CI4		66,000		4,200.00	4.25	170.00
CI5		132,000		11,000.00	4.10	170.00
IT		Interruptible off-peak supplies		240 or 415	≤ 15,000	240.00 when used with DC or SC
SL	Street lighting	240	-	120.00	7.50	-

Note: Schedule of Retail Electricity Tariffs and Rates (effective as of 1 July 2008)
 Source: Electricity Regulatory Board, as of 2005



COUNTRY CHAPTER: RWANDA

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ACRONYMS AND ABBREVIATIONS

RWANDA

AfDB	African Development Bank
ACP	African, Caribbean and Pacific Group of States
AKFED	Agakhan Fund for Economic Development
ARED	Association Rwandaise pour Énergie Durable (Rwandan Association for Sustainable Energy)
ARD	Associates in Rural Development
ARIPO	African Regional Intellectual Property Organization
ATI	African Trade Insurance Agency
BADEA	Banque Arabe de Développement Économique en Afrique (Arab Bank for Economic Development in Africa)
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
BRGM	Bureau de Recherche Géologique et Minière (Bureau of Geological and Mining Research)
BTC	Belgian Technical Cooperation
CDM	Clean Development Mechanism
CEPGL	Communauté Économique des Pays des Grands Lacs (Economic Community of the Countries of the Great Lakes)
CIF	Cost Insurance and Freight
CITT	Center for Innovation and Technology Transfer
COMESA	Common Market for Eastern and Southern Africa
DED	Deutscher Entwicklungsdienst (German Development Service)
DGIS	Directoraat Generaal Internationale Samenwerking (Dutch Directorate General for International Cooperation)
DNA	Designated National Authority
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy
EU	European Union
€	Euro
EXIM	Export and Import Bank in India
F.O.B.	Free On Board
GEF	Global Environmental Facility
GDP	Gross Domestic Product
GoR	Government of Rwanda
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HFO	Heavy Fuel Oil
IDA	International Development Agency
IFC	International Finance Cooperation
IPA	Industrial Promotion Agency
IPP	Independent Power Producer
IRST	Institut de Recherche Scientifique et Technologique (Institute of Scientific and Technological Research)
KenGen	Kenya Generating Company
KIST	Kigali Institute of Science and Technology
KP1	Kibuye Project 1
MIGA	Multilateral Investment Guarantee
MINAGRI	Ministry of Agriculture
MINALOC	Ministère d'Affaires Locales (Ministry of Local Governments)
MINECOFIN	Ministère d'Économie et de Finances (Ministry of Finance and Economic Planning)
MINICOM	Ministry of Commerce
MININFRA	Ministry of Infrastructure
MINITER	Ministère des Terres, de l'Environnement, des Forêts, de l'Eau et des Mines (Ministry of Lands, Environment, Forests, Water and Mines)
MoU	Memorandum of Understanding
NDBP	National Domestic Biogas Program
NEDA	National Energy Development Agency
NEPAD	New Partnership for Africa's Development
NTB	National Tender Board
NUR	National University of Rwanda
OGMR	Office of Geology and Mines in Rwanda
OPEC	Oil Producing and Exporting Countries



PPP	Private–Public Partnership
PV	Photovoltaic
RE	Renewable Energy
RIEPA	Rwanda Investment and Export Promotion Agency
RURA	Rwanda Utilities Regulatory Agency
RIG	Rwanda Investment Group
RRA	Rwanda Revenue Authority
RWF	Ruanda Franc
SINELAC	Société Internationale d'Électricité de Pays du Grand Lacs (International Electric Society of the Countries of the Great Lakes)
UPEGAZ	Unité de Promotion et d'Exploitation du Gaz Méthane (Association for the Promotion and Exploitation of Methane Gas)
UNIDO	United Nations Industrial Development Organization
USTDA	US Trade and Development Agency
SLF	Solar Electric Light Fund
SNEL	Société Nationale d'Électricité (National Electricity Company)
SNV	Stichting Nederlandse Vrijwilligers (Netherlands Development Organization)
UNDP	United Nations Development Program
USAID	United States Agency for International Development
USD	United States Dollar
VAT	Value Added Tax
WB	World Bank
WTO	World Trade Organization

MEASUREMENTS

bbl	barrel
cbm	cubic meters
GWh	gigawatt hour
km ²	square kilometer
KW	kilowatt
kWp	kilowatt-peak
l	liter
m	meter



SUMMARY

ECONOMIC STATUS AND DEVELOPMENT OF RWANDA

Rwanda has made substantial progress in stabilizing its economy after it has managed to overcome the genocide in 1994. Over 40% of the population, however, live below poverty line. The GDP per capita is 250 USD, the economic growth has been stable since the year 2000 with an average rate of 5% per year (with higher rates claimed over the last years) mainly driven by construction and agriculture. Coffee and tea are the central products in Rwanda's economy, accounting for nearly two-thirds of the export value. Tourism is another important source of foreign income. The Government of Rwanda (GoR) remains committed to a strong and enduring economic climate for the creation of a favorable investment conditions as proclaimed in its Vision 2020 with the issue of 'Development of Entrepreneurship and the Private Sector' as one of its central objectives.¹

STRUCTURE OF ENERGY SUPPLY IN RWANDA

The population still relies on biomass like wood, animal waste and crop residues as its primary energy source (85%) used mainly for cooking. Commercial energy resources include hydro power, oil-fired thermal power stations and methane gas from lake Kivu.

Oil

Rwanda's oil consumption averaged about 5,300 barrels per day (bbl/day) in 2007, which is almost all imported through the port of Mombasa, Kenya. Kerosene is used extensively in rural areas for lighting and, to some extent in urban areas, for cooking and lighting.

Electricity

A national average of 6% of the population is connected to the national grid, mainly in Kigali and other cities, only 1% of the rural population uses electricity. Power stations in Rwanda produced 54 MW in 2007, of which 30 MW came from thermal oil-fired power stations and 24 MW from hydro electricity. Rwanda's electricity consumption was 210 GWh, only 138 GWh were produced within the country (hydro and diesel power). 69 GWh was imported from Rusizi I power plant (Congo) as well as from Rusizi II (Uganda).

Rwanda's Government is committed to diversify the country's sources of energy, and a number of large investments are underway (e. g. the Nyaborongo Hydro Power Dam of 27,5 MW, other small micro hydro power and lake Kivu methane plants with an estimated 250 MW to be installed over the coming years. The country's electricity supply has been erratic in the early years of the decade because of the national grid's heavy reliance on hydroelectric power, which in turn depends on rainfall. In the past years, poor rainfall caused several electricity shortages. Ongoing high transmission losses of around 25% deteriorate the country's electricity supply.² Currently, however, the electricity supply is stable due to the installation of diesel-powered generators.

Natural Gas

Rwanda has proven natural gas reserves identified as methane in the Lake Kivu waters. Currently, 4,5 MW of electricity are generated in a pilot plant in the vicinity of Gisenyi. Other projects are underway for the expanded exploitation and use of this resource, one of them being operated by the Rwanda Investment Group (RIG) with a concession of 3.5 MW for a pilot project. The US-based Contour Global Group has a concession of 100 MW and construction has started to put the first 25 MW in operation by late 2010. The reserves of methane gas deposits in Lake Kivu are estimated to be sufficient for 350 MW of electricity power and other uses for a period of up to 50 years. Similar reserves are available for the DR Congo with whom Rwanda is sharing the lake Kivu.³

STATUS OF RENEWABLE ENERGIES IN RWANDA

Biogas

The National Domestic Biogas Program (NDBP) aims to install at least 15,000 biogas digesters in rural households to provide sufficient energy for cooking and lighting. So far, over 300 biogas digesters have been installed in rural households. Biogas has also been used in prisons and schools where it is produced with waste from the latrines. Rwanda has even gained international recognition for its achievement, which has reduced the cost of cooking in prisons by 40%. The Government is now considering the expansion of this technology to more schools and hospitals.

Solar

Africa's so far largest grid-connected solar plant of Kigali Solaire is in operation at Mount Jali on the outskirts of Kigali. It has been constructed by the Ministry of Infrastructure with the support of the German utility of Stadtwerke Mainz and the German company of Juwi. The first phase of the project was started in June 2007. Through the solar plant, the Stadtwerke Mainz as an Independent Power Producer (IPP) currently feeds 250 kWp into the grid (from June 2007 to April 2009 production of 626,010 kWh) and is planning to expand to a capacity of 1 MWp.

PV systems have been implemented in recent decades by local and international organizations for the electrification of churches, schools and households in rural areas. Starting in 2009, the EU will contribute 10 million € for the support of solar and hydro power rural electrification projects through funds from the ACP-EU Energy Facility.⁴

1 SEE MINECOFIN, AS OF 2000

2 SEE POVERTY ENVIRONMENT INITIATIVE RWANDA, AS OF 2006

3 SEE REPUBLIC OF RWANDA, AS OF 2009

4 FOR MORE INFORMATION ON THE ACP-EU ENERGY FACILITY SEE WEBSITE ([HTTP://EC.EUROPA.EU/EUROPEAID/WHERE/ACP/REGIONAL-COOPERATION/ENERGY/INDEX_EN.HTM](http://ec.europa.eu/europeaid/where/ACP/regional-cooperation/energy/index_en.htm))



Hydro

Several large hydro power projects are underway through international cooperation. 21 micro hydro power stations in various places are under construction and are expected to generate 10 MW in 2009. An additional 300 sites have been identified for the construction of micro hydro power stations. The construction of the 27,5 MW Nyaborongo dam has started early 2009 and the project is expected to be in operation by the end of 2012. Pre-feasibility studies are underway for a number of large projects with a total capacity of around 400 MW at the Ruzizi and Akagera rivers, which are shared with neighboring countries.

Wind

Wind energy has not yet been given priority in Rwanda because of the lack of detailed and reliable information on wind regimes and potential exploitation sites. A wind atlas has to be developed which requires detailed meteorological measurements⁵. A wind survey will be carried out in 2009/10 in selected locations.

Geothermal

The exploitation of the geothermal potential is in its preliminary stage. Studies and prospects have estimated a potential of 170–300 MW⁶. Since June 2007, the German Federal Institute for Geosciences and Natural Resources (BGR) has been assessing the geothermal potential.

Methane

55 billion cubic meters of methane are trapped at the bottom of Lake Kivu, roughly equivalent to 275 million barrels of oil. A pilot project of extraction started in 2008 to pump methane gas from a rig to a small on-shore power plant. Next steps will include projects with private investors for up to 250 MW of electric power. The Government is also looking at the opportunities to convert gas into liquid for transport and is cooperating with a South African investment group for this purpose.

CDM

Rwanda is a signatory to Clean Development Mechanism (CDM) and has therefore created a Designated National Authority (DNA). A permanent secretariat has identified a number of projects, e. g. energy saving lamps, hydro power, biogas, methane gas, solar for water purification, voluntary credits for reforestation etc.

⁵ ALSO SEE REPUBLIC OF RWANDA, 2009

⁶ SEE MININFRA, 2009



1 COUNTRY INTRODUCTION

1.1 RWANDA OVERVIEW

Rwanda is a landlocked nation of rich culture and great natural beauty. The country is situated in central Africa bordered by Uganda, Tanzania, Burundi and the Democratic Republic of Congo. The Republic of Rwanda comprises Kigali City and four provinces (North, East, South and West). The country is mainly rural with about 90% of the population engaged in mainly subsistence agriculture. It is the most densely populated country in Africa with few natural resources, minimal industry and coffee and tea as the primary foreign exchange earners. Over 40% of the population live in poverty with less than 1 USD per day.

The 1994 genocide decimated Rwanda's fragile economic base. However, Rwanda has made substantial progress in stabilizing and rehabilitating its economy to pre-1994 levels. Gross Domestic Product (GDP) has rebounded and inflation has been curbed. The Government has embraced an expansionary fiscal policy to reduce poverty by improving education, infrastructure, foreign and domestic investment and pursuing market-oriented reforms, although energy shortages, instability in neighboring states and lack of adequate transportation linkages to other countries continue to handicap growth.

1.2 RWANDA STATISTICS: GEOGRAPHY AND ECONOMICS

LAND AREA:	26,340 square kilometers
POPULATION:	9.7 million (as of 2007), growth rate 2.35%
DENSITY:	369 inhabitants/km ² (as of 2007)
CLIMATE:	Two rainy seasons (February–April, November–January), mild in mountains with frost and snow
AVERAGE TEMPERATURE:	24.6–27.6° C (hottest months: August–September)
ALTITUDE	From 1,000–4,500 m above sea level, highest point is Karisimbi volcano (4,507 m)
MAIN WATER BODIES:	Lake Kivu, Lake Muhazi, Lake Ihema, Lake Bulera, Lake Ruhondo, Lake Mugesera
VEGETATION	Ranges from dense equatorial forest in the North West of the country to tropical savannah in the East
GDP PER CAPITA (AT PURCHASING POWER PARITY)	813 USD (as of 2007)
INFLATION RATE:	8% (as of 2007)
AGRICULTURE:	Coffee, tea, pyrethrum (insecticide made from chrysanthemums), bananas, beans, sorghum, potatoes, livestock
INDUSTRIES:	Cement, agricultural products, small-scale beverages, soap, furniture, shoes, plastic goods, textiles, cigarettes
ELECTRICITY – PRODUCTION:	138.79 million kWh (as of 2007)
ELECTRICITY – CONSUMPTION:	210.13 million kWh (as of 2007)
ELECTRIFICATION RATE:	6% (urban 35%, rural 1%; as of 2007/2008)
OIL – PRODUCTION:	0 bbl/day (as of 2007)
OIL – CONSUMPTION:	5,300 bbl/day (as of 2005)
OIL – PROVEN RESERVES:	0 bbl/day (as of 2007)
NATURAL GAS – PRODUCTION:	0 bbl/day (as of 2006)
NATURAL GAS – PROVEN RESERVES:	54.32 billion cubic meters (as of 2006)
EXPORTS:	170.8 million USD F.O.B. (as of 2007)
EXPORTS – COMMODITIES:	Coffee, tea, hides, tin ore
EXPORTS – PARTNERS:	China (10.3%), Germany (9.7%), USA (4.3%) (as of 2006)
IMPORTS:	472.5 million USD F.O.B. (as of 2007)
IMPORTS – COMMODITIES:	Food, machinery and equipment, steel, petroleum products, cement and construction material
IMPORTS – PARTNERS:	Kenya (19.6%), Germany (7.9%), Uganda (6.8%), Belgium (5.1%) (as of 2006)
EXCHANGE RATE:	1 RWF = 0,00126 € (as of 2009)

Source: data compiled by the author from different sources, e.g. CIA, as of 2009



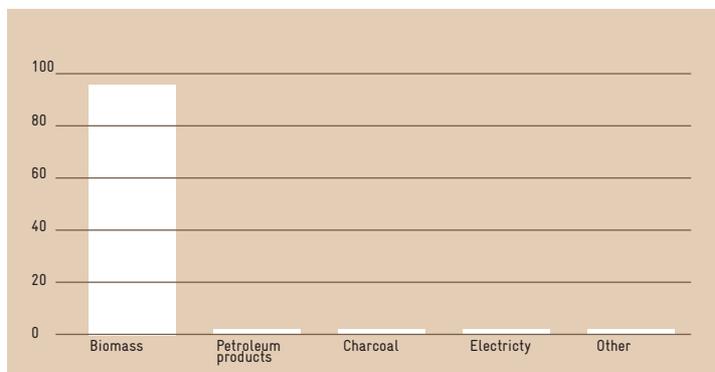
2 ENERGY MARKET IN RWANDA

2.1 ENERGY SITUATION OVERVIEW

Rwanda's demand for energy has grown rapidly by 25 % per year due to population growth and the increase in economic activities. Biomass accounts for 95 % of the total energy consumed and only 70.000 households (about 5 %) are connected to grid power. The electricity consumed in Rwanda has changed from almost entirely hydro-generated to largely thermal-generated at present. This has been a result of a high demand for electricity and unexpectedly low reservoir levels. The shares of the total primary energy consumption are shown below. It is obvious that the commercial energy sources contribute only 5 % to the total primary energy supply, for example electricity 0.6 %.

FIGURE 1

Shares of Total Primary Energy Consumption



Source: UNIDO, 2002, graph PSE A6

TABLE 2

Electricity Sources, Capacities and Net Generation

TYPE OF ENERGY SOURCE	2002		2003		2004		2005		2006		2007	
	Cap. (MW)	Net Gener. (GWh)										
Hydro Power - of that												
Local	24.44	233.90	24.44	117.64	24.44	84.32	24.44	65.73	24.44	41.17	24.44	27.32
Imports		135.69		120.92		115.81		89.05		90.02		69.34
Hydro Power total	24.44	233.90	24.44	238.56	24.44	200.13	24.44	154.78	24.22	121.19	24.44	96.66
Thermal power (oil)	2.00	0.00	2.00	0.00	14.57	6.25	24.57	50.14	29.57	127.40	29.57	111.47
Solar PV		0.00		0.00		0.00		0.00		0.00		2.00
Total capacity	26.44		26.44		39.01		49.01		54.01		54.01	
Total power generated		233.90		238.56		238.21		204.92		248.59		210.13

Source: ELECTROGAZ, Electricity Department, as of 2007

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The UNDP Human Development Report stated Rwanda's electricity consumption per capita and year as 31 kWh.⁷ This figure was crosschecked by dividing the electricity production of 138 million kWh through 8.6 million inhabitants. On average, the per capita electricity consumption in Rwanda is 19,5 kWh (for 2005; for comparison: Germany has 7,442 kWh per capita per year).

Table 2 shows the electricity production by hydro power and thermal oil power stations.

In 2007, local hydro power stations produced 27.32 GWh and thermal oil-fired power stations 111.47 GWh. This results in 138.79 GWh in total. Another 69.34 GWh were imported. A more detailed table showing all power stations of Rwanda can be found in annex 8.4 (Share of Local and Imported Energy Sources).



2.3 ENERGY PRICES

Electricity prices in Rwanda are one the highest amongst all East African countries with around 14 Eurocent/kWh, as shown table 3.

With the exception of kerosene, prices of all other petroleum products have been fluctuating since January 2007 and are heavily taxed although the Government sometimes reduces taxation to stabilize prices. Table 4 shows the trend of price from January 2007 to February 2008.

TABLE 3

Energy Prices in Rwanda

ELECTRICITY (RWF/KWH)		PREMIUM (RWF/L)		GASOIL (RWF/L)		KEROSENE (RWF/L)	
Private	Industrial	Private	Industrial	Private	Industrial	Private	Industrial
123	105	726	726	726	726	623	623

Source: MINICOM, as of 2007

TABLE 4

Increasing Fuel Prices in Rwanda 2007–2008

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB
Petrol	Price RFW	607	607	607	607	607	617	617	617	617	617	637	684	726	726
	Subsidies (reduced taxes)	61	47	58	72	86	90	90	89	88	85	83	81	90	80
Diesel	Price RFW	595	595	595	595	595	605	605	605	605	605	620	677	726	726
	Subsidies (reduced taxes)	72	62	70	74	89	87	89	93	94	96	99	99	91	90

Source: MINICOM, as of 2008

2.4 MARKET ACTORS FOR ENERGY PLANNING, REGULATIONS AND DISTRIBUTION

MININFRA

The overall governance of the energy sector is in the responsibility of the Ministry of Infrastructure (MININFRA). The Department of Energy supervises the implementation of the energy policy, which is the main guidance for change, backed by legislation and regulation.

ELECTROGAZ

While the ministry is responsible for policy, the public utility company of ELECTROGAZ (entirely owned by the Government of Rwanda) offers electricity services. The Government has assigned the monopoly to produce and distribute electricity to ELECTROGAZ. It is currently in the process of restructuring ELECTROGAZ to increase private sector involvement in an attempt to improve managerial and operational performance.

RURA

Rwanda Utilities Regulatory Authority (RURA) was established in 2001 for the regulation of certain public utilities including those providing for energy. The regulatory authority promulgates rules to establish licenses and tariffs and dispatches preferences for indigenous and foreign Renewable Energy (RE) producers of electricity in their production, transmission, distribution, system operation and international trade activities.

RIEPA

The Rwanda Investment and Export Promotion Agency (RIEPA)⁸ has a mandate to promote investment opportunities with local and foreign investors, to facilitate the establishment and smooth operation of investor projects and the business development and export production. It also advises the Government on additional policies and initiatives needed to encourage and support investment in the country.

⁸ SEE WEBSITE OF RWANDA INVESTMENT AND EXPORT PROMOTION AGENCY - RIEPA (WWW.RWANDAINVEST.COM)



3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

According to the East African Community (EAC) Development Strategy (2006–2010)⁹, only a small percentage of the EAC region specifically provides support for medium-term investments in the energy sector. Each country is compiling a detailed inventory of all RE technologies to be submitted to the EAC Secretariat for the integration in a regional inventory. Based on that the EAC region plans to develop standards and codes of practice on RE technologies.

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

The following regulations in Rwanda are in place:

Law on Investment:

A new Law on Investment and Export Promotion and Facilitation (No.26/2005)¹⁰, which came into force in March 2006, is intended to assist investors in obtaining the necessary license and other activities. The principal features of the law include the following:

- The law distinguishes between foreign and local investors and specifies that foreign investors qualify for an investment certificate with an investment of 250,000 USD and local investors with an investment of 100,000 USD.
- The law provides for free economic zones of three kinds: export-processing zones, single-export processing zones and free trade zones.
- The provisions for fiscal incentives have been shifted to the new Law of Customs and the new Law of Income Tax, but were maintained as annexes to the Investment Law for ease of reference.
- The law provides special non-fiscal incentives for investors who invest 500,000 USD in one step. These include permanent residence, citizenship and access to land.
- RIEPA is required to make and communicate its decision regarding an investment certificate within 10 working days after receiving a complete application. Should RIEPA fail to act within 10 days, the investor may complain to the Minister of Commerce (MINICOM) who is in turn required to investigate the matter and communicate the result within five working days.
- The law states that the holder of an investment certificate, amongst other benefits, is entitled to free residence and work permits for three members of the certificate holder's management or technical staff, valid for one year and reusable to the same or different persons.
- Value Added Tax (VAT) on imported capital goods and raw material is subject to zero-rated tariffs. In contrast, a flat tax of 5% on imported capital goods and raw materials - in lieu of all other duties (tariffs, excise and VAT) is not subject to zero-rated tariffs. Further conditions are that upon application for each transaction, an accelerated rate of depreciation of 40% in the first year is available, if the

asset is held for the minimum of four years, increasing to 50% for investments located outside Kigali or in one of the 10 priority sector. These regulations are specified by the 2005 Law on Investment and Export Promotion and Facilitation.

There are no special import conditions for RE products. Law No. 54 (as of 2006) – modifying and the complementing law No. 21 (as of 2006)¹¹ which establishes the customs system – stipulates that capital goods, equipment, raw materials and imported goods by an investor in a free trade zone shall be relieved from customs duties when imported by an investor registered under the investment agency (RIEPA).

There are no clear legal guidelines for electricity production and feed-in tariffs into the power grid for RE or other sources. There is no separate incentive package for investors in RE or any special support program for RE investment.

At the end of 2008, the EU contributed 10 million € supporting solar and hydro power rural electrification projects through funds from the ACP-EU Energy Facility. The GoR has developed a five-year development plan to improve energy access and rural development. The European Union is supporting Rwanda in achieving these objectives by financing half of this energy program. The program targets areas of the country beyond the reach of the national electricity network and will provide electricity primarily via solar PV systems to some 25% of the currently non-electrified institutions such as health centers, schools and public offices, covering 350 institutions in 150 of Rwanda's 419 sectors. In addition, micro hydro electricity plants will be installed at various sites serving up to 70 villages (Umudugu) giving access to electricity to some 15,000 households. The program will support decentralization of education, health, water supply, telecommunication and general administration functions. It is designed as a Private-Public Partnership (PPP), as the micro hydroelectric plants will be financed, constructed, managed and maintained by private firms, thus leading to the promotion of the private sector and the creation of many new off-farm jobs in rural areas.¹²

SHORT BUSINESS INFO

- Zero VAT on imported capital goods and raw material
- No feed-in tariff for RE electricity
- 19 different projects planned in hydro, biogas, solar, geothermal
- 10 Mio € for ACP-EU project on hydro and solar energy in rural areas



RE
Business
Opportunity

There are several reconstruction and development projects in the energy sector planned and/or under implementation, which are shown in the following table:

⁹ SEE EAC, 2006

¹⁰ SEE REPUBLIC OF RWANDA, AS OF 2005

¹¹ SEE REPUBLIC OF RWANDA, AS OF 2006

¹² FOR RECENT DEVELOPMENTS ON THE PROGRAM SEE WEBSITE OF MININFRA (WWW.MININFRA.GOV.RW)



TABLE 5
Planned and Implemented Energy Projects in Rwanda

PROGRAM	RE TECHNOLOGY	FINANCING PARTNERS	COST IN RWF	STATUS
Construction of the 3 micro hydro power stations Keya,Nkora and Cyimbili (1.6MW)	Micro hydro	Belgian Technical Cooperation (BTC)	1,185,740,158	Under construction
Study and construction of micro electric stations in Kibuye and Cyangugu Region	Micro hydro	Belgian Technical Cooperation (BTC)	789,419,400	Planned (there is no tender body because the project is still under planning)
Construction of 8 micro hydro power stations (total capacity: 6.7 MW)	Micro hydro	GoR	1,500,000,000	Under construction by the Sri-Lankan company of Hydro Power International Ltd.
Construction of hydroelectric power station at Rukarara (9.5 MW)	Hydro	GoR	1,000,000,000	Under construction by Eco Power Global Ltd.
Construction of hydroelectric power station at Nyabarongo (27.5 MW)	Hydro	GoR (through a grant)	4,725,776,000	Started
Construction of 6 hydro power stations (1.5 MW)	Hydro	Private Sector Participation (Rwandan Companies) with GTZ (financed by BMZ/ DGIS)	531,000,000	Under construction
Rehabilitation of 3 micro hydro power stations (Gihira, Mukungwa, Gisenyi)	Micro hydro	Loan from BADEA/ OPEC and GoR	1,092,470,012	Feasibility has been advertised
Urgent electricity rehabilitation project for transmission and distribution (20 MW)	/	GoR, IDA, Norwegian Fund	7,016,883,340	Under construction
Geothermal resource assessment	Geothermal	GoR and BGR	300,000,000	Ongoing
Rural energy facility	/	GoR and Grants	220,000,000	Planned (contact: MININFRA)
Electrification by solar	Solar	BTC	161,106,000	Planned (contact: MININFRA)
Network line for micro hydro power stations of 20 KW (Cyimbiri, Funda, Nkora)	Hydro	BTC	513,391,120	
Rehabilitation of Gikondo and urgent electrical material	/	GoR	270,000,000	Planned
Umutara rural electrification by solar energy	Solar	GoR	500,000,000	Planned (there is no tender body as the project is still under planning; contact: MININFRA)
Elaboration and study of electricity tariffs	/	GoR	55,000,000	Planned (contact: MININFRA)
Setting up of control system for stability of Lake Kivu	/	Grants	300,083,000	Planned (contact: MININFRA)
Project to substitute wood and wood/coal use in families by biogas	Biogas	GoR, SNV, GTZ, SNV, DGIS	397,000,000	Being implemented
Project to substitute wood and wood/coal based stoves by improved stoves	Improved stoves	GoR	332,000,000	Being implemented

Source: compiled by the author from various data sources

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

RE energy sources in Rwanda are less or even non-exploited. The Rwanda Government has given strong emphasis on the development of hydro power. Due to rising oil prices and the currently high electricity prices, the development of RE power supply can be financially viable within the near future.¹³

4.1 BIOMASS/BIOGAS

Firewood is clearly the main source of energy for cooking in Rwanda and is being used by more than 80% of the households. The other sources of energy used for cooking include charcoal (over 5%) and other vegetal materials. Even in Kigali City, some 65% of the households are using charcoal and around 25% wood for cooking. This underlines the dominant role of biomass as a major energy source in Rwanda.

