Renewable Energies in West Africa

Regional Report on Potentials and Marktes – 17 Country Analyses

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

gtz Promotion of Renewable Energies

On behalf of
Federal Ministry
for Economic Cooperation
and Development

IMPRINT

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Deutsche Gesellschaft für Technische Zusammenarbeit – GTZ (2009): Regional Reports on Renewable Energies. 30 Country Analyses on Potentials and Markets in West Africa (17), East Africa (5) and Central Asia (8). Frankfurt/Eschborn

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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 knowledge 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.

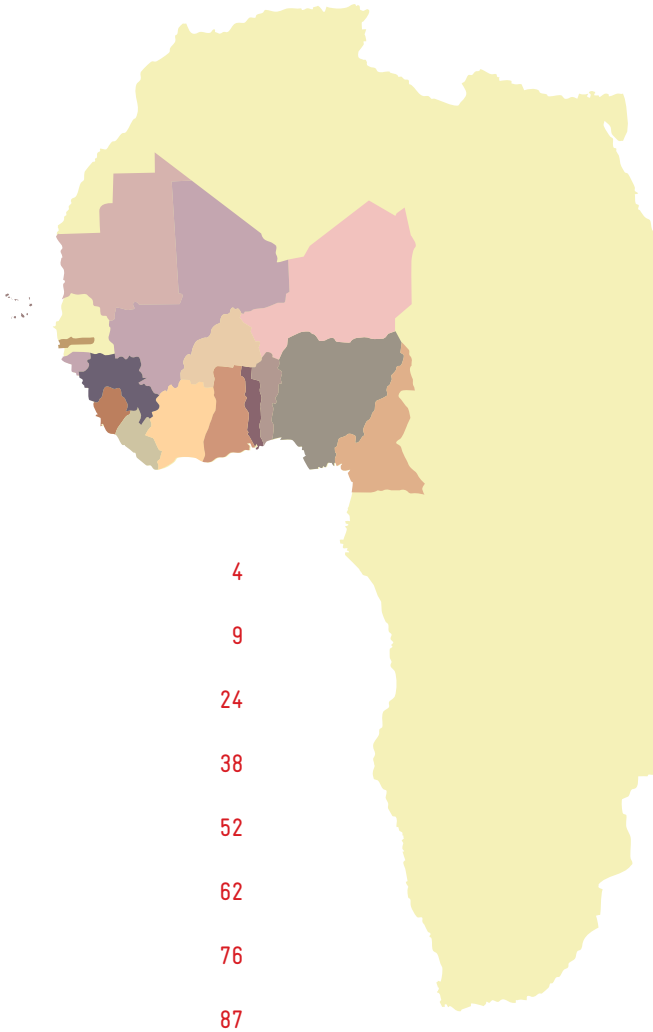
The presented regional reports series is part of the Energy-policy Framework Papers of the "Energy and Transport" section of Deutsche Gesellschaft für Technische Zusammenarbeit (gtz) GmbH.

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

Acknowledgements
The editorial team – also on behalf of the Federal Ministry for Economic Cooperation and Development (BMZ) – would like to thank all contributors, in particular all authors and coordinators (especially Anton Hofer of WIP, Rafael Wiese of PSE AG and Dr. Klaus Jorde of Entec AG) who have contributed to this publication by sharing their valuable insights and experiences.

Special thanks also to Rolf-Peter Owsianowski for his efforts to identify appropriate local experts as authoring contributors, to Barbara Meder for editing of the reports and to "die Basis – Kommunikation. Ideenwerk. Design." for the design of the publication.