Households with two or more cows have the potential for a small biogas plant. A significant national domestic biogas program has been launched, staff has been recruited and funds have been made available by GoR. The program is especially viable because the national zero grazing policy makes the cow dung available close to the household.

On top of that, the one-cow-per-family program will enable more people to actually benefit from the biogas program. So far, 350 biogas digesters have already been installed in households. These digesters are built by local craftsmen with the support of the Center for Innovation and Technology Transfer (CITT) of the Kigali Institute of Science and Technology and Management (KIST). Most of the digesters are made from stones and cement. There is also a pilot test phase for digesters made of fiberglass with help of Chinese engineers in Kirehe district. By December 2011, the project is aiming to install 15,000 biogas systems for cooking and lighting. Biogas plants using human feces are in operation in six prisons

¹³ FOR A GENERAL CURRENT OVERVIEW SEE WEBSITE OF MININFRA, 2009



with 30,000 inmates. KIST is expected to install three more plants every year.

Other players in the sector include SAM Muhiima, a community-based organization, which collects, sorts and processes garbage for high-quality biomass fuel briquettes for household (for cooking) and industrial use (to run engines and produce electricity). This project is financed by USAID through Associates in Rural Development Inc (ARD).

SHORT BUSINESS INFO

- 95% of primary energy source is „non-commercial“ biomass.
- NEDA facilitates a national domestic biogas plant program targeting implementation in 15,000 households by 2011.
- Biogas plants are used in prisons.

4.2 SOLAR ENERGY

Rwanda has favorable irradiation conditions of 5.15 kWh/m² per day¹⁴, but the use of solar energy is still very limited. In Rwanda, solar energy has been exploited in recent decades by local and international organizations for the electrification of churches, schools and households in rural areas. However, the low income situation and the resulting high costs of solar systems have been a barrier to widespread dissemination until now. The Government has been able to attract efficient partners including the European Union (EU), the Belgian Technical Cooperation (BTC), the Global Environmental Facility (GEF) and the United States Agency for International Development (USAID).

The GoR through the Ministry of Infrastructure (MININFRA) and with the support of Stadtwerke Mainz¹⁵ was able to inaugurate the first phase of a solar power generation project in June 2007. The Kigali Solaire Plant is located on Mount Jali at the outskirts of the city and is currently feeding 250 kWp into the grid, operated by Stadtwerke Mainz as IPP and constructed by German Juwi GmbH. It is so far the largest solar power plant known in Africa. Stadtwerke Mainz in cooperation with MININFRA is looking into expanding the plant to a capacity of 1 MWp. Technicians from ELECTROGAZ have already been trained to take care of the maintenance of this system. With mixed financing of BTC, GEF, EU, USAID and German Technical Cooperation Agency (GTZ) on behalf of the German Government, 268 health centers, 500 schools and 200 administrative offices will be electrified with solar systems by 2010.

Stadtwerke Mainz is investing in 50 small-scale solar plants of 1 kW each for remote off-grid villages. The solar systems will supply refrigeration for medicine in health centers and will provide light for schools. The Public-Private Partnership (PPP) project of Stadtwerke Mainz and GTZ on behalf of the German Development Cooperation guarantees the smooth operation of the solar systems. GTZ trains electricians from the various rural districts and the capital as solar technicians. The cooperation project also includes the establishment of a micro-financing system for solar start-up companies¹⁶.

¹⁴ SEE ALSO ANNEX 7.3

¹⁵ POWER UTILITY IN THE FEDERAL STATE OF RHINELAND-PALATINATE, GERMANY

¹⁶ SEE GTZ, 2007, AND RENEWABLES MADE IN GERMANY, AS OF 2007

The private sector, which has been more or less inactive so far, is eventually emerging and starting to participate. A number of players in both thermal and PV are setting themselves up and some have already started to offer these services in isolated cases. The MININFRA is keen to assist such private initiatives in staff capacity building and other promotional logistics.

Solar Electric Light Fund (SELF) has installed solar diesel hybrid systems for the communities of Mulindi, Rusumo, Rukira, Nyarabuye and Kirehe. SELF was approached by Columbia University's Mailman School of Public Health to carry out the solar electrification of clinics run by the School's International Center for AIDS Care and Treatment programs. Through this collaboration, there are now 15 additional health centers enjoying the benefits of a solar-diesel hybrid power station in the country's North and West (4 kWp each), with a total capacity of 60 kWp.

Through the ACP-EU Energy Facility, solar PV systems shall electrify 25% of the currently non-electrified institutions such as health centers, schools and public offices, covering 350 institutions in 150 of Rwanda's 419 sectors.

SHORT BUSINESS INFO

- The 250 kWp grid-connected PV Kigali Solaire Plant was put in operation by Stadtwerke Mainz.
- Training for solar technicians is carried out as PPP with Stadtwerke Mainz and GTZ (on behalf of German Development Cooperation).
- 15 PV diesel hybrid systems for clinics (4 kWp each) were installed by SELF.
- ACP-EU Energy Facility is operational from 2009 with grants for PV systems in schools and clinics.

4.3 WIND POWER

In collaboration with the Belgian Government, a wind regime study is projected to develop a wind atlas in the country. A contract has been awarded to an international company to install wind metering equipment at a limited number of points with the highest potential in the country. It is expected that the first results of these measurements will be available by mid-2010.

4.4 GEOTHERMAL POWER

The investigation of geothermal energy is still in its preliminary stage. Currently, the northern region (Virunga geothermal prospect) is under investigation carried out jointly by GoR and the German Government organization of BGR. Further investigation is to follow for the southern section (Bugarama). The French bureau BRGM (Bureau de Recherche Géologique et Minière) has estimated the geothermal energy potential between 170 and 300 MW, based on the preliminary work carried out at geothermal springs in the northwestern part of the country.

In 2006, the US company of Chevron confirmed the results of BRGM. In June 2007, MININFRA submitted a proposal to BGR. Project activities started in November 2007. So far, the Virunga geothermal prospect has been assessed by structural analysis via aerial photographs and satellite images.



In addition, a detailed geothermal sampling campaign and geophysical surveys are being conducted by BGR and Ken Gen from Kenya. Expected activities for 2009 are additional gas measurements and further geophysical studies. The first phase of the geo-scientific assessment will be completed in June 2009.

The ministry furthermore has plans to begin geothermal exploratory drilling of appraisal wells once the best locations have been selected, and is set to identify prospective investors.

SHORT BUSINESS INFO

- A potential of 170 to 300 MW has been identified is estimated by BRGM (as of 1984) and Chevron (as of 2006).
- A detailed assessment by BGR is currently ongoing.
- GoR is seeking for investors.



4.5 HYDRO POWER

Small Hydro Power

A study conducted in 2007 with the support of the Belgian Government identified 333 potential sites for smaller hydro power stations, 125 located in the Western Province, 115 in the Southern Province, 92 in the Northern Province and 13 in the Eastern Province. As only very few of these sites are being exploited so far, this condition provides good investment opportunities. The country has 23 lakes and numerous rivers, and the technical potential for small hydro power stations is estimated at 10 MW, which would provide more than 40,000 households with electricity. The tributaries within the upper Kagera river catchment area offer particularly good prospects for hydro development, especially the Mukungwa, Nyabarongo, Rukarara and Akanyaru rivers in the West. Further projects could be built on the Ruzizi river, where a water head of approximately 664 m is available over a relatively short distance along the East Africa Rift. International agreements would be necessary to start such initiatives.

The Government is constructing a hydroelectric dam at Rukarara with a capacity of 9.5 MW and operational in 2009. Moreover, through cooperation with GTZ on behalf of the German Government, BTC, UNIDO, World Bank, AfDB and Private Partnership Program, 21 micro hydro power stations in various places financed under different schemes are under construction and are expected to generate 10 MW in 2009. Eight micro hydro plants financed by the Government are currently being constructed by the Sri-Lankan company of Hydro Power International Ltd. The sites are: Rugezi, Mukungwa II, Janja, Gashashi, Nyabahanga, Nyirabuhombohombi, Nshili I and Ruhwa. Construction works on these sites will be completed by the second half of 2009.

To ensure the sustainability of micro hydro power businesses through private sector participation, the GoR with financial support from the Dutch Directorate-General for International Cooperation (DGIS) and through GTZ initiated a project (as part of the international Energizing Development Program) consisting of the construction of the 6 micro hydro power plants. The program finances 50% of the total cost, and the private developers cover the remaining 50% through their

own equity and loan from financing institutions. They are getting technical assistance from GTZ who are advising the project developers in financial as well as engineering aspects. These 6 projects are expected to deliver a total of 1.5 MW by 2010.

Through an UNIDO/GoR partnership, 4 micro hydro power plants are being constructed while the construction of three micro hydro stations (Keya, Nkora and Cyimbiri) is ongoing in partnership with CTB. These projects are expected to yield 1.8 MW by the year 2009.

Rural electrification through micro hydro power production is being developed by the ACP-EU Energy Facility with a budget of 10 million €. 50% of the construction costs for a total production capacity of 3 MW have been secured for 5–10 different sites. As financing has already been approved, project development is currently under way with the necessary feasibility studies to be conducted for tendering the construction contracts. It is expected that the power plants will be operational also by 2010.¹⁷

Large Hydro Power

The construction of the 27.5 MW Rukarara hydro dam, financed through domestic resources and with credit from the Indian Government banks, is ongoing and almost on track. Power output is expected by the end of 2009. The negotiations with an Indian company for the building of the Nyabarongo hydro power plant are being finalized. The EXIM Bank (Export and Import Bank in India) will provide a portion of the financing through a grant. The Government will also invest own sources through direct funding of the project by taking a commercial loan. The total cost will be 126 million USD.

Some larger regional projects are being designed on the borders of Rwanda (Rusumo, Rusizi III and IV) and can only be developed from 2012 onwards.

SHORT BUSINESS INFO

- 333 potential sites identified in the country
- 3 MW for rural electrification under ACP-EU Energy Facility as PPP with 50% investment funds
- Supply of 7,000 households and 350 small businesses in rural areas under DGIS/GTZ
- 21 micro hydro stations (with total 10 MW as PPP)

4.6 METHANE GAS

There is a high level of exploitable methane gas in Lake Kivu that can serve the country for a whole century. Lake Kivu is estimated to have over 55 billion m³ of methane gas of which 29 billion are economically exploitable. Such reserves are located at a depth of approximately 300 m. This resource is renewable at the rate of 100 to 150 billion m³ per year as far as the large-scale exploitation of this resource is concerned. GoR is in negotiations with a number of parties to produce methane from the lake at an initial development of 35 MW.

It is expected that the cost of generation from the Lake Kivu IPP will be about 0.04–0.05 € Cent/kWh (as compared to current diesel generation cost of 0.17 € Cent/kWh), thereby dramatically lowering the overall costs of power generation.

¹⁷ SEE EUROPEAN COMMISSION - EC, AS OF 2009



Switching to the proposed Lake Kivu IPP will also improve the reliability and stability of power.

The pilot plant of Kibuye Stage 1 (KP1) has a capacity of 4.5 MW. The project experienced considerable delays due to technical setbacks and the dispute with Dane Associates Ltd., an Israeli-Norwegian group. Since the end of November 2008, the plant has been producing 1.5 MW of methane gas. Furthermore, Rwanda Investment Group (RIG) has been granted a gas concession of 50 MW. So far, it has two pilot projects under development (totaling around 7.5 MW) expected to be commissioned in March 2009. RIG, GoR and the Industrial Promotion Service (IPS), part of the Agakhan Fund for Economic Development (AKFED), decided to join forces and form a consortium for a 100 MW project. Negotiations with an American investor (Contour Global) for the gas concession and the Power Purchase Agreement (PPA) have been completed early 2009. The investor Contour Global wishes to develop a 100 MW methane gas to power plant, starting with a first phase of 25 MW with equity funding. The Government has embarked on a monitoring program in partnership with the Democratic Republic of Congo. A Memorandum of Understanding (MoU) was signed between the two governments for the monitoring of the stability of Lake Kivu.

SHORT BUSINESS INFO

- 29 billion m³ are economically exploitable in 300 m depth.
- Rwanda Investment Group (RIG) holds a 50 MW gas concession.
- KP1 pilot project of 4.5 MW is in operation since May 2008.

4.7 PEAT

There are several sites with peat reserves in Rwanda. The total amount of exploitable dry peat reserves is currently estimated at 155 million tons. Due to technical and economic difficulties and possible environmental impacts, however, there has been very little exploitation of peat yet. The Office of Geology and Mines in Rwanda (OGMR) mines peat in Rwabusoro on behalf of the MININFRA, while a concession has been given to ENEDOM, a local company, to mine peat in Rulindo. The Government is considering the use of peat for electricity generation and has invited potential investors to come forward for power plants of 25–50 MW capacity.

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

The following list shows RE companies and other business related organizations in Rwanda. None of the companies is manufacturing RE related products. There are also a number of companies involved in consultancy and research on the development of RE technology.

COMPANY	SUB-SECTOR	ADDRESS	EXPERIENCE IN RE	PHONE	E-MAIL/ WEBSITE
(ABC-R) Africa Business Consulting Rwanda	Wind, solar, hydro, bioenergy	/	/	Phone: +250 (0)8803665/08302323	jbmirira@yahoo.fr
Coopérative pour l'Environnement et le Développement au Rwanda (COOPED)	Bioenergy	/	Established in 1999 as a waste collection company; has now expanded to produce bioenergy	Phone: +250 (0)8508290-55101070	bupaulin@yahoo.fr
Rwanda Import Export (RIEX)	Micro Hydro Power, solar	P.O. Box 6165 Kigali – Rwanda	In final stage of implementing a micro hydro power plant project	Phone: +250 (0)8302845	gtayi@hotmail.com
Africa Business (AFRIBUS)	Established as an ICT company; has now expanded to include micro hydro and solar	P.O. Box 1253 Kigali – Rwanda	In the final stage of implementing a project to build a micro hydro power plant on river Masige in Kibuye	Phone: +250 (0)8305299-55101691	gilkal@yahoo.fr
Société de Transformation Industrielle de Ruhengeri (SOTIRU)	Micro hydro	/	Constructing a micro hydro power plant on Mpenge river to cater for the factory's power needs; has already experience in mini power plant management	Phone: +250 (0)8307455	sotiru1@yahoo.com
SOGEMER s.a.r.l.	Micro hydro	/	Currently constructing a 425 KW power plant on Musarara River in Gakenke District under the PSP Program	Phone: +250 (0)842 1191	hakundajmv@yahoo.fr
Groupe de Travail Ruraue (GTR)	Construction, distribution, commercialization of electricity to local population	P.O. Box 6445 Kigali – Rwanda	In the final phase of starting the construction of a 120 KW mini hydro power plant on River Mpenge Musanze	Phone: +250 (0)861 1946	mutag1@yahoo.com



COMPANY	SUB-SECTOR	ADDRESS	EXPERIENCE IN RE	PHONE	E-MAIL / WEBSITE
Association pour le Développement de Nyabimata (ADENYA a.s.b.l) Nyaruguru Southern Province	Micro hydro for rural electrification	P. O Box 226 Butare – Rwanda	Constructing a 250 KW micro power plant at Mazimeru river in Nyaruguru District under the PSP program through its affiliate company Energie Nyaruguru	Phone: +250 (0)842 1911	firmin_mutabazi@yahoo.fr
Rural Energy Solutions (RES)	Micro hydro power	/	Constructing a 110 KW micro hydro power plant on River Kavumu MWange river in Gicumbi District under PSP Program	Phone: +250 (0)877 1385	edkato2000@yahoo.co.uk
Énergie Domestique (ENEDOM)	Bioenergy	P.O. Box 339 Nyarugenge – Muhima	Established in 2000 for purposes of manufacturing briquettes from waste materials using funds secured from UNDP and Swiss embassy. Full-scale operation of the briquetting process started in 2001.	Phone: +250 8501309	enedom@yahoo.fr
Biomass Renewable Energy Rwanda (BRER)	Promotion of biomass technology	/	Building a 600 KW bioenergy plant at the BRALIRWA plant in Rubavu	Phone: +250 (0)8304031-05106636	atkanyo@yahoo.com
Construction and Renewable Energy Technologies (CRET s.a.r.l.)	Promotion of biofuel and biogas from organic waste	P.O. Box 1437 Kigali – Rwanda	Started operations in the field of construction and biogas technology. Design and construction of 60 m ³ biogas plant at St. Gabriel Monastery, Nyarugenge. Don Bosco Secondary School in Gatsibo and 21 others are under construction	Phone: +250 (0)8561340-05102712	cret06_sarl@yahoo.fr
AFRISET/HYGEBAD	Bioenergy and solar	/	Exploitation of the existing potentials in RE to provide alternative energy solutions	Phone: +250 8300327	afris1@yahoo.fr
Rwanda Energy Company (REC)	Exploitation of methane gas	/	It has contracted the French Datat Environment Company and the German/Belgian group of Global Power Systems to carry out a 7.5 MW power project with Methane from Lake Kivu; project is expected to be commissioned in March 2009	Phone: +250 8303959	ivan.twagirashema@gmail.com, itwagirishema@rig.co.rw
Kibuye Power Ltd.	Methane gas	/	KP1 pilot project of 4.5 MW commissioned in May 2008	Phone: +250 (0)8304499,58062/63	akabuto@yahoo.fr
Rwanda investment Group (RIG s.a.r.l.)	Association of Rwanda's business acumens	/	Currently in consortium with GoR and IPS to exploit methane gas from Lake Kivu	Phone: +250 8301452	fbirasa@yahoo.fr,fbirasa@rig.co.rw
CRE	Production of bioenergy	/	/	Phone: +250 8305836	mikemunya@hotmail.com
AHIG	Promotion of bioenergy	/	/	Phone: +250 8304001	Ahig_rw@yahoo.com
Modern Technologies Services (MTS) s.a.r.l.	Hydro, solar	/	/	Phone: +250 8352222	muluart@gmail.com
GIC	/	/	Production of biogas, pollution reduction and environmental protection by lowering firewood consumption	Phone: +250 8450078	nyiragnes@yahoo.fr
SEFIK	Solar, micro hydro and wind	/	Sale and installation of solar equipment	Phone: +250 8303426	b_assum@yahoo.fr
Bureau des Formations Medicales Agrées du Rwanda (BUFMAR).	Installation and maintenance of electricity by solar energy in rural areas	P.O. B 716 Kigali –Rwanda	Installation of solar equipment since 1975	Phone: +250 8300306	Erwagasana@hotmail.com
SOS Energy	Sale and installation of solar equipment	/	Not operating	Phone: +250 8301780	sosenergiw@yahoo.fr
Rural Energy Production (REPRO)	Electricity power production, especially for rural areas	P.O. Box 5155 Kigali – Rwanda	Currently constructing a micro hydro plant on R. Rwishwa in Murunda, Kamonyi District	Phone: +250 8646404	ngobro@hotmail.com
SNV	/	P.O. Box 1049 Kigali –Rwanda	Dutch organization with 25 years of experience in Rwanda; carries out advisory services to develop a viable biogas sector	Phone: +250-504121	www.snvworld.org/en/Pages/default.aspx
Industrial Promotion Service (IPS)	Part of Agakhan Fund for Economic Development (AKFED)	/	Has formed consortium with Rwandan Government and RIG to exploit methane gas form lake KIVU	Phone: +41 22 909 7200 Fax: +4122 9097292	/
(ABC-R) Africa Business Consulting Rwanda	Wind, solar, hydro, bioenergy	/	/	Phone: +250 (0)8803665/08302323	jbmira@yahoo.fr
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Rwanda investment Group (RIG s.a.r.l.)	Association of Rwanda's business acumens	/	Currently in consortium with GoR and IPS to exploit methane gas from Lake Kivu	Phone: +250 8301452	fhirasa@yahoo.fr, fhirasa@rig.co.rw
CRE	Production of bioenergy	/	/	Phone: +250 8305836	mikemunya@hotmail.com
AHIG	Promotion of bioenergy	/	/	Phone: +250 8304001	Ahig_rw@yahoo.com
Modern Technologies Services (MTS) s.a.r.l.	Hydro, solar	/	/	Phone: +250 8352222	muluart@gmail.com
GIC	/	/	Production of biogas, pollution reduction and environmental protection by lowering firewood consumption	Phone: +250 8450078	nyiragnes@yahoo.fr
SEFIK	Solar, micro hydro and wind	/	Sale and installation of solar equipment	Phone: +250 8303426	b_assum@yahoo.fr
Bureau des Formations Medicales Agrées du Rwanda (BUFMAR).	Installation and maintenance of electricity by solar energy in rural areas	P.O. B 716 Kigali –Rwanda	Installation of solar equipment since 1975	Phone: +250 8300306	Erwagasana@hotmail.com
SOS Energy	Sale and installation of solar equipment	/	Not operating	Phone: +250 8301780	sosenergiw@yahoo.fr
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Industrial Promotion Service (IPS)	Part of Agakhan Fund for Economic Development (AKFED)	/	Has formed consortium with Rwandan Government and RIG to exploit methane gas form lake KIVU	Phone: +41 22 909 7200 Fax: +4122 9097292	/



5.2 LOCAL BUSINESS-RELATED INSTITUTIONS

NAME	ADDRESS	PROFILE	ROLE
Kigali Institute of Science and Technology (KIST)	P.O. Box 3900 Kigali – Rwanda	KIST was established through the combined efforts of Rwanda's Ministry of Education, UNDP Rwanda and the German Technical Cooperation Agency (GTZ) as the implementing agency.	The institute equips students with advanced skills and hands-on training and promotes research on energy, environment and other disciplines. It has established a center for innovation and technology transfer between various disciplines including RE.
The Institute of Scientific and Technological Research (IRST)	P.O. Box 227 Butare – Rwanda Phone: +250 530395	The institute was established within the framework of research restructuring in Rwanda. Its innovative technologies help the Rwandan population to solve their socio-economical problems.	The institute specializes in research activities in energy (peat, solar, hydro electric micro central).
National University of Rwanda	P.O. Box:117 Butare – Rwanda Phone: +(250) 30122	The university was established in 1963 by the Government in cooperation with Quebec and focuses on science, technology and humanity science.	The university generates and disseminates high-quality multidisciplinary knowledge and promotes effective research, skills training and community service for sustainable socio-economic development .

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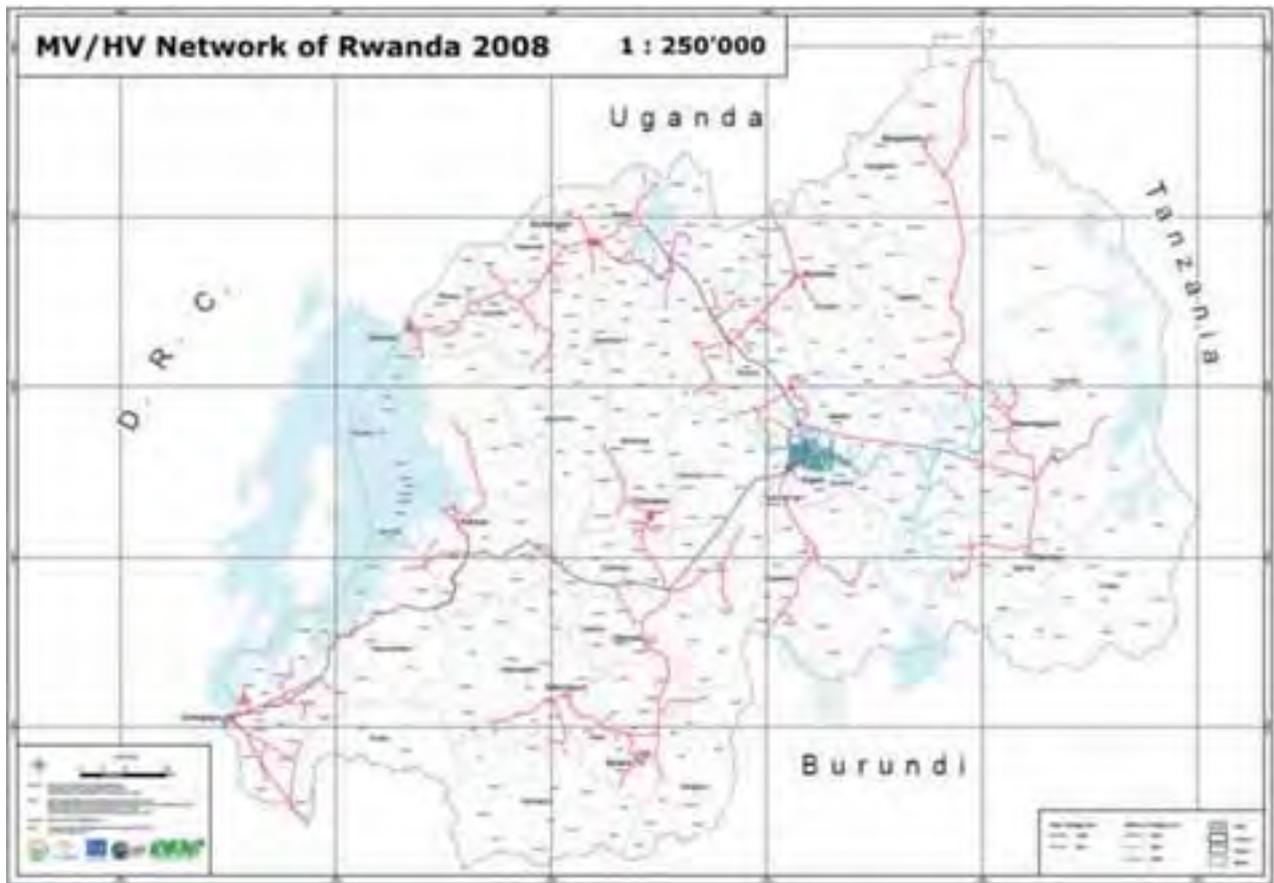
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7.2 MAP OF THE NATIONAL ELECTRICITY GRID



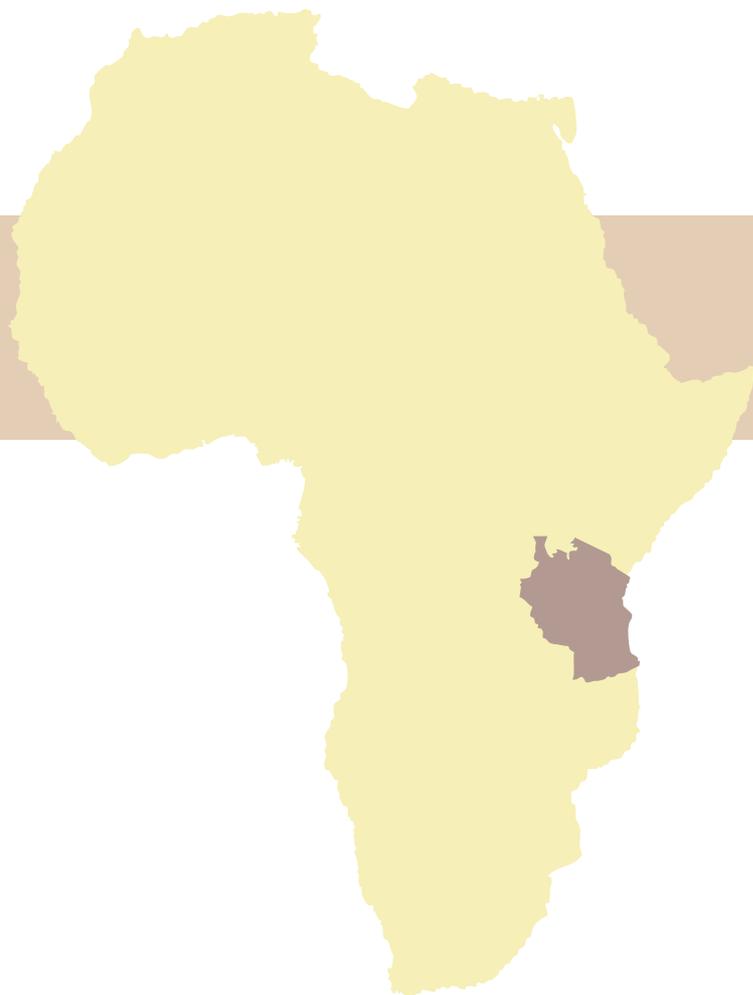
Source: BTC-CTB/CGIS-NUR, as of 2008



7.3 SHARE OF LOCAL AND IMPORTED ENERGY SOURCES

LOCAL ENERGY SOURCES		2002	2003	2004	2005	2006	2007
Type of power	Power plant	Net gen. (GWh)	Net gen. (GWh)	Net gen. (GWh)	Net gen. (GWh)	Net gen (GWh)	Net gen. (GWh)
Hydro	GIHIRA	6.91	6.57	5.55	5.91	5.91	5.95
Hydro	GISENYI	5.70	4.78	4.54	4.38	3.81	4.53
Hydro	MUKUNGWA	56.69	71.11	53.03	40.09	25.70	16.04
Hydro	NTARUKA	28.91	35.17	21.20	15.35	5.75	0.80
Hydro	Total	98.21	117.64	84.32	65.73	41.17	27.32
Diesel/light fuel oil	Jabana	0.00	0.00	3.59	25.40	19.24	9.47
Diesel/light fuel oil	Gatsata (old plant)	0.00	0.00	0.00	0.00	0.00	0.00
Diesel/light fuel oil	Gatsata (new)	0.00	0.00	2.66	14.08	1.18	1.93
Diesel/light fuel oil	Gikondo	0.00	0.00	0.00	10.66	82.26	66.22
Diesel/light fuel oil	Mukugwa	0.00	0.00	0.00	0.00	24.72	33.85
Diesel/light fuel oil	Total	0.00	0.00	6.26	50.14	127.40	111.47
Biomass		12,240.00	12,290.00	12,341.00	12,391.00	12,442.00	12,492.00
Solar	JARI	0.00	0.00	0.00	0.00	0.00	2.00
Total energy produced locally		12,338.21	12,407.64	12,410.38	12,506.84	12,610.87	12,632.79
Imported energy sources							
Hydro Power							
Import of power	RUSIZI 1/SINELAC	7.44	2.52	20.09	20.89	36.45	15.06
Import of power	GOMA SNEL/DRC	0.00	0.00	0.10	0.00	0.00	0.00
Import of power	RUSIZI II/SINELAC	126.74	116.06	91.42	64.56	40.78	53.62
Import of power	KABALE/UGANDA	1.52	2.33	4.19	3.59	2.79	0.66
Import of power	Total	135.69	120.92	115.81	89.05	80.02	69.34
Oil		2,498.00	2,498.00	2,498.00	2,498.00	2,498.00	2,498.00
Total imported energy		2,633.69	2,618.92	2,613.81	2,587.05	2,578.02	2,567.34
Total energy (local and imported)		14,971.90	15,026.56	15,024.19	15,093.89	15,188.89	15,200.13
Energy imported to the total (%)		17.60	17.40	17.40	17.40	17.00	16.90

Source: unknown



COUNTRY CHAPTER: TANZANIA

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ACRONYMS AND ABBREVIATIONS

TANZANIA

AfDB	African Development Bank
AREED	African Rural Energy Enterprises Development
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
BDS	Business Development Services
BEB	Bio-Energy Berlin GmbH
BP	British Petroleum
BRELA	Business Registration and Licensing Authority
CAMARTEC	Center for Agriculture Mechanization and Rural Technology
CDM	Clean Development Mechanism
CEO	Chief Executive Officer
CHP	Combined Heat and Power
CNG	Compressed Natural Gas
CoET	College of Engineering and Technology
COSTECH	Commission for Science and Technology
DIT	Dar es Salaam Institute of Technology
DNA	Designated National Authority
DRC	Democratic Republic of Congo
E&CO	Energy & Company (Enterprise for clean energy investments in developing countries)
DTP	Deutsch-Tansanische Partnerschaft
E+Co	Energy through Enterprise (international financing institution)
EE	Energy efficiency
ESAMI	Eastern and Southern Africa Management Institute
EU	European Union
EWURA	Energy and Water Utilities Regulatory Authority
FELISA	Farming for Energy for Better Livelihoods in Southern Africa
GDP	Gross Domestic Product
GEF	Global Environment Facility
GENI	Global Energy Network Institute
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HFO	Heavy Fuel Oil
IEA	International Energy Agency
ICSID	International Center for Settlement of Investment Disputes
ICT	Information Communication Technology
IIRT	International Investor's Round Table
IPPs	Independent Power Producers
IPTL	Independent Power Tanzania Ltd.
KAKUTE	Kampuni ya Kusambaza Teknolojia
KARADEA	Karagwe Development Association
LIRT	Local Investors' Round Table
LPG	Liquefied Petroleum Gas
MCC	Millennium Challenge Corporation
MEM	Ministry of Energy and Minerals
MFI	Microfinance Institutions
MIGA	Multilateral Investment Guarantee Agency
MIGESADO	Miradi ya Gesi ya Samadi Dodoma
MLVTC	Mafinga Lutheran Vocational Training Center
MRHP	Mwanza Rural Housing Project
NAPA	National Adaptation Program of Action
NEMC	National Environment Management Council
NEP	National Energy Policy
NG	Natural Gas
NGO	Non-governmental Organization
NORAD	Norwegian Development Agency
PDD	Project Design Document



PIN	Project Idea Note
PPA	Power Purchase Agreement
ProBEC	Program for Biomass Energy Conservation
PSMP	Power Sector Master Plan
PSOM	Programma Samenwerking Opkomende Markten (Program for Cooperation with Emerging Markets)
R&D	Research and Development
RE	Renewable Energy
REA	Rural Energy Agency
REB	Rural Energy Board
REDCOT	Renewable Energy Development Company Tanzania
REF	Rural Energy Fund
RES	Rural Energy Systems
SACCOS	Savings and Credit Cooperative Society
SEECO	Sustainable Energy and Environment Company
SGP	Small Grant Program
SIDA	Swedish International Development Agency
SIDO	Small Industries Development Organization
SSMP	Sustainable Solar Market Packages
SSPPA	Standardized Small Power Purchase Agreement
SUDERETA	Sustainable Development through Renewable Energy Tanzania
SUMATRA	Surface and Marine Transport Regulatory Authority
TANESCO	Tanzania Electric Supply Company
TANWAT	Tanzania Wattle Company
TASEA	Tanzania Solar Energy Association
TaTEDO	Tanzania Traditional Energy Development and Environment Organization
TAZARA	Tanzania Zambia Railway
TBS	Tanzania Bureau of Standards
TCCIA	Tanzania Chamber of Commerce, Industries and Trade
TCRA	Tanzania Communication Regulatory Authority
TDTC	Technology Development and Transfer Center
TEDAP	Tanzania Energy Development Access Program
TFC	Total Final Energy Consumption
TIC	Tanzania Investment Center
TIRDO	Tanzania Industries Research Development Organization
TPC	Tanzania Planting Corporation
TPDC	Tanzania Petroleum Development Corporation
TPES	Total Primary Energy Supply
TPSF	Tanzania Private Sector Foundation
TRA	Tanzania Revenue Authority
TZS	Tanzanian Shilling
UDSM	University of Dar es Salaam
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Program
UNIDO	United Nations Industries Development Organization
USD	United States Dollar
VAT	Value Added Tax
VETA	Vocational Education and Training Authority
WB	World Bank
ZASEA	Zanzibar Solar Energy Association



MEASUREMENTS

°C	degree Celsius
m ³	cubic meter
GWh	gigawatt hour
kg	kilogram
kgoe	kilogram of oil equivalent
km	kilometer
km ²	square kilometer
kWh	kilowatt hour
l	liter
m	meter
MW	megawatt
MWe	megawatt electrical
s	second
toe	tons of oil equivalent
Wp	Watt-peak (kWp = kilowatt peak)



SUMMARY

ECONOMICAL STATUS AND DEVELOPMENT OF TANZANIA

Tanzania is located at the Indian Ocean with Dar es Salaam as the country's commercial capital.

Agriculture is the dominant sector in Tanzania, providing livelihood, income and employment to over 80 % of the population. It accounted for 56 % of the Gross Domestic Product (GDP) and 60 % of export earnings in the past three years. It is also an important sector in terms of food production, employment generation, production of raw materials for industries and generation of foreign exchange. Poverty is one of the main problems affecting about 50 % of the households throughout the country and even more in rural areas¹. The recently completed National Adaptation Program of Action (NAPA) is supposed to enable the country to further integrate adaptation issues in the development process. The program is focusing on high and shared growth, quality livelihood, peace, stability, unity, good governance, high-quality education and international competitiveness².

Gold, coffee and cashew nuts are the main export goods. The economy is growing steadily at a rate of about 6 % (as of 2006).

82 % of the population live in rural areas and are mainly engaged in subsistence agriculture. The GDP per capita is 1,400 USD. About 50 % of the population live below the poverty line, spending around one third of their income on energy products. Tanzania Development Vision 2025 aims at poverty alleviation by the year 2025.

STRUCTURE OF ENERGY SUPPLY IN TANZANIA

Tanzania's primary energy supply and consumption is dominated by biomass (90 %) followed by petroleum (7 %), gas (2 %) and hydro power (1 %)³. The majority of the population relies on biomass as fuel for cooking.

Electricity

Electricity is generated from six hydro power stations (591 MW) and thermal gas or oil fired power stations (658 MW). Tanzania also imports electricity from Uganda (8 MW) and Zambia (5 MW). The total capacity of 1,249 MW produced 4,156 GWh in 2008. In the last years, the share of Independent Power Producers (IPP) increased from 14 % (as of 2002) to 42 % (as of 2008) due to the increase in private electricity generation by thermal sources increased from 190 GWh to 1,58 GWh⁴.

The electrification rate is at 10 % countywide with about 30 % of the urban population having access to the national grid, while in rural areas access stands at 2 %. The average per capita consumption is 82 kWh per year.

Oil

Oil exploration is being pursued by more than eleven companies, but so far no oil has been found. The nation imports all of its liquid fuel for an annual demand of about 1.8 million metric tons. Petroleum consumption by sector was at the following levels in 2006: transport 76 %, industry 10 % and residential use 13 %. Presently, Tanzania spends more than 190 billion USD per year on the importation of petroleum products equaling about 26 % of the country's total foreign currency earnings⁵.

It is important to note that a number of exploration agreements for petroleum have been signed between the Government and oil exploring companies, namely Dodsal Hydrocarbon and Power of India (exploration of Ruvo area), Funguo Petroleum of Australia (exploration of western Songosongo area) and Hydrotanz of Mauritius (exploration of northern Mnazi Bay area).

STATUS OF RENEWABLE ENERGIES IN TANZANIA

Biomass

90 % of Tanzania's primary energy supply is covered by biomass as dominant source of energy with a per capita consumption of 1.13 m² per year. To reduce deforestation, improved efficiency stoves were introduced many years ago. Today, around 15,000 improved stoves are produced and sold per month in Tanzania. In addition, around 6,000 small residential biogas plants for cooking purpose are currently in operation⁶.

The conversion of biomass into biofuels is currently under development with eight international companies having registered pilot projects. Moreover, a pilot biogas demonstration plant for electricity production is in operation.

Solar

The photovoltaic (PV) market in Tanzania has been developed via international programs in the recent years. The total installed PV capacity is around 1,8 MW, while the annual installation rate is at around 200 kWp per annum with rising tendency. Around 20 registered solar companies are currently benefiting from two PV promotion projects, the Swedish Development Agency (SIDA)/Ministry of Energy and Minerals (MEM) project and the United Nations Development Program (UNDP)/Global Energy Facility (GEF)/MEM project. In addition, residential PV systems of up to 100 Wp are subsidized at 2 USD per Wp by the Rural Energy Agency (REA) respectively the Rural Energy Fund (REF).

There are more than 300 technicians already trained for installation and after-sales service, but the distribution channels of the solar companies into the rural areas remain weak.

1 SEE ALSO UNITED REPUBLIC OF TANZANIA/VICE PRESIDENT'S OFFICE, AS OF 2007

2 SSN TANZANIA ADAPTATION TEAM, AS OF 2006

3 IEA, AS OF 2007

4 MINISTRY OF ENERGY AND MINERALS MEM, AS OF 2008

5 IEA, AS OF 2007

6 PROBEC, AS OF 2009



Hydro

Over the years, the power sector of Tanzania has been dominated by hydro power at 50–75 % of the electricity supply. To date, the development of new hydro power capacities still offers the main business opportunity in the power sector.

Of the available 315 MW of small hydro potential in Tanzania, only less than 8 MW have been exploited. Feasibility studies in seven regions were facilitated by MEM in 2006 and 2007 for further development.

Wind

The potential for wind energy was quantified by the East Africa Meteorological Department in 1975 for the entire region. Since the data were measured at an insufficient height of about 2 m, they are not reliable. No wind map exists for Tanzania so far.

Geothermal

A geological survey of Tanzania is being conducted since June 2006 by MEM and the Federal Institute for Geosciences and Natural Resources (BGR) of Germany. The estimated geothermal potential is about 600 MWe. Detailed surveys, however, are still required to quantify the available potential.



1 COUNTRY INTRODUCTION

1.1 TANZANIA OVERVIEW

The United Republic of Tanzania became a union of two sovereign states namely Tanganyika and Zanzibar on 26 April 1964. Tanzania borders Kenya and Uganda in the North and Rwanda, Burundi and Democratic Republic of Congo in the West. In the South, it borders Zambia, Malawi and Mozambique and in the East it the Indian Ocean.⁷

1.2 TANZANIA STATISTICS: GEOGRAPHY AND ECONOMICS

LAND AREA:	945,000 km ² (Tanzania mainland 881,000 km ² , Zanzibar 2,000 km ²)
LOCATION:	Between longitudes 290 and 410 East and latitudes 10 and 120 South
POPULATION:	38.7 million (mainland 37.6, Zanzibar 1.1), growth rate 2.9% (as of 2007)
ADMINISTRATIVE REGIONS:	26 administrative regions (21 are in the mainland and 5 in Zanzibar)
LANGUAGE	Swahili (common language) and English
CAPITAL CITY:	Dodoma region is the political capital city, located 309 km West of Dar es Salaam as commercial capital
POLITICAL:	Free of ideological confrontations, ethnic problems and labor disputes; center of economic and political stability in Sub-Saharan Africa; multiparty democracy was adopted in 1992 and has not disturbed the peaceful political climate; country is home of a number of refugee camps for neighboring countries in the region (e.g. Burundi, Rwanda, Democratic Republic of Congo)
ROLE IN EAST AFRICA:	Easy networking; it borders the Indian Ocean, has three international airports and extensive road networks; is strategically positioned as a hub for most surrounding landlocked countries including Malawi, Zambia, Burundi, Rwanda and Uganda as well as Eastern DRC; other sea ports include Zanzibar, Tanga, and Mtwara; Dar es Salaam Port and the international airport present themselves as gateways into East and Central Africa thus rendering Tanzania a logical investment destination for investors; furthermore, Tanzania is home of the East African Community Secretariat in Arusha
POPULATION DENSITY:	41 inhabitants/km ² (as of 2007)
SHARE URBAN/RURAL POPULATION:	Urban 18% and rural 82%
BIG CITIES AND POPULATION:	Dar es Salaam (2.5 million), Mwanza (2.9 million), Mbeya (2.1 million), Arusha (1.3 million), Dodoma (1.7 million) and Tanga (1.6 million) (as of 2002)
CLIMATE:	Tropical climate; in highlands temperatures between 10° and 20°C for both cold and hot seasons; rest of the country has an average temperature of above 20°C; hottest period between November and February (25°-31°C); coldest period between May and August (15°C-20°C); two rainfall regimes over Tanzania: unimodal (December-April, experienced in southern, southwestern, central and western parts of the country) and bimodal (October-December; March-May, found towards the northern coast)
PHYSIOGRAPHIC REGIONS:	Islands and coastal plains to the East; inland saucer-shaped plateau; the highlands; Tanzania is also marked by the Great Rift Valley running from the North East of Africa through central Tanzania
ALTITUDE:	Main mountains include Mount Kilimanjaro (5,895 m), Mount Meru (4,566 m) and Mount Rungwe (2,960 m); others are the Uluguru Mountains (2,648 m), Rubeho Mountains (2,576 m), Livingstone Mountains (2,521 m), Mbizi Mountain (2,418 m), Mahari Mountain (2,373 m) and Usambara Mountains (2,300 m)
MAIN WATER BODIES:	Water surfaces cover 62,000 km ² and include Lake Victoria, Nyasa, Tanganyika, Rukwa, Kitangiri, Eyasi and Manyara, Tanzania also borders the Indian Ocean with significant part of the coastline, islands and waters within its boundaries
FOREST AND WOODLANDS:	3.350 km ²
MINERALS:	Gold, diamonds, tanzanite and various other gemstones, natural gas, iron ore, coal, spring water, phosphates, soda ash and salt
WILDLIFE:	12 National Parks, the Ngorongoro Conservation Area, 13 game reserves, 38 game controlled areas and about 120 national cultural heritage sites
FORESTRY:	Non-reserved forest land (1,903.8 km ²), forest/woodlands with national parks etc. (200 km ²) and forest reserves (1,251.7 km ²)
FISHERY:	Practiced on the three large lakes, i.e. Victoria, Tanganyika and Nyasa, on Indian Ocean coastline, rivers and wetlands; potential yield of fish from natural waters is 730,000 metric tons annually; present catch is 350,000 metric tons
GDP - PER CAPITA (AT PURCHASING POWER PARITY):	TZS 399,873 (as of 2006); 1,296 USD (as of 2007)
GDP SECTORS:	Agriculture 45%, industry 17%, services 38%
INFLATION RATE (CONSUMER PRICES):	7% (as of 2007)
EXCHANGE RATE:	1 TZS = 0, 00053 € (as of 2009)
GDP GROWTH (2007):	6.2%
POVERTY:	About 35% of the population live below poverty line (as of 2007), out of which 35.7% are unable to access all basic needs (including energy services; the poor spend 35% of household income on energy; the better off spend only 14,45%)
CORRUPTION PERCEPTIONS INDEX 2007 (TRANSPARENCY INTERNATIONAL):	Rank 94 out of 179
AGRICULTURE:	Tea, coffee, cotton, sisal, cashew nuts and horticulture
INDUSTRIES:	Cement, agro processing, mining, textile, refining and construction industry

⁷ A COUNTRY MAP FOR VISUALIZATION IS ATTACHED AS ANNEX 7.1.



TOTAL ENERGY CONSUMPTION:	22 million toe or 0.7 toe per capita (energy consumption in rural areas accounts for about 85 % of total national energy consumption)
ELECTRICITY – PRODUCTION:	4,156 GWh (as of 2007)
ELECTRICITY – CONSUMPTION:	3,288 GWh (as of 2007)
ELECTRIFICATION RATE:	urban 30 %, rural 2 %
PETROLEUM – CONSUMPTION:	1.45 million metric tonnes per annum (2005 est.)
OIL – PROVEN RESERVES:	45 million cubic metres (at Songo Songo and Mnazi Bay)
EXPORTS:	2.49 billion USD (as of 2008)
EXPORTS – COMMODITIES:	gold, diamond, gemstones, nickel, tea coffee, cotton, cashew nuts and horticultural products including cut flowers
EXPORTS – PARTNERS:	East African Community, SADC Countries, Europe, South Africa and East Asia
IMPORT – COMMODITIES:	5.901 billion USD (as of 2008)
IMPORT – PARTNERS:	EU (22 %), South Africa (14 %), China (8 %), Japan (7 %), UAE (7 %), Kenya (5 %)
TOURISM (2006):	622,000 arrivals; 950 million USD revenue

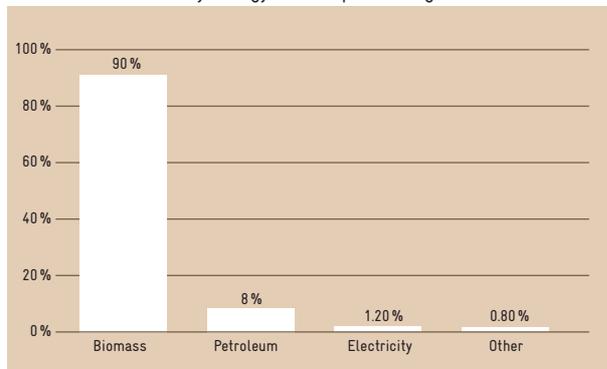
Source: data compiled by the author from different sources, e.g. CIA, as of 2009

2 ENERGY MARKET IN TANZANIA

2.1 ENERGY SITUATION OVERVIEW

Similar to other East African countries, the majority of the population lives on biomass (90 %). The share of other energy sources is significantly lower with petroleum at 8 %, electricity at 1.2 % and others as solar, wind etc. at 0.8 %. Biomass is mainly used for cooking (primarily firewood and charcoal). Tanzania’s energy demand and supply balance reflects the country’s low level of industrialization and development. Tanzania has no known petroleum or crude oil resources. There are substantial gas deposits and some coal is found, but the majority of used resources still comes from renewable biomass and waste. Concerning its petroleum products, Tanzania is fully dependent on imports. Electricity is generated mainly from hydro power and thermal (gas) plants⁸. Further detailed information about supply, resources and consumption is given in annex 7.

FIGURE 1
Shares of Total Primary Energy Consumption in Uganda



Source: graph compiled by PSE AG with data from MEM (as of 2008) and from ProBEC, as of 2009

8 SEE IEA, AS OF 2007 AND 2007

9 NOTE: THIS NUMBER ONLY CONSIDERS THE DECOMMISSIONED DOWAN’S POWER PLANT AND THE AMOUNT OF POWER GENERATED UP TO JUNE 2008.