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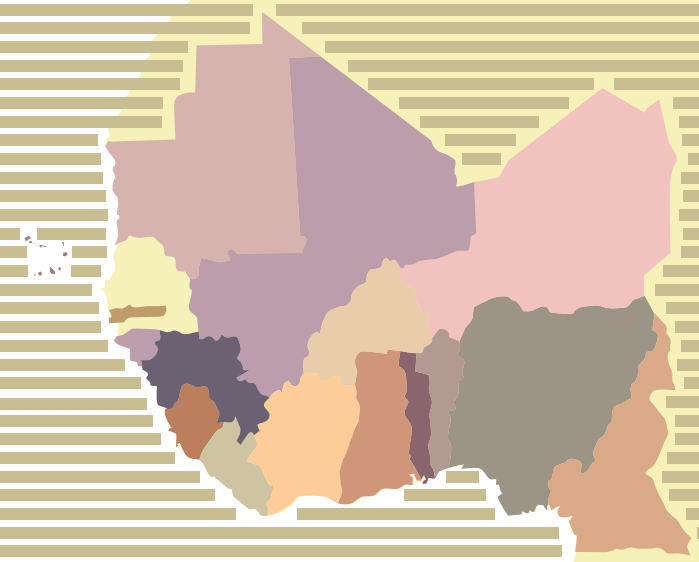

REGIONAL REPORT SUMMARY – BASED ON THE 17 COUNTRY CHAPTERS BENIN, BURKINA FASO, CAPE VERDE, CAMEROON, COTÊ D'IVOIRE, GAMBIA, GHANA, GUINEA, GUINEA BISSAU, LIBERIA, MALI, MAURITANIA, NIGER, NIGERIA, SENEGAL, SIERRA LEONE, TOGO

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ACRONYMS AND ABBREVIATIONS

REGIONAL REPORT SUMMARY

ECOWAS	ECONOMIC COMMUNITY OF WEST AFRICAN STATES (COMMUNAUTÉ ÉCONOMIQUE DES ÉTATS DE L'AFRIQUE DE L'OUEST – CEDEAO)
EBID	ECOWAS BANK FOR INVESTMENT AND DEVELOPMENT
GDP	GROSS DOMESTIC PRODUCT
USD	UNITED STATES DOLLAR
RE	RENEWABLE ENERGIES
WAPP	WEST AFRICAN POWER POOL
CHP	COMBINED HEAT AND POWER
ERC	ENERGY REGIONAL CENTER
EE	ENERGY EFFICIENCY
UNIDO	UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
GEF	GLOBAL ENVIRONMENTAL FACILITY

MEASUREMENTS

KWH	KILOWATT HOUR
KM	KILOMETER
M^2	SQUARE KILOMETER
MW	MEGAWATT HOUR

1 INTRODUCTION TO THE REGION OF THE ECONOMIC COMMUNITY OF WEST AFRICAN STATES (ECOWAS)

1.1 GENERAL OVERVIEW

The Economic Community of West African States (ECOWAS or in French: CEDEAO)[1] is a regional alliance of fifteen countries[2] established in 1975. As defined in Article 3 of the ECOWAS Treaty[3], the overall goal of the community is to promote co-operation and integration in order to establish an economic union in West Africa. The union intends to raise the living standards of its inhabitants, to maintain and enhance economic stability, to foster relations among the member states and to contribute to the progress and development of the African continent.

In order to achieve these aims, ECOWAS shall, by stages, ensure both the harmonization and coordination of all national policies and the promotion of integration programs, projects and activities focusing on various sectors (especially food, agriculture and natural resources, industry, transport and communications, environment trade, finance, taxation, economic reform, science, technology, legal matters and energy). Moreover, ECOWAS aims at the establishment of a common market with a total liberalization of trade between its member states. Structure-wise, the Economic Community of West African States consists of four major institutions, namely:

- The Commission
- The Community Parliament
- The Community Court of Justice
- ECOWAS Bank for Investment and Development (EBID)

The Commission (formerly "ECOWAS Secretariat") and the ECOWAS Bank for Investment and Development (formerly "Fund for Cooperation, Compensation and Development") are the two central institutions to support the implementation of programs and development projects in ECOWAS member states.

1.2 GEOGRAPHIC AND ECONOMIC CONDITIONS OF THE ECOWAS REGION

According to official figures issued by ECOWAS, the current population is estimated at 220 million inhabitants, which amounts to roughly 40 % of the total population of Sub-Saharan Africa. It is estimated that by 2015, about 325 million people will live in the ECOWAS region. The area of the ECOWAS territory is 6.1 million km². The Gross Domestic Product (GDP) of ECOWAS reaches a total of 106.7 billion USD.

1 A PRESENTATION WITH MORE DETAILED INFORMATION ON ECOWAS IS AVAILABLE ON THE ECOWAS WEBSITE: WWW.COMM.ECOWAS.INT/SEC/EN/PPS/ECOWAS.PPS

2 BENIN, BURKINA FASO, CAPE VERDE, CÔTE D'IVOIRE, GAMBIA, GHANA, GUINEA, GUINEA BISSAU, LIBERIA, MALI, NIGER, NIGERIA, SENEGAL, SIERRA LEONE, TOGO. ALTHOUGH MAURITANIA IS NO LONGER A MEMBER STATE OF THE ECOWAS (MAURITANIA LEFT THE COMMUNITY IN 2001), IT IS ALSO CONSIDERED AS COUNTRY CHAPTER OF THE REPORT "RENEWABLE ENERGIES IN WEST AFRICA – REGIONAL REPORT AND MARKET ANALYSIS".

3 ECOWAS, AS OF 2007

2 ENERGY MARKET OF THE WEST AFRICAN COMMUNITY REGION

2.1 OVERVIEW OF ENERGY SITUATION AND RENEWABLE ENERGY POTENTIAL

Currently, the ECOWAS region suffers from a huge demand/supply gap (more than 40 %) in modern energy services. About 64 % of the total energy supply are covered by thermal power plants, 31 % are generated with Hydro Power, 5 % come from imports and other energy resources such as Renewable Energies (RE). With a total contribution of 80 %, traditional biomass is currently a vital part of the primary energy consumption within ECOWAS. Moreover, the region is strongly dependent on fossil fuels. Less than 10 % of the rural population have access to electricity and modern energy services. Therefore it is necessary to utilize local and RE sources in order to enhance the energy situation within the ECOWAS region.

The hydroelectricity potential of the ECOWAS region is estimated at 25,000 MW. Up to now, only 16 % are developed and utilized. With regard to the utilization of wind energy, considerable wind speeds are encountered along the coasts and the desert zones. The average solar irradiation in West Africa offers a significant solar energy potential of 4–6 kWh/m²/day.

2.2 EXISTING IMPEDIMENTS AND DEFICIENCIES

The development of existing RE sources is currently neither limited by missing local availability nor by lack of technical feasibility. The illustrated potentials for sustainable RE supplies, however, are rather handicapped by a variety of obstacles and deficiencies in the ECOWAS region:

- Financial aspects (higher costs of RE as compared to fossil fuels, lack of financing facilities)
- Lack of local experts and skilled personnel (financial, technical and administrative area)
- Limited production capacity for technical installations & equipment (expensive imports)
- Inefficient institutional structures (energy services in rural areas and peri-urban areas)
- Bureaucratic and legal barriers (lack of tax incentives and feed-in-tariffs)
- Little interest to diversify the existing energy mix and the energy supply structure
- Lack of strategic planning and coordination in the energy sector and energy markets

3 (RENEWABLE) ENERGY FRAMEWORK CONDITIONS AND POLICY INITIATIVES

Faced with significant deficiencies in the energy supply sector, the ECOWAS member states have adopted ambitious regional policies, committing themselves to harmonize national energy legislation, to increase the autonomy of energy supply and to significantly raise the level of access to modern energy services. In order to achieve these goals, various policy initiatives and programs have been developed in the ECOWAS region.

The Common Energy Policy covers the introduction of an integrated energy planning system, the promotion of RE and the speeding up of the connection of interlinked systems for electricity grids in cooperation with ECOWAS.

The ECOWAS Energy Protocol[4] is a legal text formalizing the juridical framework of enterprises in the energy sector. It was designed as a guarantee for foreign direct investments in the energy sector. The adoption and ratification of this convention is an eligibility criterion for access to the World Bank Facility for the West African Power Pool (WAPP).