10 MAGESSA, 2008, P.9.

11 THE MAJORITY OF HOUSEHOLDS USES WOOD OR CHARCOAL FOR COOKING; SEE ALSO PROBEC, VIEWED IN 2009

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

The table below (Table 1) shows the overall performance of the electric power sector:

A significant portion of electric energy is produced by hydro power followed by gas as the second important electricity source. The total installed capacity (hydro and thermal) was about 1,186 MW in 2008⁹. Still, current hydro power resource exploitation is estimated at less than 13 % of the available potential¹⁰. The additional electricity demand is covered by small imports from Zambia and Uganda of around 2 % in 2006 and about 1 % in 2008.

The total electrification rate reached 10.8 % (as of 2008), of which urban electrification rate is around 30 % and the rural electrification rate only reaches 2 %. At the same time, 94 % of the rural population use biomass (such as wood or dung) as prior (non-electric) energy source. On household level, 12 % have access to the national grid, but only 1 % is able to use electricity for cooking¹¹. This means that the vast majority of people have no access to electricity and the rural population is nearly completely excluded from this source of modern energy. Basically, the high costs of grid extension and connections as well as for the transport of petroleum products adversely impact on the pace of exploitation and extension of grid services especially to communities in rural areas. It costs more than 10,000 USD per kilometer to extend a high transmission line of 132 kW. The total number of customers connected to the grid is about 701,000. New connections are still limited to 3,255 connections per month. Regardless of connection bureaucracy at TANESCO, there are more than 100,000 applications for new connection per annum, which suggest an existence of a strong demand for the service¹².

Regarding the sectoral energy consumption in Tanzania, the industry sector accounts for 11 % of the final energy consumption. The highest consumption is covered by other sectors such as residential, commercial and public services, agriculture etc. (83 %)¹³.

12 MAGESSA, 2008, P.9-10 AND TANESCO, 2008

13 FOR DETAILS SEE ANNEX 8.5 – FINAL ENERGY CONSUMPTION BY ENERGY SOURCE AND SECTOR, P.42-43, AND IEA, AS OF 2007



TABLE 1
Power and Electricity Performance in Tanzania

YEAR	2002	2003	2004	2005	2006	2007	JUNE 2008
Peak Demand (MW)	474.9	506	509	551	603	653	760
Load Factor	69.5	73.1	76.1	78.1	67.9	72.6	74.7
Total Installed Capacity (MW)	882	871	911	953	956	1226	1186
Public	717	755	635	633	615	715	715
%	86	87	70	66	64	58	60
Private (IPPs)	115	116	276	320	343	511	471
%	14	13	30	34	36	42	40
Generation (GWh) by	2,892	3,239	3,394	3,771	3,588	4,156	2,154
Hydro	2,668	2,551	2,011	1,881	1,439	2,576	1,422
Thermal (mainly gas)	190	647	1,337	1,840	2,089	1,580	700
Imports from Zambia and Uganda	33.5	41.0	46.0	50.4	60.5	60.5	32.1
Electricity sales (GWh)	2,187	2,326	2,465	2,628	2,769	3,288	3,288
Total electricity customer	515,000	581,000	608,000	665,000	635,000	662,000	701,000

Source: TANESCO, as of 2008

2.3 ENERGY PRICES

The average prices of energy sources in 2008 are provided in the table below. The prices fluctuate very much with crude oil prices and exchange rates.

TABLE 2
Average Energy Prices in Tanzania

ENERGY FORM	PRICE		REMARK
Diesel	1,430.00 TZS/l	0.780 €/l	Price at filling station
Petroleum	1,340.00 TZS/l	0.730 €/l	Price at filling station
Electricity	129.03 TZS/kWh	0.070 €/kWh	For households
Electricity	70.00 TZS/kWh	0.039 €/kWh	For industry
Kerosene	1,000.00 TZS/l	0.540 €/l	Pump price
LPG	2,133.00 TZS/kg	1.160 €/kg	Retail price at dealers
Charcoal	500.00 TZS/kg	0.270 €/kg	Not sold per kg, but a bag of 60 kg is sold at 30,000 in TZS Dar es Salaam (differs in other townships)

Sources: data compiled by the author (as of 2008) with information on tariffs from EWURA website (www.ewura.go.tz/fuelprices and www.tanESCO.com)

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

The Ministry of Energy and Minerals is responsible for policy planning, implementation and the facilitation of a conducive atmosphere for the development and use of energy in the country. RE is a section in the Department of Energy of the MEM. Other energy sections include energy development and planning for electricity, petroleum and gas and are headed by Assistant Commissioners who report to the Commissioner for Energy and Petroleum Affairs.

Other actors who also take part in energy planning, regulation and distribution include EWURA, REA, TANESCO and established IPPs. While REA is responsible for rural energy investment promotion, EWURA regulates energy and water utilities. TANESCO is still the key generator, grid operator and distributor of grid power in the country.

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

The Government of Tanzania is committed to facilitate the increased use of RE as an important source in the energy mix and a major means to support the national development goals. Therefore, a number of legal framework measures, policies and strategies have been formulated and enacted to provide a constructive atmosphere for industrial growth. In the following section, some of the existing policies and strategies adopted for the promotion and facilitation of an increased use of RE within the country are presented.

There are no Value Added Tax (VAT) and custom duties on solar and wind technology products. Other products and appliances are subject to a VAT of 20%, while custom duties range from 20 to 30%.

SHORT BUSINESS INFO

Zero import duty on wind and solar technology products.



3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

The current National Energy Policy (NEP) was issued in the year 2003. This is the second energy policy after launching the first NEP in 1992. Some legal framework measures and strategies have been formulated by the Government in order to enhance and guide the implementation of the energy policy. These include the Rural Energy Act of 2005 established by the REA/REF, the Energy and Water Utilities Regulatory Authority (EWURA) Act of 2001 and the Electricity Act of 2008.

National Energy Policy

Objectives of the NEP¹⁴ are to ensure availability of reliable and affordable energy supply and use in a rational and sustainable manner in order to support national development goals. Therefore the existing energy policy aims to establish energy production, procurement, transportation, distribution and end use systems in an efficient, environmentally sound, sustainable and gender-sensitized manner. The NEP comprises local and international political, economic, social, environmental and other structural changes. Key objectives of the NEP regarding RE technologies and services include:

- Encourage efficient use of alternative energy sources
- Ensure priority on power generation capacity based on indigenous resources
- Facilitate R&D and application of RE for electricity generation
- Facilitate increased availability of energy services including grid and off-grid electrification of rural areas
- Establish norms, codes of practice, standards and guidelines for cost-effective rural energy supplies and for facilitating the creation of an enabling environment for the sustainable development of RE sources
- Introduce and support appropriate fiscal, legal and financial incentives for RE
- Ensure the inclusion of environmental considerations in energy planning and implementation
- Enhance co-operation with other relevant stakeholders
- Support R&D in RE technologies
- Promote entrepreneurship and private initiatives for the production and marketing of products and services for rural and renewable energy

Energy and Water Utilities Regulatory Authority

EWURA, established by Act No. 11 of 2001 (amended as chapter 414)¹⁵, is responsible for water and energy regulation affairs. Being a legal corporate entity, EWURA promotes effective competition and economic efficiency, protects the interests of consumers and the financial viability of efficient suppliers and promotes the availability of regulated services to all consumers including low-income, rural and disadvantaged consumers. It also enhances public knowledge, awareness and understanding of the regulated sectors including:

- Rights and obligations of consumers and regulated suppliers
- Ways in which complaints and disputes may be initiated and resolved
- Duties, functions and activities of EWURA

The key functions of EWURA include the issuing, renewing and canceling of licenses, the establishment of standards, terms and conditions for the supply of goods and services and the regulation of rates and charges. Other functions comprise performance monitoring of the regulated sectors with regard to investment, availability, quantity and standard of services, cost of services, efficiency of production and distribution of services. As to petroleum and natural gas, EWURA regulates transmission and distribution, facilitates the resolution of complaints and disputes, disseminates relevant information, consults with other regulatory authorities and administers the Act.

Rural Energy Act¹⁶

The Rural Energy Agency (REA) and the Rural Energy Fund (REF) are autonomous bodies established under the Rural Energy Act No. 8 of 2005. The Ministry of Energy and Minerals (MEM) oversees the activities of REA/REF.

As rural energy issues are diverse and characterized by various actors with different interests, an institutional framework was established in order to mobilize, coordinate and facilitate private and public initiatives for the development of a rural energy industry. In order to reach this goal, the REA/REF were established to:

- Promote, stimulate, facilitate and improve modern energy access for social and commercial use in rural areas
- Promote the rational and efficient production and use of energy
- Utilize the REF to finance suitable rural energy projects
- Facilitate activities of key stakeholders with interest in rural energy
- Provide capital subsidies to rural energy projects through a trust fund
- Allocate resources to projects in a transparent manner and with well-defined criteria

The Act provides REF with funds from the following sources:

- Governmental budgetary allocations on an annual basis
- Contributions from international financial organizations, multilateral and bilateral agencies and other development partners
- Levies of up to 5% on the commercial generations of electricity from the national grid
- Levies of up to 5% on the generation of electricity in specified isolated systems
- Fees for programs, publications, seminars, consultancy activities and other services provided by the agency
- Interests or return on investment

REA/REF have already supported various off-grid projects with developers including 13 Small Hydro Power Projects, two Biomass Cogeneration Projects (TPCL & Sao Hill) and

14 SEE ALSO PARLIAMENT OF TANZANIA (WWW.PARLIAMENT.GO.TZ) > DOCUMENTS > ACTS

15 EWURA, AS OF 2001

16 SEE ALSO PARLIAMENT OF TANZANIA (WWW.PARLIAMENT.GO.TZ) > DOCUMENTS > ACTS



two Biomass Gasification Projects (Mafia & Mkonge Energy). These projects are currently at various stages of implementation. The total expected capacity is 46.2 MW, 8,400 new connections are expected. The total expected costs for all projects are 118.9 million USD of which REA will contribute 4.2 million USD.

REA/REF support fiscal incentives for rural energy projects and programs and count amongst the national aid initiatives attracting international fiscal initiatives. The autonomous agency provides capital subsidies and grants for successful rural energy projects developers. On top of the Government subsidy to the REF, the agency is allowed to take up to 5 % surcharge on each unit of energy generated by commercial electricity producers. The REA/REF will grant a subsidy of 500 USD per rural connection that will be made.

REA/REF subsidies also support solar PV systems, but whereby all small rural PV systems need to be installed by a developer. The subsidy is Ltd. to 100 Wp for residential systems and 300 Wp for Institutions. System subsidy is 2 USD per Wp. Bigger projects must be negotiated bilaterally with REA.

Electricity Act of 2008¹⁷

The Act replaced the Electricity Ordinance Cap. 131 of 1931, which was amended eleven times and was stipulating monopoly in the electricity sector. The act implements the NEP of 2003. It is opening up the sectors of electricity generation, transmission, distribution and sales to private sector participation. The Act provides instruments for the regulator (EWURA), stipulates the roles of REA/REF and sets the general conditions for cost reflective tariffs and least-cost electrification options.

The Act recognizes other strategic Acts and legal entities for the electricity sector such as the EWURA Act, Fair Competition Commission, Rural Energy Act, Standardized Small Power Purchase Agreement for 100 kW to 10 MW, Standardized Power Purchase Tariff and Fair Competition Tribunal. The act allows for electricity to be generated from any primary source (including RE). Moreover, the Act lays down that the Power Sector Master Plan (PSMP) be updated annually, which is an opportunity for new confirmed resources to be accommodated as potential options for power supply and use in the country. It also calls for the preparation of a Rural Electrification Strategy & Plan to promote access to electricity in rural Tanzania.

In general, the Electricity Act 2008 has opened up windows for increased RE promotion especially in rural areas. As to the aspects of least cost and cost effectiveness in electricity supply, more research and development in RE would increase competitiveness of the same.

Finance Sector

In Tanzania there are 25 commercial banks, three financial institutions, more than 150 Bureau de Changes and a number of local Microfinance Institutions (MFIs) and savings and credit organizations. The participation of local financial enti-

ties in the promotion and support of RE businesses, however, has been Ltd..

A study on removing barriers for solar PV markets in Tanzania revealed the fact that a financing scheme for solar PV systems could raise the market segment of potential customers (those who can buy right away from shelves) from 10 % to 40 %. A number of international finance organizations like the World Bank, Triodos Bank of the Netherlands and E+Co are already lending money to energy projects and private companies involved in RE for the following projects:

- The World Bank is supporting a solar PV scheme named Sustainable Solar Market Packages (SSMP) piloted in the Rukwa region. The region has been divided into three zones. Each of them will be served by one contractor. Education, health and community centers will be supplied with solar systems. In addition, commercial enterprises are being encouraged to develop their own supply chains and technical bases in the area. Currently tenders are being evaluated.
- The Triodos Bank supported the private company Umeme Jua Ltd.. with a loan from the Dutch Program for Cooperation with Emerging Markets (PSOM)¹⁸.
- E+Co has been investing a total of 1.6 million USD in 13 Tanzanian enterprises since 2001. The companies include FREDKA, TaTEDO, ENSOL, ZARA SOLAR, RESCO, BETL, UMEME JUA, FADECO, FELISA, MENA WOOD, REX, OMK and AFROZONE. Zara Solar, for example, has been receiving 350,000 USD since 2002. Zara was established in 1998 by the local entrepreneur Mohammed Parpia and is selling SHS in MWanza. To date, Zara has sold over 10,000 SHS (due to legal requirements other financial information for the companies cannot be quoted). The average interest rate is 8 % (in USD).
- The Tanzania Investment Bank is the Trust Bank that handles and transacts REA/REF funds to rural energy developers.

3.2 DONOR AID ACTIVITIES

SIDA/MEM Solar PV Project

The MEM, with support from the Swedish International Development and Cooperation Agency (SIDA), is engaged in a five-year national project to facilitate solar PV market development in rural Tanzania. The Swedish support makes up about 3 million USD in total. The project started in May 2005 and consists of four components:

- Business development services (BDS) for existing and start-up companies
- Marketing and public awareness
- Development of a solar network
- Policy reforms and institutional development

With BDS, capacity building is provided for regional dealers, suppliers, importers and local microfinance agents addressing specifically business planning, marketing, bookkeeping, accounting and product knowledge. Technicians are trained in

¹⁷ SEE PARLIAMENT OF TANZANIA (WWW.PARLIAMENT.GO.TZ) > DOCUMENTS > ACTS

¹⁸ FOR MORE INFORMATION ON THE PSOM SEE WEBSITE OF NL EVD INTERNATIONAAL - PSOM (WWW.EVD.NL/HOME/FINANCIERING_PROJECTEN/INVESTEREN/PROGRAMMA.ASP?LAND=PSM)



PV system design, installation and maintenance. Both suppliers and dealers can apply for specific training and support. Support is granted to them on demand and on a case-by-case basis. The training of dealers and technicians is sub-contracted.

Regarding marketing, the component focuses on end users and involves awareness creation for solar technology, its availability and workability through physical demonstration. Other marketing strategies include promotional campaigns at national and regional level using TV, radio broadcasting, posters, brochures and other means. Suppliers and local dealers are made to actively participate in the campaign, and a special solar campaign targeted to Savings and Credit Cooperative Society (SACCOS) is carried out.

The networking component aims at the development of a networking association of all solar PV stakeholders in the country. TASEA was chosen to support institutional capacity building, to support the SunENERGY magazine and to host solar energy days.

The policy and institutional development component aims at developing a system to enforce solar PV quality standards through the Tanzanian Bureau of Standards. It also focuses on taxation issues and on the dissemination and sharing of project findings among policy makers in various ministries and awareness creation in higher levels of the Government.



RE Business Opportunity The SIDA/MEM solar PV project awarded small grants to six rural based solar market development projects activities. It granted 67% of the project costs with the remaining sum to be met by the project owners. The maximum grant from SIDA/MEM for solar PV projects is 20,000 USD. Njombe Electronics Center and Ensol Tanzania Ltd., for example, are among the six companies that received the grant. The Njombe Electronics Center project involved solar PV market development campaigns in the Ludewa district and the training of rural electricians and sellers of solar PV systems. This training covered specification, installation, troubleshooting and maintenance and aimed at building capacity at the local level. The Ensol Tanzania Ltd. project involved the development of a dealer network, technical training and market development campaigns in the Karatu, Ngorongoro, Hanang and Mbulu districts (further information can be found in chapter 7 Bibliography among the indicated internet sources).

UNDP/GEF/MEM Solar PV Project

The project is similar to the SIDA/MEM solar PV project and was piloted in MWanza region between 2002 and 2007. It eventually will be replicated in the lake zone. The project has four components covering policy support and institutional strengthening, awareness raising, private sector strengthening, financial engineering and learning as well as replication. Under policy support, PV standards were developed. Under the awareness component, information about companies and institutions active in solar energy in the MWanza region was given. Regarding private sector strengthening, technical and business skills were imparted to target groups. Under the financial engineering, dealers received loans through a local bank and end users got consumer financing through two selected pilot SACCOS in the region. Moreover, actors will-

ing to enter solar income generating activities were supported through a subsidy to a maximum of 40% of the system costs. After three years of project activities, learning and replication started in other lake zone regions.

The project supports part of the investment costs for pilot solar PV income generating activities in rural areas of MWanza, where more than 12 firms benefited. Such income generating activities included the provision of solar PV systems (80 Wp) for Phone charging in Sengerema district. The system owner at Kijiweni currently charges more than 60 cell phones at a rate of 300 TZS. The grant contributed was 30–40%. Maximum contribution of the project was 3,000,000 TZS (about 2,500 USD) per project. The project cost is estimated at 2.5 million USD¹⁹.

NGO Initiatives: TASEA, TaTEDO and Clinton Foundation

A number of NGOs are involved in promotion of RE. The Tanzania Solar Energy Association (TASEA) is a national association that brings together RE actors and stakeholders targeting improved sector dynamics. These include, among others, lobbying and advocacy for a sound sector environment, quality peer pressure creation, information dissemination, capacity building (training, magazines, workshops, solar days etc.) and networking.

The Tanzania Traditional Energy Development and Environment Organization (TaTEDO) is involved in capacity building for sustainable energy services. It implements RE projects in rural areas with support from development partners including the EU, Norway, the Netherlands and the UN.

The Clinton Foundation is supporting solar PV installations for rural health facilities in Mtwara and Lindi regions to support HIV reduction initiatives by powering vaccination fridges, wards, laboratories, computers and staff houses to motivate them to remain in rural areas.

3.3 MARKET RISKS

Business environment in Tanzania is currently very stable with legal support through policies and framework measures as well as political will. The translation of political will is, however, not necessarily executed through budgets allocated for energy. That may result in delays and unimplemented commitments when it comes to decision-making on investments. Corruption in the energy sector needs a strong political will and commitment. If the current fight against corruption in the energy sector is not backed-up by high level political and Government leaders, it could negatively impact on investment planning and decision-making. So far, there is no restriction on transfer of margins in relation to investors' interests.

19 FURTHER INFORMATION CAN BE FOUND AT THE CORRESPONDING PROJECT WEBSITE SOLAR MWANZA (WWW.SOLARMWANZA.ORG)



4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

RE are still in an infancy stage with a Ltd. number of project developers, promoters, finance providers, service companies and planners. RE is a section in the Department of Energy of the MEM. Other sections include energy development, planning, electricity, petroleum and gas, which are all headed by Assistant Commissioners who report to the Commissioner for Energy and Petroleum Affairs.

RE sources contribute less than 1 % of the national energy balance. Biomass energy within the RE section accounts for more than 90 % of the cooking resources in Tanzania, but the budget allocated by the Government for RE (including biomass energy services) is Ltd. to less than 1 % of the annual energy development budget of the MEM. The budget for year 2007/2008 was 354 million USD, of which local contribution is 197 million USD. Out of this budget only about 300,000 USD were allocated for RE and energy efficiency (EE).

Nevertheless, RE applications in Tanzania have a good potential for powering development goals considering their local availability, the Ltd. energy per capita consumption, the sparsely populated communities and the ever-hiking prices of imported fossil fuels.

Presently, there is no manufacturer of RE products in Tanzania. REDCOT, a private company, and the College of Engineering and Technology (CoET) of the University of Dar es Salaam have recently started building up education facilities to stimulate entrepreneurship in the production sector. While the Tanzania Bureau of Standards (TBS) is strictly advocating quality products, it has no testing facility for most of RE products.

The following RE education facilities can be found in Tanzania:

- CoET: The college offers courses for the manufacturing and fabricating of RE technologies. Technologies such as windmills, solar water heaters and micro hydro turbines are being researched. In addition, a masters course on RE has recently been introduced.
- University of Dar es Salaam: The university's Physics Department is offering solar PV activities to physics students.
- VETA: The Vocational Education and Training Authority has piloted a curriculum on solar PV systems.
- MLVTC: The Mafinga Lutheran Vocational Training Center has been offering courses for empowering skills on RE for more than five years.
- TASEA: The Tanzania Solar Energy Association has been offering short courses on the basics of solar PV systems including system components, system planning, sizing, installation, troubleshooting and maintenance.
- KARADEA: The Karagwe Development Association has RE training facilities.
- TaTEDO: The Tanzania Traditional Energy Development and Environment Organization also has training facilities for RE.

In total, approximately 300 technicians for basic solar PV systems were trained in Tanzania over the last years. It is, however, important to note that a number of Tanzanian experts on RE undertook studies in the Netherlands, Germany, UK, USA, Japan, India and China.

4.1 BIOMASS/BIOGAS

More than 90 % of primary energy consumption in Tanzania come from biomass. The administration of the forests in Tanzania covers 38.83 million hectares, and the fuel consumption in Tanzania in 2005 was 46.2 million cubic meters of solid round wood. However, biomass used in rural Tanzania is collected by the people themselves, but vendors from urban areas employ the rural poor to collect biomass for urban use. The majority of the urban population uses firewood and charcoal for cooking. A few people from the middle and upper class use electricity and LPG for cooking in urban areas. Fuel wood and charcoal business is largely practiced as an informal business.

In Tanzania around 6,000 small residential biogas plants for cooking purpose are in operation (Guardian newspaper of 26.7.07; and Citizen newspaper of 24.7.07).

Tanzania has the power capacity for cogeneration of more than 200 MW from sugarcane residues (bagasse) in the four sugar factories of Mtibwa, Kilombero, Kagera and Tanzania Planting Corporation (TPC). Mtibwa currently generates 7 MW although it has the capacity to generate 15 MW. TPC has invested in the power plant generating 15 MW of which 7 MW will be fed into the national grid.

A total of eight developers have been registered by the Tanzania Investment Center (TIC) to develop biofuel activities in Tanzania including Sun Biofuels Tanzania Ltd., CAMS Agri-Energy Tanzania, and Sweden's Sekab Company. A Germany company, PROKON, has mobilized 1,800 farmers in Rukwa region to plant jatropha with an agreement to buy seeds from them for biofuel production. These activities are part of a PPP project with German Development Cooperation. The company FELISA is involved in palm oil production for energy.

UNIDO is managing the implementation of a pilot project on Cleaner Integral Utilization of Sisal Waste for Biogas and Bio-fertilizers initiated in 2001. It became a reality in May 2006 when Bio-Energy Berlin (BEB) of Germany was awarded the contract to supply equipment, material and parts for the construction, installation and commissioning of a pilot biogas demonstration plant at Hale Estate in Tanga Region. BEB opted for steel tanks instead of concrete tanks and subcontracted the erection of the tanks to Sichuan Guojiao Energy and Environmental Protection Engineering Co. Ltd. from Chengdu in Sichuan Province of China. Jinan Diesel Engine Co. Ltd. from Jinan City was subcontracted to supply a 180 kW biogas engine and generator (CHP unit). The pilot plant was operational by July 2007, six months after the construction started. This pilot biogas demonstration plant utilizes sisal biomass from the stationary decorticator and the hammer mills installed at Hale Estate. It utilizes only 30 % of the sisal biomass generated which is normally 100–130





tons. The plant has a 180 kW engine and generator. With one more storage tank added, the plant capacity can be increased to utilize 45 % of the leaf waste to produce up to 300 kW of electricity.

Other biomass initiatives include:

- KAKUTE of Arusha is promoting jatropha by buying jatropha seeds and processing biofuels for different uses.
- Mgololo Paper Industry in Iringa Region generates about 40 MW from wood residues. The energy is used for running paper making machineries.
- Tanzania Wattle industry in Njombe generates about 2.5 MW from wattle tree residues, which are fed into the national grid. The industry is planning to generate 15 MW and sell to TANESCO. Research has established that 2.4 kg of wattle residues can generate 1 kWh of electricity.
- The City of Dar es Salaam is in the process of generating 2.5 MW from waste from a closed dumpsite at Mtoni. Methane from the dumpsite is already being collected and burnt to protect the environment. It is expected that in a near future the gas could be used to generate electricity. This is the only Clean Development Mechanism (CDM) project in Tanzania.
- The SADC Biomass Energy Conservation Project (ProBEC) under the MEM has developed, constructed and tested 60 prototype barns for curing tobacco in Tabora, where preliminary results show savings of up to 50 % of wood as compared to traditional curing barns.
- TaTEDO has been involved in development, promotion and dissemination of improved firewood and charcoal stoves in Tanzania for more than 15 years. About 15,000 improved wood and charcoal stoves are produced and sold in the country per month.
- Presently, the following private companies are generating electricity from biomass either for their own use or for selling to TANESCO: sugar companies (generating 38 MW), TANWAT (wood/forestry, generating 2.5 MW), Sao Hill (wood/paper, generating 1.0 MW), Mufindi Paper Mills (generating 15 MW) and Hale Sisal Estate (sisal waste biogas, generating 300 kW).

SHORT BUSINESS INFO

- Biomass consumption per capita is 1.13 m³/year
- Cogeneration capacity (200 MW) in four sugar plants are nearly untapped
- 8 developers have been registered to develop biofuels
- 15,000 improved stoves are produced and sold per month
- 6,000 small residential biogas plants are in operation
- BEB supplied equipment of a pilot biogas demonstration plant

4.2 SOLAR ENERGY

Tanzania is endowed with a global solar radiation of 4 to 7 kWh/m²/day. Tanzanian solar industry has been growing fast over the last five years. This is caused by various factors including frequent modern energy crises in the country, increased level of awareness in some communities where promotional projects are in progress, globalization that has brought

rural Tanzanians in touch with Information Communication Technology (ICT) and the growth of the number of organiza-



RE
Business
Opportunity

tions and commercial institutions operating in areas without electricity.

The current total installed electricity generation from solar energy is estimated at around 1.8 MW. The annual capacity was 100 kWp in 2005 and 200 kWp in 2006. The situation indicates a positive growth in the sector, which can also be seen from the increase in the number of solar companies. While the number of solar companies was less than 10 in 2000, there were already 20 in 2007. These companies rarely do have branches or established networks in rural areas. Promotional projects to stimulate market development and to remove market barriers are ongoing, e.g. the SIDA/MEM project and the UNDP/GEF/MEM project in the MWanza region (see also chapter 4.2 Donor Aid Activities).

The REA/REF subsidy goes to solar PV systems in general; in addition all small rural PV systems of up to 100 Wp that are installed by a developer will be subsidized with 2 USD per Wp (see chapter 4.1 Policy and Renewable Energy Promotion Programs).

The two associations active in solar energy market development, training and information dissemination are TASEA and TaTEDO. For more detailed description see chapter 4.2 Donor Aid Activities.

SHORT BUSINESS INFO

- Installed PV capacity is around 1,8 MW.
- The annual installation rate is increasing to over 200 kWp.
- Two PV promotion projects with subsidy schemes are ongoing (the SIDA/MEM project and the UNDP/GEF/MEM project).
- 20 solar companies are registered.
- PV systems up to 100 Wp will be subsidized with 2 USD/Wp by REA/REF.

4.3 WIND POWER

The potential for wind energy has not been quantified yet. According to Climatologic Statistics of East Africa (Part III), Tanzania, edited by the East Africa Meteorological Department in September 1975, the annual average wind speeds vary from 2.1 m/s in the Morogoro region to 6.3 m/s in Tanga region. The data were measured in 17 regions, but in an insufficient height of about 2 m.

Ongoing wind studies in the country considering surface roughness and heights over 30 m have already revealed some more potential sites for wind farms in Tanzania. The Singida region and Makambako in the Iringa region have for example revealed wind speeds of more than 8 m/s, which is good and promising for electricity generation at reasonable costs. Other areas with wind speeds of more than 4.5 m/s are Mkumbara, Karatu and Mgagao. Wind farms for commercial plants appear promising at Makambako and Kititimo in Singida as well as at Mkumbara, Karatu and Mgagao. Wind resource measurements in other areas are planned and include the Rift valley in Rukwa, the Livingstone Mountains, the Mafia island, Singida and Shinyanga, just to mention a few.



Good wind speeds are also expected along the eastern coastline. Areas along rift valleys, the southern highlands and along Lake Victoria are reported to have some possibilities of potential wind sites as well.

Unfortunately, no reliable wind maps exist for Tanzania so far. The lack of wind energy feed-in tariffs has negatively affected the development of wind energy. However, the national grid in such areas of high wind speeds is available.

Over the years, wind energy resources in Tanzania have been used for windmills to pump water. Less has been done in electricity generation. These wind mills (installed numbers of windmills indicated in brackets) are found in the Singida (36), Dodoma (25), Iringa (16), Shinyanga (6), Tabora (4), Arusha (4), Kilimanjaro (1) and Mara (8) regions. 44% of them are still operational, the remaining ones are defunct.

4.4 GEOTHERMAL POWER

There is some potential of geothermal resources in Tanzania. Currently, the existing potential is being assessed by the Government of Tanzania through the MEM. A geological survey of Tanzania has been conducted since June 2006 in collaboration between MEM and the Federal Institute for Geosciences and Natural Resources (BGR) of Germany. The project partners have been assessing the geothermal potential at Songwe. Songwe is located about 20 km west of Mbeya, which is the third largest city in Tanzania. The estimated geothermal potential there is about 600 MWe.

Detailed surveys, however, are still required to come up with realistic figures on the available potential.

4.5 HYDRO POWER

Small Hydro

Out of the available 315 MW small hydro potential in Tanzania, less than 8 MW have been exploited by installing two power plants. The MEM has been effective in funding studies for small hydro power plants. Studies for seven regions including Ruvuma, Rukwa, Iringa, Kagera, Morogoro, Mbeya and Kigoma were facilitated by MEM in 2006 and 2007.

Large Hydro

Over the years, the power sector of Tanzania has been dominated by hydro power. Poor rainfalls in the past few years, however, have resulted in a shortage of water for the turbines. This has been further aggravated by agricultural activities that are going on upstream. The table below provides data on hydro electricity installations as of June 2007. All stations are operated by the national utility TANESCO.

Feasibility studies²⁰ reveal the potential of hydro power as follows: Ruhudji (360 MW), Rumakali (222 MW), Nakatuta (15 MW) and Mandera (21 MW). Other potentials studied to a pre-feasibility level include Mpanga (144 MW), Masigira (118 MW), Malagarasi (11 MW) and Stiglers Gorge (2100 MW). All these are possible business opportunities that could be exploited.

TABLE 3

Hydro Electricity Installations in Tanzania

STATION	UNITS	SIZE (MW)	INSTALLED CAPACITY (MW)	GENERATED ELECTRICITY IN 2007 (GWH)	SYSTEM
Kidatu	4	51.0	204	964	Great Ruaha River
Kihansi	3	60.0	180	662	Kihansi River
Mtera	2	40.0	80	363	Great Ruaha River
New Pangani falls	2	34.0	68	323	River Pangani
Hale	2	10.5	21	88	River Pangani
Nyumba ya Mungu	2	4.0	8	35	River Pangani
Total hydro	/	198.5	561	2435	/

Source: TANESCO, as of 2007



5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

The private and Government-related actors in Tanzania’s RE sector are manifold. In the following, a list of companies and organizations indicates this variety.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS-RELATED ORGANIZATIONS

NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
A. A. Power and Tools Ltd.	Along Zanaki Street P. O. Box 1205 Dar es Salaam – Tanzania Phone: +255 22 2123284	/	/	Solar energy systems	Supplies of solar systems, equipment and balance of system
AGLEX Company Ltd.	Plot 302, Regent Estate, Victoria Area, Ali Hassan MWinyi Road, P.O. Box 9818 Dar esSalaam – Tanzania Phone: +255 22 2700069	radiocalls@ aglexcompany.com	www.aglexcompany.com	Solar energy systems	Solar equipment and 2-way radios supply and installations
Artumas Group	Artumas Group Inc. 900, 606 – 4th Street SW, Calgary, Alberta, Canada Phone: +(1) 403 294-1530 Dar es Salaam Office Artumas Energy (T) Ltd. P. O. Box 203, Plot 8/1, Tumbawe Road, Oyster Bay Dar es Salaam – Tanzania Phone: +255 22 266 6622 Mtwara Office, P.O. Box 432 Mtwara – Tanzania Phone: +255 23 233333	info@artumas.com info.tz@artumas.com	www.artumas.com	Oil and gas	Independent oil and gas exploration and production company with significant asset position and competitive advantage in the emerging resource basins of East Africa
BP (Tanzania) Ltd.	Kurasini, Bandari Road, P. O. Box 9043, Dar es Salaam – Tanzania Phone: +255 22211126972	SPhonela.kasamballa@ tz.bp.com	www.bp.com	Solar PV	Supply of solar PV systems and equipment
Chloride Exide Tanzania Ltd.	Millenium Business Park, along Morogoro Road P. O. Box 12746 Dar es Salaam – Tanzania Phone: +255 22 2450	cexidetz@africaonline. co.tz		Solar energy technologies	Sale of solar energy systems and components
D. Light Design East Africa	Coral Lane Plot 580, Msasani Peninsula, P. O. Box 110297 Dar es Salaam – Tanzania Phone: +255 22 2601559	infoea@dlightdesign.com	www.dlightdesign.com	Solar lanterns	International lighting and power company with design, manufacturing and distribution capabilities
Davis & Shirtliff (T) Ltd.	Nyerere Road, opposite Shoprite Supermarket, P. O. Box 10725, Dar es Salaam – Tanzania Phone: +255 22 2112515	office@tzdayliff.com	www.tzdayliff.com	Solar water pumps	Sale and installation of solar PV systems and water pumps
Energy for Sustainable Development (T) Ltd.	P. O. Box 8694 Dar es Salaam – Tanzania Phone: +255 22 2667758	esd@esdt.co.tz	www.esdt.co.tz	Technology-free	Consulting firm in sustainable energy development
ENSOL (T) Ltd.	P. O. Box 42227 3rd Floor NSSF Ubungu Office Block, Dar es Salaam Phone: +255 22 2450468	Solartz@yahoo.com	www.ensol.co.tz	Solar energy technologies (PV and thermal)	Solar energy contractors for sales, services, solar water pumps, backup systems
Farming for Energy for Better Livelihoods in Southern Africa (FELISA)	P. O. Box 1349 Kigoma – Tanzania Phone: +255 28 2804909 Fax: +255 28 2804904	farmingforenergy@ yahoo.com	/	Biofuels	Palm oil growing for biodiesel production, processing and electricity generation
GS Power Installations Ltd.	Gerezani Area, P. O. Box 45924 Dar es Salaam Phone: +255 22 2183278	gspower2@yahoo.com	www.gspower.piczo.com	Solar energy equipment and control systems	Supply of solar equipment, balance of systems and security systems
Kagera Sugar Company	P. O. Box 16541 Dar es Salaam – Tanzania Phone: +255 22 2862661 Fax: +255 22 2862667	info@gmitz.com nkandala@gmi-tz.com	/	Cogeneration	Combined heat and electricity generation from bagasse
KAKUTE Ltd. (Kampuni ya Kusambaza Teknolojia)	Nane Nane Grounds, P. O. Box 13954, Arusha – Tanzania Phone: +255 27 2544549	kakute@tz2000.com	/	Biofuels	Promotion of jatropha growing and products
Katani Ltd.	Katani House, 1 Tasma Road, Bombo Area, P. O. Box 123 Tanga – Tanzania Phone: +255 272644401	info@katani.co.tz	www.katanitz.com	Biogas	Private firm generating biogas from sisal residues for electricity generation



NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
Kilombero Sugar Company	P. O. Box 50, Kidatu Morogoro Phone: +255 23 2626027/2119525	dcoates@illovo.co.za rwarren@africaonline.co.tz	/	Cogeneration	Combined heat and electricity generation from bagasse
Locking Center Chromagen Solar water heaters	102 Kinondoni Road, P. O. Box Dar es Salaam – Tanzania Phone: +255 22 2666547	/	/	Solar	Solar water heater supply and services
Mtibwa Sugar Factory	P. O. Box 16541 Dar es Salaam – Tanzania Phone: +255 22 2862661 Fax: +255 22 2862667	info@gmitz.com nkandala@gmi-tz.com		Cogeneration	Combined heat and electricity generation from bagasse
NORPLAN Tanzania Ltd.	Plot 127 Mafinga Street, P.O. Box 2820 Dar es Salaam – Tanzania Phone: +255 22 2668090/2667020 Fax: +255 22 2668340	admin@norplantz.org	www.norplan.com	Energy technologies and services	Consulting firm in energy

5.2 LOCAL INSTITUTIONS RELATED RENEWABLE ENERGY BUSINESS

PROJECTS AND DEVELOPMENT PARTNERS

NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
African Rural Energy Enterprise Development (AREED)	c/o TaTEDO, off Shekilango Road near National Socio Welfare Institute P. O. Box 32794, Dar es Salaam – Tanzania Phone: +255 22 2700438 Fax: +255 22 2700438	energy@tatedo.org	www.tatedo.org	Solar, wind, biomass, MFPs	NGO specializing in dissemination of sustainable energy services and biofuels
Biomass Energy Tanzania Ltd.	c/o P. O. Box 1828 Tanga	biobrik@satconet.net	/	Biomass	Production of briquettes
Danish Embassy,	Embassy of Denmark Ghana Avenue P. O. Box 9171 Dar es Salaam – Tanzania Phone: +255 (22) 211 3887 Fax: +255 (22) 211 6433	daramb@um.dk	www.ambdarsalaam.um.dk	Wind technologies and services	Development partner in the wind industry
Deutsch-Tansanische Partnerschaft e.V. (DTP)	Deutsch-Tansanische Partnerschaft e.V. (DTP Furtredder 18, 22395 Hamburg, Germany	andreakarsten@gmx.de	www.d-t-p-ev.de	Wind, solar, biomass	Volunteer project in renewable energy and environment
Eastern and Southern African Management Institute (ESAMI)	ESAMI, P. O. Box 3030 Arusha – Tanzania Phone: +255 27 2508384-7	admin@esami-africa.org	www.esami-africa.org	Solar, wind and biomass	Training institute offering periodical renewable energy courses
German Technical Cooperation (GTZ)	GTZ Office Dar es Salaam, P.O. Box 1519, Dar es Salaam – Tanzania Phone: +255 222 115901 Fax: +255 222 116504	gtz-tanzania@tz.gtz.de	www.gtz.de	Biomass energy and conservation	Preparation, implementation and evaluation of technical cooperation projects
Germany Embassy	Umoja House Garden Avenue und Mirambo Street, P.O. Box: 9541, Dar es Salaam – Tanzania Phone: +255 – 22 – 211 7409 –15 Fax: +255 – 22 – 211 2944	german.embassy@bol.co.tz	www.darsalam.dipla.de/	Sustainable energy technologies	Development partner and key supporter of energy activities and initiatives
Japanese Embassy	P. O. Box 2577, Plot No. 1018, Ali Hassan MWinyi Rd, Dar es Salaam – Tanzania Phone: +255-22 2115827/9 Fax: +255-22 2115830	EmbassyofJapan_TZ@raha.com	www.tz.emb-japan.go.jp/	Technology-free	Development partner in environmental issues and climate change initiatives
Netherlands Embassy	PO Box 9534, Umoja House, 4th Floor, Corner Mirambo Street/Garden Avenue Dar es Salaam – Tanzania Phone: +255 22 2110000 Fax: +255 22 2110044	dar@minbuza.nl	tanzania.nlembassy.org/	Solar and biomass	Development partner
Norwegian Embassy (NORAD)	P. O. Box 2646, Dar es Salaam, Phone: +255 22 2113366/2139955 Fax: +255 22 2116564	emb.darsalaam@mfa.no	www.norway.go.tz/	Biomass, solar, wind	Development partner, among others, key supporter of energy activities and initiatives
Project for Biomass Energy Conservation (ProBEC)	Coordinator P. O. Box 1519 Dar es Salaam – Tanzania Phone: +255 713 420380	probec.gtz-tanzania@gtz.de		Biomass	SADC biomass conservation project administered by GTZ
SIDA/MEM Solar PV Project	SIDA/MEM Solar PV Project P. O. Box 71605 Dar es Salaam Phone: 255 22 2667758	esd@esdt.co.tz	www.esdt.co.tz	Solar PV technology	Solar PV market development project
Swedish Embassy	Mirambo Street/Garden Avenue, P.O. Box 9274, Dar es Salaam Phone: +255-22-219 6500/219 6503	ambassaden.dar-es-salaam@foreign.ministry.se	www.swedenabroad.com/	Sustainable energy technologies	Development partner and key supporter of energy activities and initiatives



NAME	ADDRESS	EMAIL	WEB PAGE	TECHNOLOGY	SHORT DESCRIPTION
The European Commission's Delegation in Tanzania	The European Commission's Delegation in Tanzania Umoja House, P.O. Box 9514 Dar es Salaam, Tanzania Phone: +255 22 2117473/6 Fax: +255 22 2113277	delegation-tanzania-info@ec.europa.eu	www.deltza.ec.europa.eu/en/contact.htm	Solar, wind, biomass and climate change mitigation	Development partner supporting energy and climate research
UNDP/MEM PV Project Mwanza	UNDP/MEM Solar PV Project, P.O. Box, Dar es Salaam Phone: 255 22 2500857 Fax: 255 22 2500858	solar@solarwanza.org	www.solarwanza.org	Solar PV technology	Solar PV market development project
United Nations Development Programme (GEF, SGP)	UNDP, Msimbasi Creek Housing Estate Ltd. Kings Way/Mafinga Street Plot 134-140 Kinondoni P.O. Box 9182 Dar es Salaam – Tanzania Phone: (255-22) 2199255	registry.tz@undp.org	www.tz.undp.org/	Solar, wind, biomass, MFPs	Development partner in various sectors including energy and environment
United Nations Industrial Development Organisation (UNIDO)	UNIDO Msimbasi Creek Housing Estate Ltd. Kings way/Mafinga Street Plot 134-140 P.O. Box 9182, Dar es Salaam – Tanzania Phone: 255-22 2199264 Fax: +255-22 2668749	office.tanzania@unido.org	www.unido.org	Biomass, micro hydro, solar	Development partner
World Bank – SSMP	World Bank, 50 Mirambo Street, P.O. Box 2054, Dar es Salaam – Tanzania Phone: +255-22 2163200 Fax: +255-22 2163295/2113039	jmointire@worldbank.org	go.worldbank.org/PFHCJT2VM1 OR web.worldbank.org/	Solar, biomass, wind, micro-hydro	Development partners supporting sustainable energy initiatives in Tanzania

NON-GOVERNMENTAL ORGANIZATIONS

NAME	ADDRESS	EMAIL	WEB PAGE	SHORT DESCRIPTION
Karagwe Development Association (KARADEA)	Karadea Solar Training Facility, P.O. Box 299, Karagwe – Tanzania Phone: +255 28 2222971	/	/	Training and awareness creation on solar energy systems
Mafinga Lutheran Vocational Training Center	P.O. Box 15, Mafinga, Iringa – Tanzania Phone: 255 767 255780	maselekaofm@yahoo.com	/	Vocational training on renewable energy technologies
Miradi ya Gesi ya Samadi Dodoma (MIGESADO)	P.O. Box 9, Dodoma – Tanzania	migesado@maf.or.tz	/	Promotion and dissemination of biogas and improved wood and charcoal stoves
Mwanza Rural Housing Programme (MRHP)	P.O. Box 2745, MWanza Phone: +255 754 654883	/	/	Promotion, dissemination and installation of improved biomass stoves and solar PV systems credits
Sustainable Development through Renewable Energies in Tanzania (SUDERETA)	P.O. Box 3033, Arusha Phone: +255 27 2508855	sudereta@yahoo.com coclshila@yahoo.com	/	NGO promoting and disseminating RETs in Tanzania
Tanzania Solar Energy Association (TASEA)	P.O. Box 32643, Dar es Salaam – Tanzania Phone: +255 22 2457416 Fax: +255 22 2457416	info@tasea.org	www.tasea.org	Information dissemination, lobbying, advocacy, networking and advisory services
Tanzania Traditional Energy Development and Environment Organisation (TaTEDO)	P.O. Box 32794, Dar es Salaam – Tanzania Phone: +255-22-2700771/2700438 Fax: +255-22-2774400	energy@tatedo.org	www.tatedo.org	NGO specialized in dissemination of sustainable energy services
Zanzibar Solar Energy Association (ZASEA)	P.O. Box 3754 Zanzibar – Tanzania Phone: +255 24 5502232	zasea2003@yahoo.com		Information dissemination, lobbying, advocacy, networking services



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- Global Energy Network Institute – GENI: (www.geni.org)
- Government of Tanzania: (www.tanzania.go.tz/vision.htm.)
- Ministry of Energy and Minerals: (www.mem.go.tz)
- Parliament of Tanzania: (www.parliament.go.tz)
- Related Institutions for PV Projects, Publications and Trainings: (www.tasea.org or www.tatedo.org/publications.html)
- TANESCO Tariffs: (www.tanESCO.com)
- NL EVD Internationaal – PSOM: (www.evd.nl/home/financiering_projecten/investeren/programma.asp?land=psm)



7 ANNEX

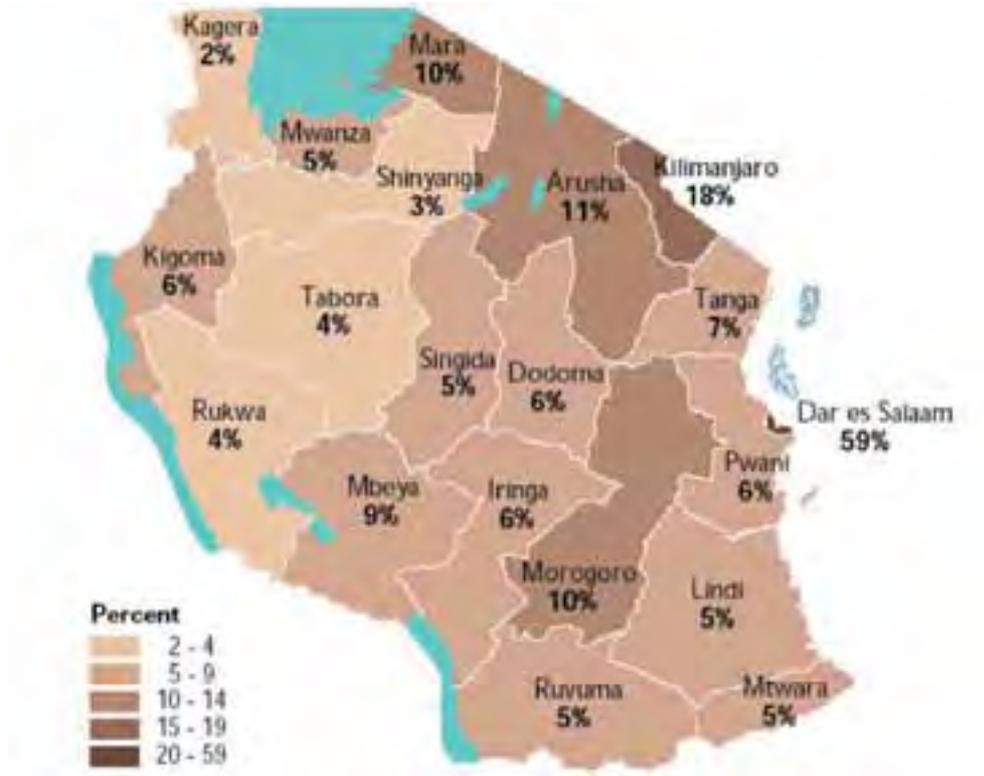
7.1 COUNTRY MAP OF TANZANIA



Source: United Nations, as of 2005



7.2 MAP OF ELECTRIFICATION RATE IN TANZANIA



Source: MEM, as of 2008

7.3 MAP OF NATIONAL ELECTRICITY GRID



Source: Global Energy Network Institute - GENI (www.geni.org, without year)



7.4 PRIMARY ENERGY SUPPLY

SUPPLY AND CONSUMPTION *	COAL AND PEAT	CRUDE OIL	PETROLEUM PRODUCTS	GAS	NUCLEAR	HYDRO	GEOTHERMAL, SOLAR ETC.	COMBUSTIBLE, RENEWABLES AND WASTE	TOTAL **
TPES	49	0	1,367	314	0	123	0	18,941	20,805
TPES %	0%	0%	7%	2%	0%	1%	0%	91%	100%

Source: IEA, as of 2006

* In thousand tons of oil equivalent (ktoe) on a net calorific value basis

** Totals may not add up due to rounding

7.5 FINAL ENERGY CONSUMPTION BY ENERGY SECTOR AND SOURCE

ENERGY CONSUMPTION BY SECTOR

ENERGY FORM	PRICE	REMARK
Diesel	1,430.00 TZS/l	0.780 €/l Price at filling station
Petroleum	1,340.00 TZS/l	0.730 €/l Price at filling station
Electricity	129.03 TZS/kWh	0.070 €/kWh For households
Electricity	70.00 TZS/kWh	0.039 €/kWh For industry
Kerosene	1,000.00 TZS/l	0.540 €/l Pump price
LPG	2,133.00 TZS/kg	1.160 €/kg Retail price at dealers
Charcoal	500.00 TZS/kg	0.270 €/kg Not sold per kg, but a bag of 60 kg is sold at 30,000 in TZS Dar es Salaam (differs in other townships)

Source: IEA, as of 2006

* In thousand tons of oil equivalent (ktoe) on a net calorific value basis

** Totals may not add up due to rounding

ENERGY CONSUMPTION BY SOURCE

SUPPLY AND CONSUMPTION *	COAL AND PEAT	CRUDE OIL	PETROLEUM PRODUCTS	GAS	NUCLEAR	HYDRO	GEOTHERMAL, SOLAR ETC.	COMBUSTIBLE, RENEWABLES AND WASTE	ELECTRICITY	HEAT	TOTAL**
TFC	19	0	1,359	0	0	0	0	14,787	190	0	16,355
TFC in %	0,05%	0%	7,95%	0%	0%	0%	0%	90,00%	1,00%	0%	100%

Source: IEA, as of 2006

* In thousand tons of oil equivalent (ktoe) on a net calorific value basis

** Totals may not add up due to rounding

7.6 DOMESTIC ENERGY RESOURCES, IMPORTS AND EXPORTS

SUPPLY AND CONSUMPTION *	COAL AND PEAT	CRUDE OIL	PETROLEUM PRODUCTS	GAS	NUCLEAR	HYDRO	GEOTHERMAL, SOLAR ETC.	COMBUSTIBLE RENEWABLES AND WASTE	ELECTRICITY	HEAT	TOTAL*
Production	49	0	0	314	0	123	0	18,941	0	0	19,427
Imports	0	0	1,389	0	0	0	0		11	0	1,400
Exports	0	0	0	0	0	0	0	0	0	0	0