The White Paper[5] aims to provide energy access to at least half of the population living in rural and peri-urban areas by 2015. It has formulated three major specific objectives: (i) the reinforcement of regional integration, (ii) the promotion of coherent, institutional and political frameworks for improved access to energy services in the ECOWAS region and (iii) the development of coherent energy programs with focus on poverty reduction. Within its specific objectives, the White Paper focuses on capacity building of private and public actors, the enhanced availability of soft loans, grants and private sector funds for energy services in rural or peri-urban areas, the improved exchange, promotion and dissemination of sub-regional experiences in view of energy services and the promotion of local energy production and energy services.

The West African Power Pool (WAPP)[6] aims at the integration of national electricity grids in a number of West African countries (i.e. Nigeria, Benin, Togo, Ghana, Côte d'Ivoire, Niger, Burkina Faso and Mali) by building up more than 5,600 km of interconnection lines. The medium- to long-term goal is to guarantee the citizens of ECOWAS member states a stable and reliable electricity supply at affordable costs. In order to reach this goal, the framework conditions of national energy markets within the ECOWAS region need to be harmonized.

The West African Gas Pipeline aims to strengthen the energy supply through a gas pipeline system. Based on natural gas imports from Nigeria, it is planned that Combined Heat and Power (CHP) plants in Benin, Ghana and Togo (total capacity of 3,000 MW) will be supplied via a 678 km gas pipeline network.

4 OUTLOOK AND ACTIVITIES FOR RENEWABLE ENERGIES

Based on the White Paper's goal for improving energy access in West Africa, the ECOWAS will shortly establish a West African ECOWAS Regional Center for Renewable Energy and Energy Efficiency (ERC) hosted by Cape Verde. The specific goal of the center is to provide a platform for leading and coordinating the implementation of the ECOWAS Regional White Paper on Energy Access focusing on RE and also on Energy Efficiency (EE). This will be facilitated through the center's four major activities: funds mobilization, policy and capacity development, knowledge management and communications and the demonstration of RE/EE technologies.

One of the major financing and promotion programs is the recently initiated Energy Program for West Africa issued by the United Nations Industrial Development Organization (UNIDO) and the Global Environmental Facility (GEF) which comprises – besides the 15 ECOWAS countries – also Mauritania, Chad and Burundi. The program with an overall project budget of 46 million USD focuses on three main objectives: (i) taking a programmatic approach in promoting RE and EE projects at the national level in the countries of the region, (ii) scaling up access based on RE and promoting EE measures in the industry, households and the public sector and (iii) creating markets to catalyze private sector investments. Among the main program components are demonstration projects, support for policy or regulatory framework, capacity building and RE based mini-grids for productive uses in rural areas.

A more detailed insight into the individual country RE market situations in the ECOWAS region is provided by the 16 analyses[7] of this regional report on RE in West Africa.