Source: IEA, as of 2006

* In thousand tons of oil equivalent (ktoe) on a net calorific value basis

** Totals may not add up due to rounding



7.7 ENERGY SOURCES FOR ELECTRICITY AND HEAT PRODUCTION IN TANZANIA

YEAR 2006	ELECTRICITY (GWH)	HEAT (TJ) (NO INDICATIONS)
Production from		
Coal	106	0
Oil	17	0
Gas	1,217	0
Biomass	0	0
Waste	0	0
Nuclear	0	0
Hydro*	1,436	0
Geothermal	0	0
Solar PV	0	0
Solar thermal	0	0
Wind	0	0
Tide	0	0
Other sources	0	0
Total production	2,776	0
Imports	123	0
Exports	0	0
Domestic supply	2,899	0
Statistical differences	0	0
Total transformation**	0	0
Electricity plants	0	0
Heat plants	0	0
Energy sector***	106	0
Distribution losses	580	0
Total final consumption	2,213	0
Industry	1,138	0
Transport	0	0
Residential	871	0
Commercial and public services	0	0
Agriculture/forestry	0	0
Fishing	0	0
Other non-specified	204	0

Source: IEA, as of 2006

* Includes production from pumped storage plants

** Transformation sector includes electricity used by heat pumps and electricity used by electric boilers

*** Energy Sector also includes own use by plant and electricity used for pumped storage



COUNTRY CHAPTER: UGANDA

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ACRONYMS AND ABBREVIATIONS

UGANDA

ACP	African, Caribbean and Pacific Group of States
AfDB	African Development Bank
ARGeo	African Rift Geothermal Development Facility
BGR	Bundesanstalt für Geowissenschaften und Rohstoffe (Federal Institute for Geosciences and Natural Resources)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BUDS-ERT	Business Uganda Development Services – Energy for Rural Transformation
BOU	Bank of Uganda
CDM	Clean Development Mechanism
CERA	Carbon Emission Reduction Association (in Uganda)
COMESA	Common Market for Eastern and Southern Africa
GSMD	Geological Survey and Minerals Department
DNA	Designated National Authority
DWD	Directorate of Water Development
EAC	East African Community
EAP	Energy Advisory Project
ERA	Electricity Regulatory Authority
ERT	Energy for Rural Transformation
EU	European Union
F.O.B.	Free On Board
GDP	Gross Domestic Product
GEF	Global Environment Facility
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
IPP	Independent Power Producer
IPS	Industrial Promotion Services Ltd.
JICA	Japanese International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau (German Banking Group including KfW Entwicklungsbank as German Development Bank)
LPG	Liquefied Petroleum Gas
MEMD	Ministry of Energy and Mineral Development
MIGA	Multilateral Investment Guarantee Agency
MOFPED	Ministry of Finance, Planning and Economic Development
N.a.	Not Applicable
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGO	Non Governmental Organization
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PSFU	Private Sector Foundation
PREEEP	Promotion of Renewable Energy and Energy Efficiency Program
PREPS	Priority Rural Electrification Projects
PV	Photovoltaic
RAP	Resettlement Action Plan
RE	Renewable Energy
REA	Rural Electrification Agency
REB	Rural Electrification Board
REF	Rural Electrification Fund
SCOUL	Sugar Corporation of Uganda Ltd.
SHS	Solar Home Systems
SIDA	Swedish International Development Agency
UAE	United Arab Emirates
UBOS	Uganda Bureau of Statistics
UEB	Uganda Electricity Board



UEDCL	Uganda Electricity Distribution Company Ltd.
UEGCL	Uganda Electricity Generation Company Ltd.
UERD	Uganda Energy for Rural Development
UETCL	Uganda Electricity Transmission Company Ltd.
UIA	Uganda Investment Authority
UNBS	Uganda National Bureau of Standards
UNDP	United Nations Development Program
UNEP	United Nations Environmental Program
UNIDO	United Nations Industrial Development Organization
URA	Uganda Revenue Authority
USD	United States Dollar (US Cent = United States Cent)
USEC	Uganda Sustainable Energy Company Limited
UG Shs	Uganda-Shilling (100 UG Shs = 0.036 €, as of December 2009)
VAT	Value Added Tax
WENRECO	West Nile Rural Electrification Company

MEASUREMENTS

bbl	Barrel
°C	degree Celsius
GWh	gigawatt hour (1 GWh = 1,000,000 kWh)
kg	kilogram
kgoe	kilograms of oil equivalent
kV	kilovolt
km ²	square kilometer
l	liter
LPD	liters per day
m	meter
m ³	cubic meter
MW	megawatt (1 MW = 1,000 kW)
Wp	Watt-peak (1kWp = 1,000 Watt-peak)



SUMMARY

ECONOMIC STATUS AND DEVELOPMENT OF UGANDA

Uganda is a landlocked country but blessed with a huge variety of fresh water. It is the source of the Great River Nile and home to Lake Victoria. 85% of the population live in rural areas and are mainly engaged in subsistence agriculture¹. More than one third of the population lives below the poverty line. Coffee and fish are the main export goods. The economy is steadily growing with a last year rate of 9%².

STRUCTURE OF ENERGY SUPPLY IN UGANDA

Uganda's primary energy supply and consumption are dominated by biomass with 92% followed by petroleum (6%) and electricity (2%)³.

Electricity

Electricity is generated from two hydro- (380 MW) and three thermal power plants (50 MW each). The countrywide electrification rate is 9%. In urban areas, mainly in Jinja-Entebbe-Kampala, about 42% of the population have access to the national grid, while in rural areas the rate is 3%⁴. The average per capita consumption is 57 kWh per year.

Oil

Uganda's oil consumption⁵ of 11,570 barrels a day (as of 2006) is met by imports from Kenya. Currently oil has been discovered in western Uganda after years of exploration. The production was expected to begin in 2009. The country plans to build an oil refinery, producing between 6,000 to 10,000 barrels a day.

STATUS OF RENEWABLE ENERGIES IN UGANDA

Biomass

The main source of the nation's energy consumption is biomass, accounting for 92% of the total primary energy supply. It is mainly used for cooking and water heating. A Dutch-German funded project has distributed around 600,000 improved stoves to decrease wood consumption. The sugar companies in the country are using bagasse for cogeneration. Out of the installed 22 MW capacity, around 12 MW are supplied to the national grid. So far, biogas technology is used on a small scale.

Solar

The annual PV market potential is estimated at 200 kWp, mainly driven by the Energy for Rural Transformation (ERT) program⁶. Main applications in rural areas are small solar home systems (SHS) and institutional systems for schools and clinics.

Solar water heaters are typically installed in hotels and lodges, but have lately also become popular with high-income urban customers. The average time for return on investment is about two years.

Hydro

Two large hydro power stations with a capacity of 380 MW are the backbone of the Ugandan electricity supply. A new dam with a capacity of 250 MW is currently under construction.

More than 60 mini hydro power sites with a total potential of about 210 MW have been identified through different studies in Uganda and some are under construction.

1 RURAL POVERTY PORTAL, AS OF 2009

2 MOPPED, AS OF 2008

3 MEMD, AS OF 2007, AND UBOS, AS OF 2009

4 MEMD, P. 27, AS OF 2007

5 CIA, AS OF 2009

6 SEE MEMD, ERT FACT SHEET, AS OF 2009



1 COUNTRY INTRODUCTION

1.1 UGANDA OVERVIEW

Uganda is a landlocked country, about 2,000 km inland from the Indian Ocean. It lies between latitudes and longitudes 4°20' North, 1°50' South, 28° East, and 35° West. Its neighboring countries are Kenya to the East, Tanzania and Rwanda to the South and South West, the Sudan to the North and the Democratic Republic of Congo to the West.

Uganda is the source of the Great River Nile and home to Africa's largest fresh water lake, Lake Victoria. 85 % of the population live in rural areas and mainly engaged in subsistence agriculture.

Uganda's political state is governed by the Constitution of 1995 adopted after emerging from the political and economic chaos of the 1970s and 1980s. The Constitution provides for presidential, parliamentary and local elections in a five-year term. Previous elections have been held in 1996, 2001 and 2006. All of the elections were won by President Yoweri Museveni. The last election of 23 February 2006 was held under a multi-party system. Considerable progress has been made in restoring peace across Uganda and in rebuilding infrastructure shattered by civil war. The lingering insecurity in northern Uganda was also being brought to an end within the framework of a peaceful settlement with the rebel movement.

1.2 UGANDA STATISTICS: GEOGRAPHY AND ECONOMICS⁷

LAND AREA:	241,020 km ²
POPULATION:	31.4 million (as of 2007), growth rate 3,2%
DENSITY:	130 inhabitants/km ²
SHARE URBAN/RURAL POPULATION:	15%/85%
BIGGEST CITIES AND POPULATION:	Kampala (1.5 million inhabitants)
CLIMATE:	Two rainy seasons (March–May, October–November)
AVERAGE TEMPERATURE:	15–30 °C
ALTITUDE	1,000–1,300 m above sea level
MAIN WATER BODIES:	Lake Victoria, Lake EdwaRd, River Nile
VEGETATION	Fertile to mountainous
GDP PER CAPITA (AT PURCHASING POWER PARITY)	963 USD (as of 2007)
GDP GROWTH RATE:	9% (as of 2007)
INFLATION RATE:	6% (as of 2007)
AGRICULTURE:	Coffee, tea, cotton
INDUSTRIES:	Sugar, cotton
ELECTRICITY – PRODUCTION:	1,560 GWh (as of 2006)
ELECTRICITY – CONSUMPTION:	1,609 GWh (as of 2006)
OIL – PRODUCTION:	None
OIL – CONSUMPTION:	11,000 bbl/day (as of 2005)
OIL – PROVEN RESERVES:	Under assessment
NATURAL GAS – PRODUCTION:	None
NATURAL GAS – PROVEN RESERVES:	None (as of 2006)
EXPORTS:	1,686 billion USD f.o.b. (as of 2007)
EXPORTS – COMMODITIES:	Coffee, fish and fish products, tea
EXPORTS – PARTNERS:	Netherlands, Belgium, Germany
IMPORTS:	2,983 billion USD
IMPORTS – COMMODITIES:	Vehicles, petroleum
IMPORTS – PARTNERS:	Kenya, China, UAE
EXCHANGE RATE:	100 UG Shs = 0.036 € (as of December 2009)

Source: CIA, as of 2009



2 ENERGY MARKET IN UGANDA

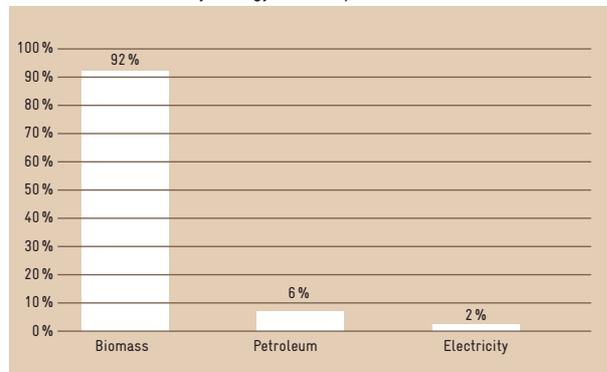
2.1 ENERGY SITUATION OVERVIEW

Uganda's energy supply and consumption is dominated by biomass, which accounts for more than 92 % of the primary energy supply. Other primary energy sources used in the country are petroleum and hydro. Since 2002, the shares of the different primary energy sources in the total supply have remained unchanged. Biomass is consumed in its traditional form as firewood and crop residues. Petroleum products are imported. Electricity is generated mainly from hydro power and thermal plants⁹.

The following table provides commercial energy consumption figures for the last three years.

FIGURE 1

Shares of Total Primary Energy Consumption



Source: MEMD, 2007c, Graph: PSE AG

TABLE 1

Shares of Total Energy Consumption

ENERGY TYPE	2005	2006	2007
Electricity (GWh)	1857,000	1609,000	1797,000
Petrol (m ³)	174,054	198,125	191,713
Diesel (m ³)	319,574	417,449	464,121
LPG (m ³)	2,822	3,474	4,300
Kerosene	39,836	42,897	34,309

Source: MEMD, as of 2007, and UBOS, as of 2008

TABLE 2

Electricity Production

SOURCE OF ELECTRICITY PRODUCTION	2005		2006	
	PRODUCED CAPACITY	PRODUCED ELECTRICITY	PRODUCED CAPACITY	PRODUCED ELECTRICITY
Large hydro power (Nalubale and Kiira)	380.0 MW	1,698,535	145.0 MW	1,160,456
Thermal power (oil fired)	50.0 MW	140,304	100.0 MW	369,499
Small-scale hydro power	15.9 MW	21,262	15.9 MW	30,021
Biomass (sugar) cogeneration (Kakira, Kinyara, SCOUL)	n.a.	n.a.	22.0 MW	n.a.
Imports (Kenya, Rwanda)	n.a.	24,177	n.a.	49,027
TOTAL	445.9	1,884,278	495.9	1,609,003

Source: table compiled by the author with data from MEMD Annual Reports as of 2005, 2006, 2007

2.2 ENERGY CAPACITIES, PRODUCTION AND CONSUMPTION

Up to 2005, electricity generation was dominated by two large hydro power stations. The stations of Nalubale and Kiira are located at the Owen Dam Falls and have a total generation capacity of 380 MW. During 2005 and 2006, the country experienced a drought enforcing the reduction of hydro power capacity to 145 MW.

Since 2006, three thermal oil-fired plants with a total capacity of 150 MW have been built, a fourth plant of 50 MW is under construction. The higher generation costs meant higher tariffs which the Government subsidized to make electricity affordable to industry and other consumers. A subsidy of about 35 % is offered through the national budget. In order to increase the generation capacity of the cheaper hydro power, the Government has introduced an energy fund of about 100 million USD per year. The funds are used to invest in large hydro power plants⁹. The table below shows the electricity generation capacity and supply to the grid.

Due to shortage of capacity on the national grid, power rationing currently takes place. At the worst, power cut-offs happen from 6:00 p. m. to 8:00 a. m. or alternately from 8:00 a.m. to 2:00 p.m. Usually, nighttime cut-offs take place once a week. For towns supplied with generators, power is available for only 4 hours from 7:00 p.m. to 11:00 p.m.¹⁰

The national system operator reports technical losses amounting to 4 %¹¹. Commercial losses at about 35 % due to poor lines and transformers, power thefts and lack of billing are reported by the distributor¹². There have been attempts to cut this rate but with limited success.

The national electrification rate is 9%. It is 42 % in the urban area of Jinja-Entebbe-Kampala and 3 % in the rural areas¹³. The average electricity consumption per capita is 57 kWh.

8 UBOS, P. 48, AS OF 2009

9 MOFPED, AS OF 2008

10 SEE UMEM, WWW.UMEME.CO.UG, AS OF 2009

11 UETCL, AS OF 2007

12 UMEM, WWW.UMEME.CO.UG, AS OF 2009

13 MEMD, P. 27, AS OF 2007



2.3 ENERGY PRICES

Energy prices in Uganda vary widely depending on the location and the supply situation. Electricity tariffs are, however, uniform on the grid and deviate slightly on mini grids. Current energy prices can be found in the table below.

Currently, feed-in tariffs for Independent Power Producers (IPP) are negotiated on a case-by-case basis¹⁴. Within the Renewable Energy (RE) policy, feed-in tariffs have been specified for the existing hydro power and cogeneration plants. Details can be found in annex 8.7.

Two sugar plantations have build cogeneration plants and are currently negotiating the tariff with the grid operator on avoided cost basis.

TABLE 3

Energy Prices November 2007/ Grid Electricity for Domestic Consumers

ENERGY TYPE	PRICE
Fuel wood (Kampala)	0.7 USD/kg
Fuel wood (outside Kampala)	0.4 USD/kg
Charcoal (Kampala)	0.21 USD/kg
Charcoal (outside Kampala)	0.10 USD/kg
Kerosene	1.17 USD/l
LPG	2.44 USD/l
Diesel	1.37 USD/l
Petrol	1.49 USD/l
Grid Electricity (without VAT)	0.25 USD/kWh

Source: ERA, www.era.or.ug, viewed In June 2009; data on petroleum products and other fuels compiled from open markets in and around Kampala.

2.4 MARKET ACTORS FOR PLANNING, REGULATION AND DISTRIBUTION

MEMD

The Ministry of Energy and Mineral Development (MEMD) is the lead Government body responsible for energy policy development, planning and programming, guidance and implementation. A new Renewable Energy Division under MEMD was formed recently¹⁷.

MOFPED

The Ministry of Finance, Planning and Economic Development (MOFPED) plays a key role in the energy market. Apart from the overall national macro-economic management, development planning and resource mobilization it is also in charge of budgetary allocation and disbursement. Specific funding to the energy sector is channeled through the Bank of Uganda to the banks that lend to project developers and private users depending on the funding mechanism. Its programs are subject to approval by the Parliament of Uganda.

DWD

The Directorate of Water Development (DWD) provides permits for water extraction for hydro power plants. The local governments including district authorities, city councils and divisions, municipalities and lower level governments carry out approval, planning, implementation and monitoring of all activities under their jurisdiction.

ERA

The Electricity Regulatory Authority (ERA) is the national regulatory body in the power sector. It issues licenses for generation, transmission and distribution of electricity.

NEMA

The National Environment Management Authority (NEMA) enforces environment impact assessments and issues environmental permits.

UNBS

The Uganda National Bureau of Standards (UNBS) develops, adopts and enforces standards for trade, industry and consumer protection.

URA

The Uganda Revenue Authority (URA) is in charge of taxation and customs.

UIA

The Uganda Investment Authority (UIA) facilitates investments.

REB/REA

The Rural Electrification Board (REB) with its secretariat, the Rural Electrification Agency (REA), is the key player in planning increased rural electricity access.

UETCL

The Uganda Electricity Transmission Company Limited (UETCL) as a public company owns and operates the high voltage transmission grid (above 33 kV) and acts as supplier, exporter, importer, and sole buyer of bulk power.

Further information on each of these institutions can be obtained from the corresponding websites given in chapter 7.

3 RENEWABLE ENERGY POLICY FRAMEWORK CONDITIONS

Uganda is a signatory of the EAC Customs Union treaty, which offers a common external tariff to gradually develop into a free trade area. Uganda is also a member of the Common Market for East and Southern Africa (COMESA). Uganda's policies are clearly aligned with the regional market. During the latest Ugandan budget period for example, the import duty on unsealed deep cycle batteries for use with solar equipment was cut by all the EAC countries.

The Energy Policy for Uganda was published in 2002 with its stated goal to meet the energy needs of Uganda's population for social and economic development in an environmentally sustainable manner. The policy provides the vision for increased and improved modern energy supply for sustainable economic development as well as improving the quality of life of the Ugandan population.

¹⁴ MEMD, AS OF 2007

¹⁵ MEMD, AS OF 2007

**SHORT BUSINESS INFO**

Zero import duty on unsealed solar deep cycle batteries in all EAC countries

3.1 POLICY AND RENEWABLE ENERGY PROMOTION PROGRAMS

In 2003, the Energy Policy for Uganda led to the unbundling of the national utility monopoly of Uganda Electricity Board (UEB) and the creation of separate entities for generation, transmission and distribution (namely UEGCL, UETCL UEDCL). Furthermore, the Electricity Regulatory Authority (ERA) and the Rural Electrification Fund (REF) were established. A clear target and operational modalities for implementing the Rural Electrification Strategy and Plan was set. The nationwide access to electricity is targeted to be increased from 2% in 2001 to 10% by 2012. In March 2007, the Government of Uganda approved a Renewable Energy Policy aiming to increase the use of modern RE from 4% in 2007 to 61% of total energy consumption by 2017¹⁶.

3.2 DONOR AID ACTIVITIES**Energy for Rural Transformation Program**

The main initiative to develop the RE market is the Energy for Rural Transformation (ERT) Program¹⁷. The ERT Program is a 10-year multi-sector program meant to eradicate poverty and achieve development. The cumulative effect has been an increase of electricity access from approximately 1% at the beginning of 2001 to 3% at the end of 2005, which is a positive step towards achieving the 10% target by 2012. The total funds provided by World Bank, GEF and other donors is 439.3 million USD (with a total of 123.3 million USD for phase I).

The project's objectives are:

- To provide increased access to adequate and reliable supplies of electricity for rural households
- To stimulate increased productivity and income arising from electricity access for rural enterprises

The three ERT components – namely grid extension, independent off-grids and PV systems – were implemented. Implementation of the first phase of ERT ended in February 2009 followed by ERT phase II¹⁸. Within the second phase, two of the three main components have business opportunities for RE:

Component 2 aims at the installation and operation of independent grid systems in concentrated but remote settlements with a potential for the use of electricity by rural enterprises. Grants will be provided for RE investments where RE, especially for small hydro power, is part of the independent grid.

Component 3 aims at marketing, sales and service of Solar PV systems. The project will provide grants for the installation of PV systems in homes and rural enterprises for relatively dispersed areas that have small loads, where even small independent grid systems are not viable. In addition,

technical assistance will be provided for business development and support services.

Administered by the Business Uganda Development Services (BUDS) the program has a group of 17 companies participating in the sales-based performance grant program (see annex 6.1).

Phase II plans were approved by the Steering Committee in late October 2008. The Government of Uganda has applied for funding from the World Bank in February 2009 amounting to 75 million USD, which was approved by the World Bank on 7 April 2009¹⁹. The first tender was already issued end of March 2009 for the 'Supply, Installation, Commissioning and Maintenance of Solar Photovoltaic Energy Packages for Health Centers' in several districts.

The organizations that played a key role in phase I will still be active, namely the Bank of Uganda (BOU) for the financing, The Private Sector Foundation (PSFU) to implement business to business support (support of private entities engaged in operation and maintenance of grid extension projects) and the Rural Electrification Agency (REA) for the provision of subsidies for grid extensions, mini-grids and PV systems. The official target figures are shown in chapter 5.2 Solar Energy.

German Development Cooperation

Since August 2007, energy has been one of three focal areas of the Ugandan-German bilateral development cooperation. Main part of the cooperation is the Promotion of Renewable Energy and Energy Efficiency Program (PREEEP), which is being implemented on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) with co-financing from the Dutch Government and ACP-EU Energy Facility. It works closely with all relevant Ugandan stakeholders (the Government, NGOs, the private sector, the media, and training and research institutions) on developing sustainable energy policies, improving energy efficiency and widening access to modern energy in rural areas. Along with policy advisory, the program has three main components: biomass, rural electrification and energy efficiency. The program supports through training, demonstration and implementation of projects the dissemination of improved stoves, micro hydro power, PV systems and energy efficient measures. Significant emphasis is given to awareness raising and capacity building. As a result of the program, until mid-2009 nearly 600,000 improved cook stoves have been disseminated as well as about 70 institutions have been equipped with solar PV systems²⁰.

Other donor countries with activities in the area of energy include Japan, Sweden and Norway. While the latter is involved in the large hydro power generation project at Bujagali falls, the former two countries are involved in transmission grid extension. The Swedish International Development Agency (SIDA) is also providing funds for energy audits and energy efficiency measures in public buildings.

16 MEMO, AS OF 2007

17 ENERGY FOR RURAL TRANSFORMATION, BUDS – ERT AND MEMO, ERT FACT SHEET, AS OF 2009

18 SEE ALSO WORLD BANK, AS OF 2009

19 FOR FURTHER INFORMATION SEE WORLD BANK, [HTTP://WEB.WORLDBANK.ORG](http://web.worldbank.org) > PROJECTS & OPERATIONS > BROWSE BY – COUNTRY/AREA > UGANDA

20 GTZ – PREEP, AS OF 2009



3.3 MARKET RISKS

Uganda operates an open and liberalized business environment. Government policy is to encourage commerce by establishing favorable general conditions for trade. Investors are given bounteous incentives and there are no restrictions on capitalization of projects or on transfer in or out of capital.

For an international company intending to market RE equipment and technologies, the easiest avenue is through local representation using the following marketing methods: local distributors, international tender, local tender or importers on their own account. The use of manufacturer's representatives and agents is widespread although it is necessary to be conscious of free riders.

In general, the Government and the donors are the major consumer of goods and services. All procurements and contracts are handled by respective procurement committees in each Ministry and governmental body. This is regulated in the Public Procurement and Disposal of Public Assets Act 2003, which does not accept direct procurement, yet emphasizes competitive and transparent bidding in an attempt to stem corruption through kick-backs. Frequent legal and administrative petitions alleging unfair procurement practices, however, often cause severe delays and even cancellation of contracts.

Tariffs in Uganda differ by commodity and are based on the Harmonized System (HS) as specified by the Uganda Revenue Authority. There are no taxes levied on renewable energy equipment²¹. Problems may, however, arise in the classification of accessories.

The development and enforcement of standards is mandated to the Uganda National Bureau of Standards (UNBS)

that is also responsible for inspection and approval of all imports at entry. Sale of substandard equipment is, however, still a problem. Manufacturers and traders may patent their inventions and register their trademarks in Uganda at The Registrar of Companies. Uganda is a party to the Paris Convention for the Protection of Industrial Property Rights.

Other business considerations worth noting are the following:

Skilled Personnel and Awareness

There is a shortage of qualified technical personnel in the country. There is also a low level of awareness of RE technologies among the population due to low literacy levels. Opportunities exist to link up with the Makerere University in Kampala that has recently started a RE master degree course and has been carrying out various capacity building activities. The ERT project has also trained some 30 technicians in 17 firms (listed in the annex) in the area of installation and maintenance of SHS.

Land Rights

Acquiring land for the development of energy infrastructure is an expensive and slow process.

Importation

Uganda being a land locked country, imports have to be air lifted, landed at the ports of Mombasa in Kenya or Dar es Salaam in Tanzania on the Indian Ocean, which entails higher transportation costs and/or extra customs procedures in Kenya or Tanzania and possible delays and/or pilferage.

4 STATUS AND FUTURE OUTLOOK FOR RENEWABLE ENERGIES

The potential of RE is relatively untapped in Uganda. Currently, the private sector started to develop the market supported by various international programs. The following table gives an overview for RE business opportunities, which will be explained in more detail in the following subchapters:

TABLE 4
Economic Potential of RE Technologies

PROJECT	INVESTMENT CLIMATE	FINANCING OPPORTUNITIES
Large hydro (700 MW, about 1,270 million USD)	Favorable as PPP or IPP	Government is committed to build hydro plant through an energy fund and to grant concession to the private sector for operation
Mini and micro hydro (70 MW, about 204 million USD)	Several available as mini grids or IPPs	Subsidies available from REA under the ERT program
Cogeneration (45 MW, about 50 million USD)	Possible joint ventures with sugar plantations owners	Subsidies available from REA under the ERT program
Geothermal (300 million USD)	Several sites earmarked for studies and development as IPPs	Government and direct investment
Household electrification (400,000 households, about 1,650 million USD)	Open for private sector operated distributors, grid extension contractors, PPPs and IPPs for mini grids and private sector distributors	Donor-financed grants as well as Government ERT financing and community-based initiatives, which are all based on the target set for 10% rural electrification; it involves a combination of grid extension, mini grids and SHS
Solar water heaters (30,000 m ² installed, about 10 million USD)	Open for private sector distributors	Government and donor grants for communities, Government institutions (schools, health centers etc.) and end-users
Biofuels (720,000 m ³ /year, about 18 million USD)	Open for direct private investment, especially for local farmers	Government to promote production of biofuels from non-food plant materials

Source: MEMD, as of 2007

21 SEE URA IN THE INTERNET



4.1 BIOMASS/BIOGAS

Energy for cooking and water heating in rural areas is mainly covered by biomass like firewood, shrubs, grasses, forest wastes and agro-industrial residues such as bagasse, husks, trash from sugar, oil milling and grain milling. Trading in charcoal contributes to the rural incomes, tax revenue and employment. Most urban households, institutions and commercial entities also rely on biomass. Biomass consumption per capita is 240 kg/year for firewood and 120 kg/year for charcoal. Furthermore, crop residues and agro-industrial residues including husks, bagasse and oil residues play a significant role (about 5%) in Uganda's energy consumption. In total, biomass accounts for 92% of the nation's energy consumption.

The use of improved stoves is currently promoted by the MEMD with support of the PREEEP Program funded by German Development Cooperation. About 600,000 units had been distributed by June 2008 in various country districts. The activity is also supported by the Dutch Government with additional funding.

Currently, three factories in Uganda – namely Kakira Sugar Works Ltd., Kinyara Sugar Works Ltd. and Sugar Corporation of Uganda Ltd. – run cogeneration plants based on bagasse. The total capacity is 22 MW. Out of this, 12 MW from Kakira Sugar Works is supplied to the grid. The rest is used for internal power supply of the sugar companies.

In July 2003, the company signed a Power Purchase Agreement (PPA) to sell electricity to Uganda Electricity Transmission Company Ltd. (UETCL) after an extension of its cogeneration plant. With the increased production capacity to 4,000 tons of cane per day, this led to increased production of bagasse. The Government of Uganda under the ERT program phase I offered a subsidy worth 3,300,000 USD to support the project. The total cost of the extension works was 8,000,000 USD with private equity of 1,608,215 USD and the rest of the funding through a loan from the World Bank. The subsidy was through a refinance scheme offered through the East African Development Bank but administered by the Bank of Uganda²². The feed-in tariff was fixed in 2008 by the regulator without a significant assessment of the actual costs of bagasse cogeneration.

According to the Renewable Energy Policy 2007, bagasse cogeneration from sugar production is targeted at 35 MW by 2012 and at 67 MW by 2017.

SHORT BUSINESS INFO

- The biomass consumption per capita is 240 kg/year of firewood and 120 kg/year of charcoal.
- 360,000 improved stoves have been already installed.
- The potential for biogas digesters is 250,000 cattle keeping households.

Biogas technologies do not have a strong demand in Uganda. Attempts have been made by the MEMD but with limited success. More than 50% of the estimated 500 existing biogas plants are not operating. There is limited statistics on the actual number in operation. With over 250,000 „zero grazing“ farming households (method where cattle is kept in one place), there is potential for small household biogas digesters in the countryside. In addition, commercial dairy farmers and pig-geries could support several thousand larger biogas plants to cater for their own thermal and electricity needs.

4.2 SOLAR ENERGY

The average solar radiation is 5.1 kWh/m² per day on a horizontal surface. Solar energy technologies have generated keen interest in the high income and commercial sectors of the Ugandan economy. Many solar energy companies have sustained activity in the market and several new ones keep emerging. A list of companies is provided in annex 5.1.

A small commercial market exists for solar thermal systems. High-income urban households as well as hotels and resorts are the typical client of such systems, and the interest in the technology has soared in the last years.

Due to their reliability and quick payback, solar thermal systems of about 100–150 liters per day (LPD) for domestic use and 3,000 LPD systems for hotels are in high demand. Several companies are involved in marketing and installation of these systems. A range of technologies is installed depending on the major international manufacturers that are represented locally. Almost all systems are flat plate collectors. Prices on the market vary depending on the type of the technology and the brand or the manufacturer, however, a typical 200 LPD system costs 2.0 million to 3.0 million UG Shs, while a 300 LPD system costs 3.5 million to 4.8 million UG Shs.

SOLAR HOT WATER HEATER – EXAMPLE

ENERGY TYPE	PRICE
Investment costs of domestic 3 kW electric heater	300,000 UG Shs
Annual energy consumption at 2 hours daily:	2,190 kWh
Annual electricity cost 2,190 kWh x 426 UG Shs/kWh x 1.18 (VAT):	1.11 million UG Shs
Investment costs of 150-liter solar water heater:	1.88 million UG Shs
Payback period:	17 months

The total annual new installed PV capacity is estimated at 200 kWp for households, institutions and commercial use. Under the ERT program, 20 companies benefited from business development support, including sales grants of 10 to 15% (see annex 6.1). The system costs were reduced from 20 USD/Wp to 16.5 USD/Wp because of the subsidy²³.

Since 2002, companies have installed nearly 5,000 institutional and household systems under the ERT phase I program. In total, 3,799 Solar Home Systems were installed with a total capacity of 187 kWp. The system sizes range between 14 Wp and 200 W. Around one-third of the systems were large systems (> 200 Wp). 635 systems had a capacity of around 50 Wp and the majority was below 30 Wp. Additionally, 1,928 institutional and 192 commercial PV systems were installed with a total power of 1,223 kWp.

22 MEMD, AS OF 2007

23 MEMD, AS OF 2008.



PLANNED IMPLEMENTATIONS UNDER PHASE II OF THE ERT PROGRAM ARE:

SHS (average 30 Wp)	20,000 systems	600 kWp
Non-project institutional systems (average 465 Wp)	1,000 systems	465 kWp
Schools (average 455 Wp)	560 systems	255 kWp
Health centers (average 835 Wp)	464 systems	387 kWp
Water pumping (a. 13 kWp)	30 systems	392 kWp
TOTAL	22,054 SYSTEMS	2,099 KWP

Approximately 16 million people in 3 million households currently use kerosene wick lamps for lighting. There is an interest to market solar lighting to substitute kerosene lamps. The Rural Electrification Strategy and Plan intends to electrify 400,000 households. 20% out of these shall be electrified with small Solar Home Systems, amounting to some 700 kWp by 2017. This is a 10% contribution to the rural electrification target by 2017²⁴.

SHORT BUSINESS INFO

- The demand for solar hot water heaters increases in the cities.
- The total PV market is estimated at 200 kWp per year with 20 PV companies.
- ERT Phase II will finance 20,000 SHS and another 2,000 larger PV systems with a total capacity of around 2MWp.
- In addition, the Rural Electrification Strategy and Plan aims to install small Solar Home Systems, amounting to 700 kWp by 2017

4.3 WIND POWER

Wind speed is low in most areas of Uganda. The average wind speeds in low heights (less than 10 m) generally range from 2 m/s to about 4 m/s²⁵. In some areas with complex terrain, the wind may speed up due to slopes of hills and escapements and tunneling effects. However, very few wind systems exist in Uganda. They are mainly used for water pumping in the remote arid centers in the North East and some cattle keeping areas in the center.

Recent studies²⁶ also confirm that electricity generation through wind is feasible, especially for small industries in rural areas with windmills in the range of 2.5 kW to 10 kW.

4.4 GEOTHERMAL POWER

There is a total geothermal energy potential estimated at 450 MW. Three potential areas, Katwe-Kikorongo, Buranga and Kibiro situated in the Western branch of the East African Rift Valley, are earmarked for detailed exploration for geothermal development.

The German Federal Institute for Geosciences and Natural resources (BGR) supports the Government of Uganda in the geo-scientific investigations at Buranga geothermal prospect. At the site, the MEMD through the Geological Survey and Minerals Department (GSMD) foresees to produce electricity with support by ARGeo (African Rift Geothermal Development Facility)²⁷.

4.5 HYDRO POWER

Small Hydro Power

The Ugandan market for small hydro power is growing rapidly. More than 60 mini hydro power sites with a total potential of about 210 MW have been identified through different studies in Uganda. Some of the sites can be developed for isolated grids, others as energy suppliers to the grid. Recently, KfW Entwicklungsbank (German Development Bank) advertised tenders for studies on two projects at Maziba in Kabale and the Bwindi Impenetrable Forest Reserve. Two plants are under construction under the ERT program – a 3.5 MW plant at Nyagak in West Nile and a 294 kW plant (upgraded from 60 kW) at Kisizi. In addition, 16 MW of independent generation are currently in operation at other grid-connected two plants. They are located at the foothills of the Rwenzori Mountains in the West of Uganda. They are operated privately by Kilembe Mines Ltd. (5.4 MW) and Kasese Cobalt Company Ltd. (10.5 MW)²⁸.

Large Hydro Power

Two hydro power plants at the source of the Nile River provide the bulk of Uganda's electricity supply. The two stations are located at the outlet of Lake Victoria – Nalubale and Kira – with a total capacity of 380 MW. Both are owned by the Uganda Generation Company Ltd. They are being operated on a 20-year concession by Eskom Uganda Ltd., a subsidiary of Eskom South Africa, which started in 2003. The Government of Uganda is investing in large hydro power through Public-Private Partnership (PPP). The Bujagali hydro power plant of 250 MW is under construction and tenders associated with this project have been issued. In 2008, the construction for the Karuma dam with a 200 MW capacity was started. The Isimba dam, with a hydro power capacity of 100 MW is also in planning. Investment opportunities exist for engineering, supply and services for these projects.

A list of planned projects can be found in annex 7 "Development of Hydro Power Projects on the Nile River"²⁹.

24 MEMD, AS OF 2002

25 MEMD, AS OF 2007

26 MEMD, AS OF 2007

27 BGR, AS OF 2009

28 MEMD, AS OF 2007

29 ERA, AS OF 2009



5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

This chapter provides a list of companies and related organizations currently involved in the Ugandan RE market.

5.1 RENEWABLE ENERGY COMPANIES & BUSINESS RELATED ORGANIZATIONS

ERT – Participation in the Sales-based Performance Grants Program: Approved Companies in 2008³⁰

COMPANY	CONTACT PERSON/ADDRESS
Uga Solar Supplies Ltd.	Mr. Joseph Mukasa Phone: +256-41-344809 ugasolar@infocom.co.ug
Incafex Solar Systems Ltd.	Mr. Henry Nganwa Phone: +256-414-250008, +256-77-2750008 incafexsolare@africaonline.co.ug
Solar Energy (U) Ltd.	Mr. Richard Kanyike Phone: +256-414-232114, +256-77-2504429 soenergy@africaonline.co.ug
Solar Energy for Africa Ltd.	Eng. Philip Walusimbi Phone: +256-41-250125 gu@africaonline.co.ug
Ultra Tec (U) Ltd.	Mr. Abhay Shah Phone: +256-414-501620, +256-77-2200007 ultratecug@usa.net
Energy Systems Ltd.	Mr. Emmy Kimbowa Phone: +256-414-250920, +256-77-2313470 emmy@energysystemsug.com
Power Options Ltd.	Mr. Musoke Kivumbi Phone: +256-312-261127, +256-77-2455401 poweroptions@africaonline.co.ug
Uganda Electronics & Computer Industries Ltd.	Mr. Charles Mulamata Phone: +256-75-2643027, +256-41-348708 ueci@infocom.co.ug
Kasese Solar Power Ltd.	Mr. Agaba Abbey Phone: +256-483-44413, +256-77-2865080 aruroko@yahoo.com
Magric (U) Ltd.	Mr. Mike Magnay, Ms. Jovia Bogere Phone: +256-41-232100 magric@imul.com
Dembe Trading Enterprises Ltd.	Mr. Anil Damani Phone: +256-41-255253 embe@africaonline.co.ug
Victoria Electricity Supply Co. Ltd.	Mr. Fred MWesigye Phone: +256-77-2757712
Solar Sense Ltd.	Mr. Francis S Kibuuka Phone: +256-392-2961267, +256-71-2606088 Fax: +256-414-568778
Ital Trade Ltd.	Mr. Andrea Marinelli Phone: +256-77-2767862, +256-41-266431 italtrade@utlonline.co.ug
Global Solar Systems	Mr. Joel Leku Phone: +256-78-2441536, +256-77-4044619 lekujoel@yahoo.com
Uganda Batteries Ltd.	Ms. Betty Kiguli Phone: +256-41-343150 ublbateries@utlonline.com, nicehse@infocom.co.ug
Uganda Solar Power Supplies Ltd.	Mr. Osbert Tindimwebwa Phone: +256-78-2952020, +256-414-376015 solarpower4all@yahoo.co.uk

30 SEE BUDS-ERT, AS OF 2009



Renewable Energy Companies Active in Uganda

NAME	ADDRESS	TECHNOLOGY	PROFILE
Uganda Electricity Generation Company Ltd.	Abercourt, 2-8 Faraday Rd. P.O. Box 1101 Jinja – Uganda Phone: +256 434 12081 Fax: +256 434 123064	Hydro	Public company that owns governmental hydro power plants
Eskom (U) Ltd.	Nalubale Power Station Box 942 Jinja – Uganda Phone: +256 434 121416 Fax: +256 434 123154	Hydro	Has the 20 year concession to run and maintain the Nalubaale and Kira power stations
Norpak Power Ltd.	Crusader House 1st Floor Portal Avenue Box 7544 Kampala – Uganda Phone: +256 414 340243/4/5 Fax: +256 414 257861	Hydro	Developer of the Karuma hydro power station
West Nile Rural Electrification Company Ltd.	Box 241 Arua – Uganda Phone: +256 47 4620076	Thermal/Hydro	Operates the West Nile power grid and developer of the 3.5 MW Nyagak hydro power plant
Uganda Electricity Distribution Co Ltd.	Amber House Plot 23/33, Kampala Rd. P.O. Box 7390 Kampala – Uganda Phone: +256 31 2330300 Fax: +256 41 4255600 contact@uedcl.co.ug	Distribution (33 kV and lower)	Owns the national electricity distribution network
UMEME Ltd.	Rwenzori House Plot 1 Lumumba Avenue Box 23841 Kampala – Uganda Phone: +256 31 2360600 Fax: +256 41 425151 umeme@umeme.co.ug	Distribution (33 kV and lower)	Has the 20 year concession to run the distribution business
Solar Construct Ltd.	15 Mulwana Rd. P.O. Box 26216 Kampala – Uganda Phone: +256 77 4290505 +256-312264264 info@solarconstruct.com Website: www.solarconstruct.com	Solar thermal	Solar water heater fabrication and installation
Balton Uganda Ltd.	Plot 47/51 Mulwana Rd. P.O. Box 852 Kampala – Uganda Phone: +256 31 2502300/+256 753330767 Fax: +256 41 4349887 sales@balton.co.ug Website: www.baltoncp.com	Solar thermal	Engineering firm, Cromagen solar water heaters repairs
Elektrex Ltd.	6th Street Industrial Area Plot 201 P.O. Box 11937, Kampala – Uganda Phone: +256 414 255966 elektrex@gmail.com	Solar PV	Sale of solar PV systems
UltraTec (U) Ltd.	P.O. Box 6832, Plot 4520 Kabalagala Close, Kampala – Uganda Phone: +256 772200007, +256 752 200007, +256 712 200007, +256 414 501620 ultratecug@usa.net Website: www.ultratecworld.com	Solar thermal, PV	Solar kits and lanterns, solar heater
Uganda Stove Manufacturers Ltd.	Kayemba Rd. P.O. Box 1265 Kampala – Uganda	Improved stoves	Rocket stove manufacturers
AB Matra Uganda Ltd.	87 First St. P.O. Box 35022 Kampala – Uganda Phone: +256 414 348874, +256 712 330 501 sales@abmatra.com	Solar thermal, PV	Solar kits and lanterns, Solar heater KOTAK URJA Rep.
Magric (U) Ltd.	Plot103 Jinja Road P.O. Box 3218 Kampala – Uganda magric@imul.co Website: www.magric.com	Solar PV	Manufacturing representative of BP Solar (and others)
Kasese Solar Power (Ltd.)	Plot 58 Rwenzori Rd. P.O. Box 299, Kampala – Uganda Phone: +256 483 444413, +256 752 865080 Fax: +25641 4349293 aruroko@yahoo.com	Solar PV	Solar systems distributor
K.K Electrical Engineering Ltd.	Church Hostel Building Plot 50/52 Mbaguta Street, P.O. Box 14 Mbarara – Kampala Phone: +256 772 571888	Solar PV	Solar systems distributor
Incafex Solar Systems Ltd.	Gathani House Plot 9/6 Bombo Road P.O. Box 25995 Kampala – Uganda Phone: +256 41 4250008, +256 41 4231160, +256 41 4251812 incafexsolar@africaonline.co.ug Website: www.incafexsolar.com	Solar PV	Solar systems distributor
Solar Energy for Africa	Plot 40 Bombo Rd. Carol House Box 4155 Kampala Telephone: +256 41 4250125 Fax: +256 41 4250131 solar-sgu@africaonline.co.org Web site: www.solarafrica.com	Solar	Supply and installation of solar PV solar heating systems



NAME	ADDRESS	TECHNOLOGY	PROFILE
Power Options Ltd.	Teachers House 1st floor Suite109 Plot 28/30 Bombo Rd. P.O. Box 33435 Kampala – Uganda Telephone: +256 31 2264264, +256 41 4348442 Fax: +256 41 434842	Solar PV	Solar system distributor
Suntopway Solar (U) Ltd.	Span House Rm 202 Portal Avenue (next to Workers House) P.O. Box 11915 Kampala – Uganda Phone: +256 75 2099999, +256 77 2393531 suntopway@yahoo.com Website: www.suntopway.com	Solar	Supply and installation of solar PV solar heating systems
Boomer Systems	Plot 13/15 Sturrock Rd. Kamokya P.O. Box 70027 Kampala – Uganda Phone: +256 312 277709, +256 77 2401854 Fax: +256 414 542286 boomersystems@yahoo.com boomersystems@37.com	Solar	Supply and installation of solar PV solar heating systems
Girasolar East Africa Ltd	P.O. Box 6946 Kampala – Uganda Phone: +256 31 2279920, +256 77 2697049 Fax: +256 41 4535685 girasolar@girasolar.co.ug Website: www.girasolar.co.ug	Solar	Supply and installation of solar PV solar heating systems
Uganda Solar Power Supplies	8th Street, Industrial Area Kampala – Uganda Phone: +256 782 952020	Solar PV and solar heating	Design, installation and maintenance of solar and backup power systems, lighting water heating, pump-ing systems
Energy Systems Ltd.	Plot 3 William Street, Get In House, Suite #109, P.O. Box 25928 Kampala – Uganda Phone: +256 414 250 920, +256 772 610904 +256 772 313470 Fax: +256 414 349055 emmy@energysystemsug.com Website: www.energysystemsug.com	Solar hybrid systems based on solar, wind, diesel, biomass, etc.	Retail sales, wholesale supplier, importer, mini grids, hybrid systems
African Alternative Energy Solutions, Ltd.	P.O. Box 100 Ntinda Kampala – Uganda Phone: +256 782 722 031	Solar PV and solar heating	Consulting, design and installation of hybrid power systems, backup power systems, solar electric power systems, batteries emergency backup
Equatorsun Ltd.	Plot 4643 Kisugu, P.O. Box 71312 Kampala – Uganda Phone: +256 772 602205, +256 312 277719 Fax: +256 312 277719	Solar water heating systems	Supply and installation of solar electric power systems for hospitals, schools, hotels, and domestic applications
GIIT Uganda	Plot 4 Pilkington Road, Colline House, Kampala, – Uganda or P.O. Box 6511, Kampala – Uganda Phone: +256 414 375046 or +256-712 503440 Fax: +256 414 348112	Solar PV	Supply, installing and servicing of solar PV systems
Power Consult (U) Ltd.	P.O. Box 9375 Telephone: +256772504551	Solar	Sales supplier
Davis & Shirtliff Solar	Kitgum House, Jinja Road PO Box 22824, Kampala – Uganda Phone: +256 4346337/6 Fax: +256 4346335 d&sug@dayliff.com Website: www.dayliff.com	Solar water heaters and solar pumps	Distributor of Dayliff solar water heaters
The Sugar Corporation of Uganda Ltd. (SCOUL)	Plot 135, 6th Street Industrial Area P.O. Box 1185, Kampala – Uganda Phone: +256-41-25 50 36 Fax: +256 41 34 75 97 scoul@mehtagroup.com Website: www.mehtagroup.com/Sugar.htm	Biomass	Sugar manufacturer
Kakira Sugar Works Ltd.	Kakira Estate, Jinja P.O. Box 121, Jinja – Uganda Contact: Richard Orr Phone: +256 (0) 414 444000 Fax: +256 (0) 414 444333 Mobile: +256 (0) 75 2790055 richardorr@kakisugar.com Website: www.kakisugar.com	Biomass	Sugar manufacturer, power export to national grid, confectionery manufacture, tea manufacture, soap manufacture
Kinyara Sugar Works Ltd.	34 Lumumba Avenue P.O. Box 7474, Kampala – Uganda Contact: Jack McLean Telephone: +256 (0) 36 600200 mcleanj@kinyara.co.ug Website: www.kinyara.co.ug	Biomass	Sugar manufacturers managed by UK Company Booker Tate Ltd. (current capacity 64,000 tons per year)



5.2 LOCAL INSTITUTIONS RELATED RENEWABLE ENERGY BUSINESS

NAME	ADDRESS	PROFILE	ROLE
Uganda Electricity Transmission Company Ltd.	Amber House 29/33 Kampala Rd. P.O. Box 7625, Kampala – Uganda	Public company that owns grid, sole bulk electricity buyer	Operation, maintenance and development of the grid connecting generation facilities to load centers and to neighboring countries
Uganda National Chamber of Commerce and Industry	17/19 Jinja Road P.O. Box 3809 Kampala – Uganda	Organization of private business	Promotion of private business interests as well as partnerships
Private Sector Foundation Uganda	Plot 43 Nakasero Road P.O. Box 7683 Kampala – Uganda Phone: +256 41 342163 230956 Fax: +256 41 259109 prisf@starcom.co.ug	Umbrella organization of business associations	Advocacy, capacity building and management of sales-based incentives on solar systems
Uganda Manufacturers Association	Lugogo Show Grounds P.O. Box 6966 Kampala – Uganda Phone: +256 41 221034/220831 Fax: +256 41 220285	Association of manufacturers	Capacity building, liaison and pressure group, organization of the Uganda International Trade Fair
Uganda Renewable Energy Association	emmy@energysystemsug.com	Association of businesses in the solar/ renewable energy sector	Liaison with Government and donor agencies
Energy Institute of Uganda	Kisozi House Complex P.O. Box 70826 Kampala – Uganda Website: www.energyinstug.org	Industry multidisciplinary organization	Capacity building and awareness raising
FINCA Uganda	Plot 22 Ben Kiwanuka Street P.O. Box 24450 Kampala – Uganda Phone: +256 41 4 231134 Fax: +256 41 340 078 Contact: Fabian Kasi (Country Director) fkasi@finca.or.ug	Financial institution providing financing services mainly for low-income entrepreneurs (to support job creation, asset building and improve living standards)	Village banking and working capital, solar loans, village phone loans, K O Net, savings accounts, money transfers etc.; as an industry leader, FINCA Uganda finances a significant proportion of its activities by mobilizing client savings



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- Rural Electrification Agency – REA: (www.rea.or.ug). The site provides information on channels for the private sector and local communities to access rural electrification subsidy funds for projects. It also provides an Investor's Guide.
- Business Uganda Development Scheme – Energy for Rural Transformation – BUDS-ERT: (www.psfuganda.org/buds-ert.asp, as of 2009). The site provides information on the ERT Program and business-related issues.
- GTZ/PREEP: (www.gtz.de/en/themen/umwelt-infrastruktur/energie/16464.htm). The site provides a description of the GTZ activities in Uganda and links to other GTZ projects in the country.
- Ministry of Energy and Mineral Development – MEMD: (www.energyandminerals.go.ug). Official government site on energy policy issues, providing policy documents, annual reports, energy balance and project documents.
- Uganda Investment Authority – UIA: (www.ugandainvest.com). The site provides information on guidelines, investment incentives and other information on investing in Uganda.
- UMEME Ltd.: (www.umeme.co.ug). The site provides information on Uganda's electricity distribution network and other information regarding network operations.
- Global Energy Network Institute – GENI: (www.geni.org). The site provides information on national energy grids including Uganda's national grid.
- Unimaps.com: (<http://unimaps.com/uganda/mainmap.gif>). The site provides information on maps and maps of African countries including Uganda in particular.
- World Bank: (<http://web.worldbank.org>)