4 ECOWAS, AS OF 2003

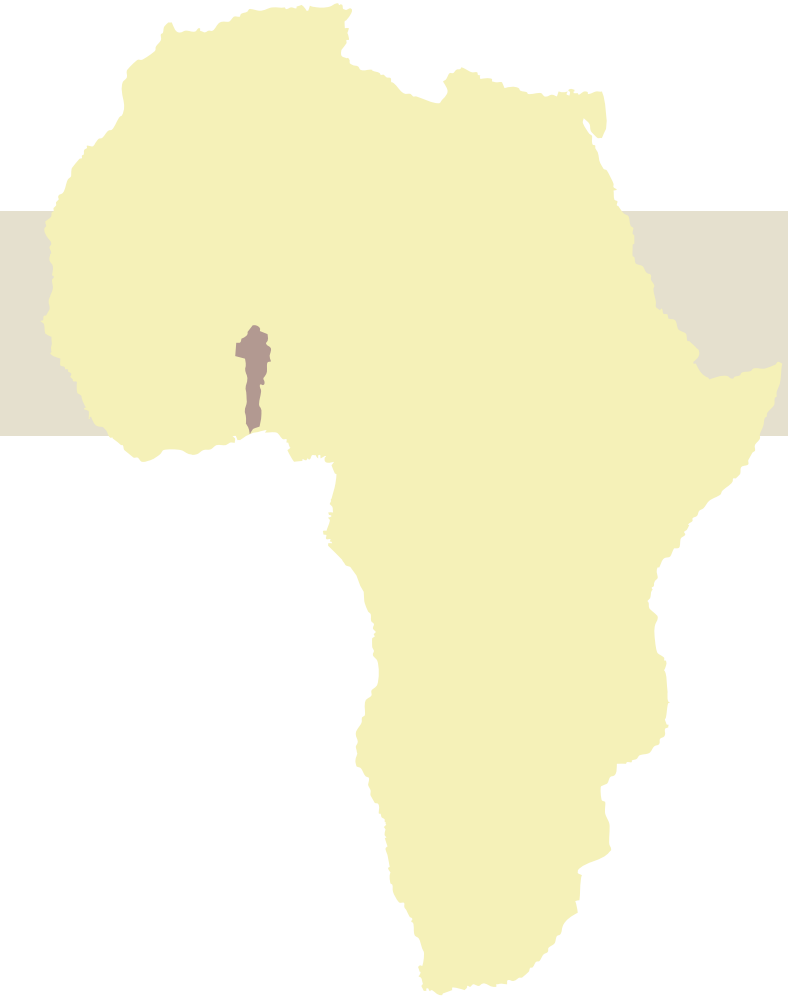
5 ECOWAS/UEMOA, AS OF 2005

6 SEE WEBSITE OF THE WAPP: WWW.ECOWAPP.ORG

7 THE REGIONAL REPORT WEST AFRICA DOES NOT INCLUDE A SEPARATE COUNTRY CHAPTER FOR THE ECOWAS COUNTRY OF SENEGAL, AS THE KEY INFORMATION ON THE SENEGALESE RE MARKET IS ALREADY AVAILABLE BY TWO OTHER STUDIES EDITED AND COMPILED BY GTZ ON BEHALF OF THE GERMAN GOVERNMENT. REFERENCE: GTZ/TERNA (2004): ENERGY POLICY FRAMEWORK CONDITIONS FOR ELECTRICITY MARKETS AND RENEWABLE ENERGIES – 21 COUNTRY ANALYSES, PART SENEGAL (IN ENGLISH) => WWW.GTZ.DE/DE/DOKUMENTE/DE-PROJEKTERSCHLIESSUNG-SENEGAL-LAENDERREPORT.PDF ‹WWW.GTZ.DE/DE/DOKUMENTE/DE-PROJEKTERSCHLIESSUNG-SENEGAL-LAENDER-REPORT.PDF›

5 BIBLIOGRAPHY

- ECOWAS (2007): Treaty of ECOWAS (www.comm.ecowas.int/sec/index.php?id=treaty&lang=en)
- ECOWAS (2003): ECOWAS Energy Protocol A/P4/1/03 (www.comm.ecowas.int/sec/en/protocoles/WA_EC_Protocol_English-_DEFINITIF.pdf)
- ECOWAS/ UEMOA (2005): White Paper for a regional policy (www.gm.undp.org/Reports/ECOWAS%20energy%20white%20paper.pdf)
- West African Power Pool, WAPP, www.ecowapp.org