7 ANNEX

FIGURE 2

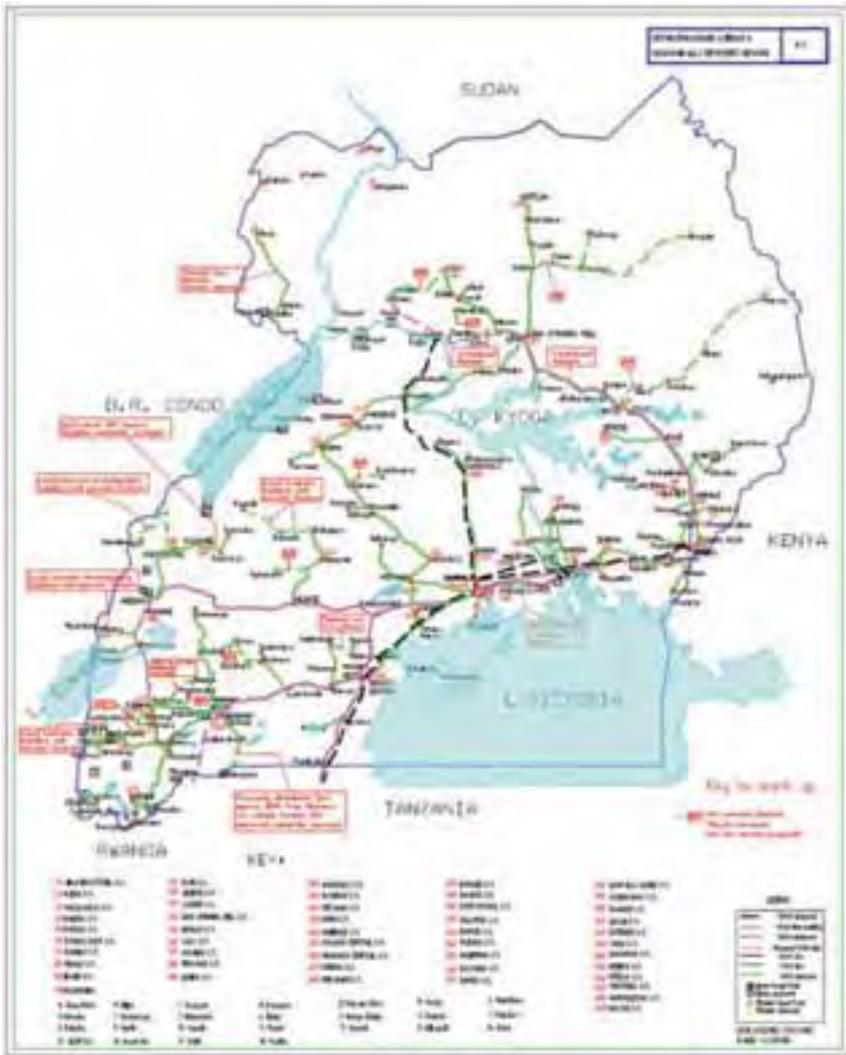
Country Map of Uganda



Source: Unimaps.com, <http://unimaps.com/uganda/mainmap.gif>, as of 2005



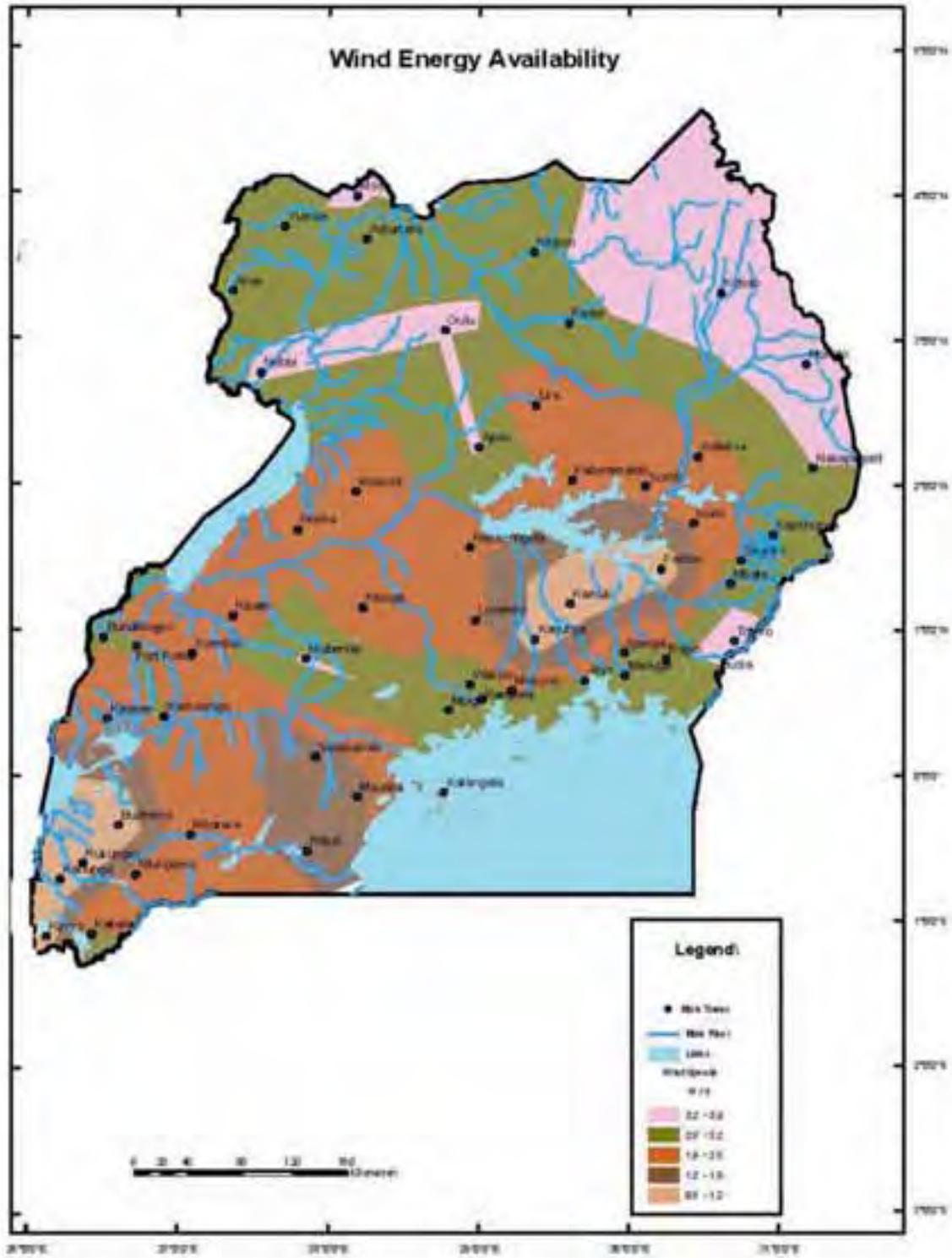
FIGURE 3
Electricity Network of Uganda



Source: UIA, as of 2008



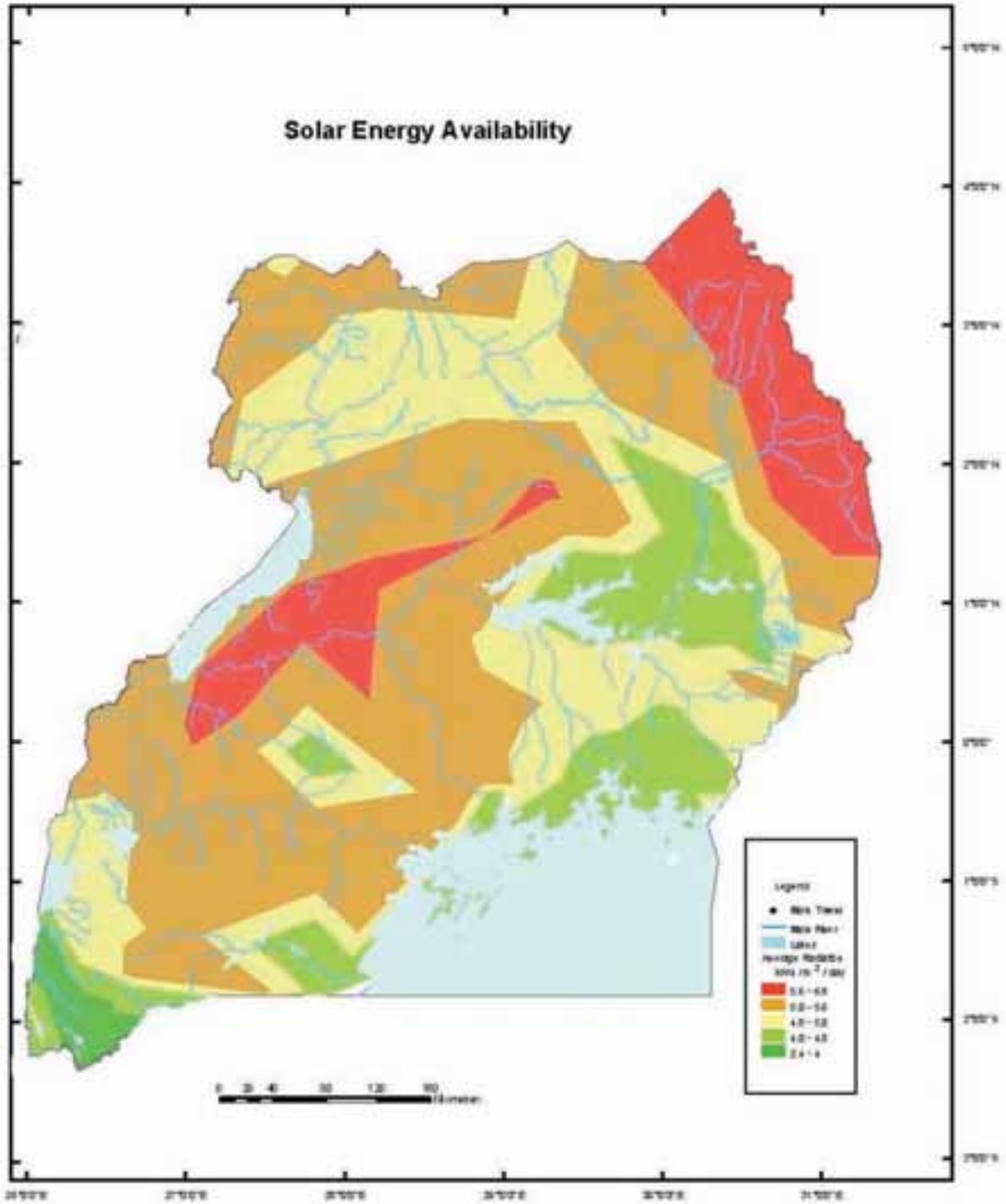
FIGURE 4
Wind Energy Sources



Source: MEMD, as of 2007



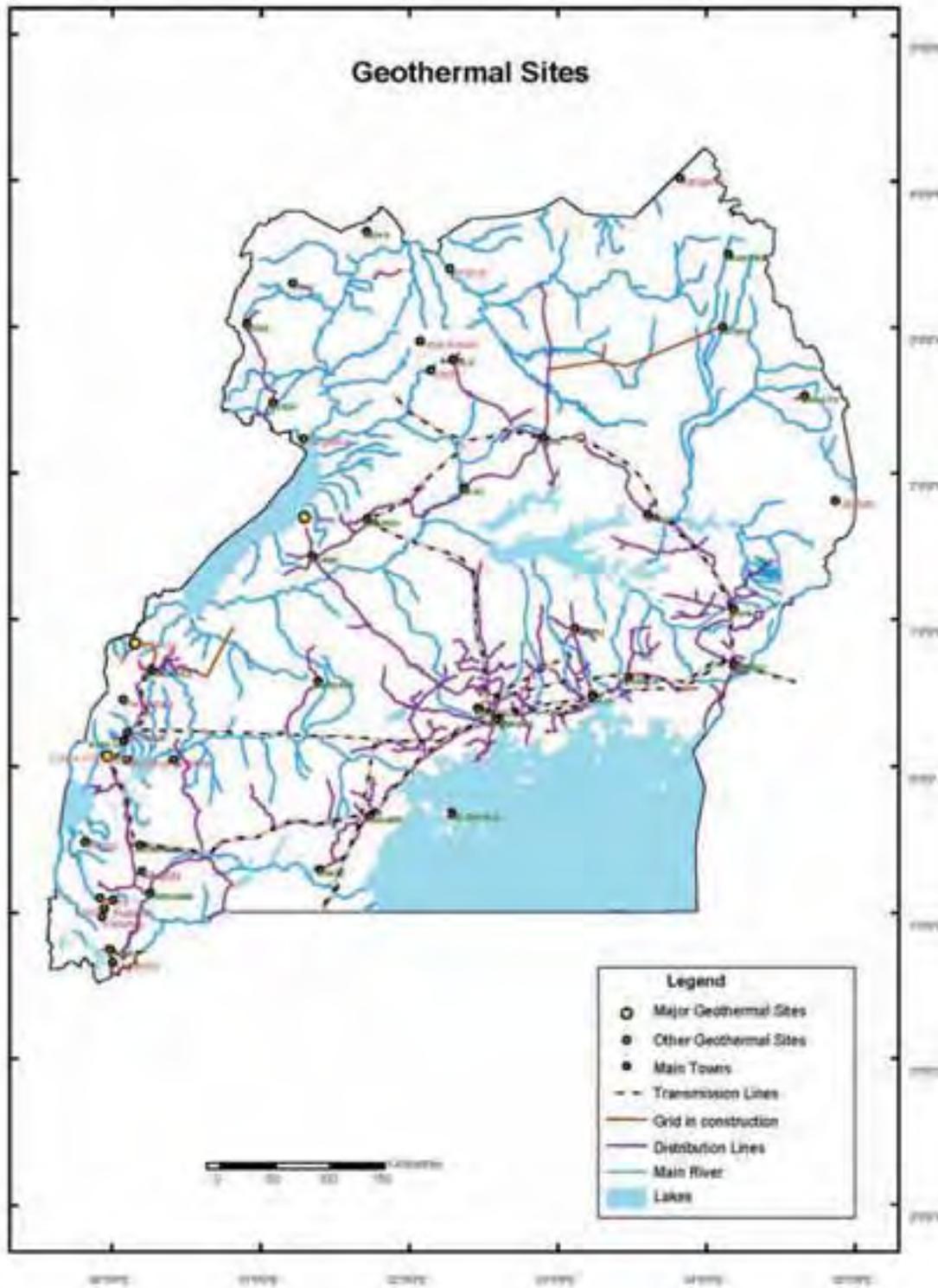
FIGURE 5
Solar Radiation



Source: MEMD, as of 2007



FIGURE 6
Geothermal Sources



Source: MEMD, as of 2007



FIGURE 7
Large Hydro Power Sources



Source: MEMD, as of 2007



FIGURE 8
Mini Hydro Power Sources



Source: MEMD, as of 2007



TABLE 5

Feed-In Tariff Schedule for Renewable Energy Generation under 20 MW Hydro Power (US Cent/kWh)

	YEAR 1 _6	YEAR 7-20	SIMPLE WEIGHTED AVERAGE
Peak	12.00	9.00	9.90
Shoulder	6.40	5.40	5.70
Off-peak	4.00	1.50	2.25
Average	7.20	5.33	5.89

TABLE 6

Cogeneration with Bagasse (US Cent/kWh)

	YEAR 1-6	YEAR 7-20	SIMPLE WEIGHTED AVERAGE
Peak	12.00	8.00	9.60
Shoulder	6.00	4.50	5.10
Off-peak	4.10	4.00	4.04
Average	7.03	5.25	5.96

TABLE 7

Development of Hydro Power Projects on the Nile River

SITE	LOCATION	INSTALLED CAPACITY (MW)	POTENTIAL CAPACITY (MW)	STATUS
Nalubale	Jinja	180	180	In operation
Kiira	Jinja	200	200	In operation
Bujagali	Jinja	0	320	A plant of 250MW capacity is under construction (due to be operational in 2011) by Bujagali Energy Limited (a joint venture of Industrial Promotion Services Ltd (Kenya) and US-based Sithe Global Power LLC)
Kalagala	Jinja	0	350	Feasibility study complete
Karuma	Masindi/ Apac	0	200	Feasibility study complete; NORPAK Power Ltd. is to develop Karuma with due diligence
Ayago South	Gulu/ Masindi	0	234	Preliminary studies available
Ayago North	Gulu/ Masindi	0	304	Preliminary studies available
Murchison	Gulu/ Masindi	0	642	Preliminary studies available, but has adverse environmental effects
Isimba	Kamuli	0	87	Estimate
Bugumira	Kamuli	0	109	Estimate

Source: MEMD, as of 2007



TABLE 8

Non-Nile Mini/Micro Hydro Power Sites

NAME	DISTRICT	STATUS	INSTALLED (MW)	POTENTIAL (MW)
Maziba	Kabale	Out of operation-needs rehabilitation (KfW financing the rehabilitation)	1.00	1.00
Kuluva	Moyo	In operation, feeding Kuluva Hospital	0.12	1.00
Kagando	Kasese	In operation, feeding Kagando Hospital	0.06	1.00
Kisiizi	Rukungiri	In operation at 60 kW; expansion to 294 kW is in progress under the ERT program	0.06	0.30
Mobuku I	Kasese	Operated by Kilembe mines; supplies Kilembe and feeds into the main grid	5.40	5.40
Mobuku III	Kasese	Operated by Kasese Cobalt Co. and feeds into the main grid	10.50	10.50
Muzizi	Kibale/Kabarole	Under development by SN Power Invest AS; permit granted November/December 2004 for 12 months; feasibility study still ongoing		20.00
Warugo	Bushenyi	Pre-feasibility study carried out by UNIDO	0	3.50
Rwizi	Mbarara	Pre-investment studies carried out	0	0.50
Kakaka	Kabarole	Feasibility studies carried out by SWECO (Swedish engineering firm), Eco Power has applied for permit	0	7.20
Nshungyezi	Mbarara	Electricity Distribution Management (Namibia) has permit to develop the site	0	20.00
Nyamabuye	Kisiro	Developer is the Uganda Sustainable Energy Company Limited (USEC); permit granted in February 2005; feasibility study was conducted by Norplan, USEC is yet to start on pre-investment study	0	2.20
Siti	Kapchorwa	Developer Mt. Elgon Power Company; permit issued in July 2002 and extended until September 2004	0	3.30
Sipi	Kapchorwa	Developer Mt. Elgon Power Company; permit issued in July 2002 and extended until September 2004	0	2.50
Anyau/ Olewa	Arua	WENRECO has exclusive rights to the site through the West Nile License	0	1.50
Haisesero	Kabale	Estimate	0	1.00
Kitumba	Kabale	Estimate	0	0.20
Mpanga	Kabarole	Estimate	0	0.40
Nyakibale	Rukungiri	Estimate	0	0.10
Leya	Moyo	Estimate	0	0.12
Amua	Moyo	Estimate	0	0.18
Mvepi	Arua	Estimate	0	2.40
Ela	Arua	Estimate	0	1.50
Agoi	Arua	Estimate	0	0.35
Ngusse	Kibale	Estimate	0	0.40
Kikagati	Mbarara	Old power plant used to operate at 1 MW; China Shang Sheng Industrial Company to rebuild and expand plant to 20MW; permit granted on 29 July 2005	0	20.00
Sezibwa	Mukono	Estimate	0	0.50
Tokwe	Bundibugyo	Developer Uganda Energy for Rural Development (UERD)	0	0.10
Mgiita	Bundibugyo	Estimate	0	0.15
Miria Adua	Arua	Estimate	0	0.10
Ishasha	Rukungiri	Feasibility studies carried out by consultant; Eco Power has applied for a permit and is carrying out pre-investment studies	0	6.50
Buseruka	Hoima	Feasibility studies done by Hydromax; 12 months of the permit granted; effective 1 August 2005	0	10.00
Nengo Ridge	Kanungu/Rukungiri	Developer SN Power Invest AS; permit granted November/December 2004 for 12 months	0	7.50
Bugoye	Kasese	Developer SN power invest AS; permit granted November/December 2004 for 12 months	0	11.00
Mobuku II	Kasese	Developer SN power Invest AS; permit granted November/December 2004 for 12 months	0	13.00
Kyambura	Bushenyi	Pre-feasibility studies being carried out by Eco Power	0	0.00
Muyembe Sirinutyo	Sironko	Developer Mt. Elgon Power Company; permit issued July 2002 and extended until expiry in September 2004	0	2.60
Ririma	Kapchorwa	Developer Mt. Elgon Power Company; permit issued July 2002 and extended until expiry in September 2004	0	1.20
Mahoma	Kamwenge/Kabarole	Developer Uganda Energy for Rural Development, permit granted in November/December for 12 months	0	3.00
Rwebijoka	Kabarole	Developer Uganda Energy for Rural Development; permit granted in November/December for 12 months	0	1.00



NAME	DISTRICT	STATUS	INSTALLED (MW)	POTENTIAL (MW)
Mitano	Kanungu/Rukungiri	Estimate	0	2.50
Rwempungu	Bushenyi	Estimate	0	2.30
Cresta	Ibanda	Estimate	0	2.00
Rwenzori	Kasese	Estimate	0	3.00
Mpanga Escarpment	Kamwenge	Estimate	0	14.00
Rwigo	Bundibugyo	Estimate	0	0.00
Nyahuka	Bundibugyo	Estimate	0	0.70
Nkussi Escarpment	Hoima/Kibaale	Estimate	0	11.00
Nkussi at Pachwa	Hoima/Kibaale	Estimate	0	0.38
Waki	Hoima/Masindi	Developer SN Power Invest AS; permit granted November/December 2004 for 12 month; feasibility study by Norplan	0	5.00
Sonso	Masindi	Estimate	0	1.40
Waisoke	Masindi	Estimate	0	1.70
Izizi	Masindi	Estimate	0	1.60
Esia	Adjumani	Developer Adjumani Rural Electrification Company	0	1.00
Kochi	Koboko	Estimate	0	0.91
Nyarwodo I	Nebbi	Estimate	0	0.00
Nyagak I	Nebbi	Feasibility study completed and ready for development; WENRECO was awarded concession in March 2003; conducting a Resettlement Action Plan (RAP); construction expected to begin January 2007	0	3.50
Nyagak II	Nebbi	Estimate	0	3.00
Ora	Arua	Estimate	0	0.90
Manafwa	Manafwa	Estimate	0	0.75
Simu	Sironko	Estimate	0	2.60

Source: MEMD, as of 2007

TABLE 9

Large Hydro Power Sites at Nile River

SITE	LOCATION	INSTALLED CAPACITY (MW)	MAX. POTENTIAL CAPACITY (MW)	STATUS
Nalubale (Owen Falls Dam)	Jinja	180	180	In operation
Kiira (Owen Falls Extension)	Jinja	200	200	In operation
Bujagali	Jinja	250	320	IPS Consortium has started construction to generate 250 MW
Kalagala	Jinja	0	350	Feasibility study complete
Karuma	Masindi/Apac	200	200	Feasibility study complete; NORPAK Power Ltd. to develop site
Ayago South	Gulu/Masindi	0	234	Preliminary studies available
Ayago North	Gulu/Masindi	0	304	Preliminary studies available
Murchison	Gulu/Masindi	0	642	Preliminary studies available, but has adverse environmental effects
Isimba	Kamuli	0	100	Estimate
Bugumira	Kamuli	0	109	Estimate

Source: MEMD, as of 2007



TABLE 10
Ongoing Energy Programs in Uganda

PROJECT	INSTITUTION INVOLVED	DESCRIPTION	FUNDING	STATUS
Energy for Rural Transformation (ERT)	Ministry of Energy and Mineral Development (MEMD)	A ten-year program that aims at increasing rural access to energy from the present 1% to 10% in ten years through three means: i) grid extension ii) IPPs (for mini grids) and iii) solar energy	World Bank and GEF have funded WENRECO hydro power, Kakira co-generation and Kisiizi hydro power projects, market development and capacity building in installation of solar home systems, electrification of pilot schools and health centers as well as water supply schemes	Phase I ending (covering institutional development, baseline studies, pilot projects in 12 districts, business development, establishment of refinancing scheme); Phase II to begin (emphasis on implementation and financing of projects)
Energy Advisory Project/Promotion of Renewable Energy and Energy Efficiency Programme (PREEP)	German Development Cooperation/GTZ	A project based at the MEMD provides energy policy advisor services and facilitates improved access to modern sustainable energy services for the Ugandan economy and the Ugandan population, especially the poor	Provided support to the dissemination of improved stoves, solar home systems through private companies and NGOs; has disseminated 600,000 stoves, electricity saving lamps to more than 10,000 households; some 69 institutions have been equipped with solar PV systems since September 2006	Phase III of the Energy Advisory project ran from June 2005 to May 2008; the new program on promotion of RE and energy efficiency started in 2008 and its first phase will be until May 2011 (funding available amounts to 5.9 million €)
Rural Electrification Projects	KfW Entwicklungsbank	Investment financing in RE projects	WENRECO, grid extension in West Nile (2007–2009), 4.0 million €; rehabilitation of Maziba Hydro Power Plant 1 MW (2007–2009), 2.5 million €; transmission line Entebbe–Mutundwe (2008–2010); mini hydro power plants in West Nile, 4 million €	Feasibility studies advertised and being undertaken
African Development Bank (AfDB)	AfDB	Investment in large hydro power projects	Bujagali hydro power project (2007–2011), 110 million USD; Bujagali Interconnection Project (2008–2010), 28 million USD; Rural Electrification Project (2009–2012), 30 million USD; Buseruka mini hydro power project (2008–2011), 8–10 million USD	

Source: data compiled by the author, as of 2009