COUNTRY CHAPTER: BENIN

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ACRONYMS AND ABBREVIATIONS

BENIN

ABERME	Agence Béninoise d'Electrification Rurale et de la Maîtrise (Benin Agency for Rural Electrification and Energy Control)
ACP	Africa, Caribbean, Pacific
AFD	Agence Française de Développement (French Development Agency)
AU	African Union
BIC	Bénéfices Industriels et Commerciaux (tax on industrial and trade benefits)
BOAD	Banque Ouest Africaine de Développement (West African Development Bank)
CBRST	Centre Béninois de la Recherche Scientifique et Technique (Beninese Scientific and Technical Research Center)
CCIB	Chambre de Commerce et d'Industrie du Bénin (Beninese Chamber of Trade and Industry)
CEB	Communauté Electrique du Bénin (Beninese Electricity Community)
CENAPI	Centre National de la Propriété Industrielle (National Intellectual Property Center)
CFE	Centre de Formalités des Entreprises (Enterprises Formality Center)
CIA	Central Intelligence Agency
DGE	Direction Générale de l'Energie (General Directorate of Energy)
ECOWAS	Economic Community Of West African States
EDF	Electricité de France (Electricity of France)
EU	European Union
GDP	Gross Domestic Product
HDI	Human Development Index
IDA	International Development Association
IEPF	Institut de l'Énergie et de l'Environnement de la Francophonie (French Speaking Countries Environment and Energy Institute)
IMF	International Monetary Fund
INSAE	Institut National de Statistique et de l'Analyse Economique du Bénin (National Institute of Statistics and Economy Analysis)
IPC	Investments Promotion Center
IPP	Independent Power Producer
IUT	Institut Universitaire de Technologie (University Technology Institute)
LIFAD	Laboratoire d'Ingénierie, de Formation et d'Assistance en Développement Local (Laboratory of Engineering, Training and Local Development Association)
LPG	Liquefied Petroleum Gas
NGO	Non-Governmental Organization
MIC	Ministère de l'Industrie et du Commerce (Ministry of Industry and Trade)
MEE	Ministère de l'Energie et L'Eau (Ministry of Energy and Water)
NDF	Nordic Development Fund
OHADA	Organisation pour l'Harmonisation en Afrique du Droit des Affaires (Organisation for the Harmonization of Business Law in Africa)
ONAB	Office National du Bois (National Wood Ressources Office)
PFSE	Projet de Fourniture de Services d'Energie (Energy Services Provided Project)
PV	Photovoltaic
RE	Renewable Energy
RPTES	Review of Politics and Traditional Energy Sector
SBEE	Société Béninoise d'Energie Electrique (Beninese Electric Energy Company)
S.I.e.	Système d'Information de l'Energie du Bénin (Energy Information System Benin)
SONACOP	Société Nationale de Commercialisation des Produits Pétroliers (National Oil Company)
SUCOBE	Sucrerie Complant du Bénin
TBE	Table of Board of Energy
UAC	Université d'Abomey-Calavi (Abomey-Calavi University)
UNDP	United Nations Development Programme
USD	United States Dollar
VAT	Value Added Tax
WAEMU	West African Economic and Monetary Union

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
km²	square kilometres
MW	megawatt (1 MW = 1,000 kW)
m³	cubic meter
mm	millimeters
toe	tons of oil equivalent
kV	kilovolt
m/s	meters per second
€	Euro

SUMMARY

The Country Study of Benin is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Benin. The study is structured as follows:

Chapter one provides **Background Information on Benin**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic andsocio-economic conditions of Benin.

Chapter two summarizes facts and figures of **Benin's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Benin. This includes an overview of support mechanisms for photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Benin.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Benin.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Benin is a West African country surrounded by Togo in the West, Nigeria in the East, Burkina Faso and Niger in the North. The country's territory comprises 112,620 km² with an estimated population of about 8,532,000. The capital of Benin is Porto Novo.

MAP OF BENIN

Benin has four main geographical regions. The southern region is a narrow coastal zone fringed in its North by a series of interconnected lagoons and lakes with only two outlets to the sea. In the Northwest of Benin there are forested mountains. The major part of the country is influenced by transitional tropical conditions. The dry season starts in November and lasts until the beginning of April. The rainy season covers the period of April to October. The southern part of the country (the coastal zone), is influenced by a northern transitional equatorial climate, marked by a long dry season from November to the end of March, a first rainy season from April to July, a small dry period in August, and a second rainy season in September and October. The average rainfalls vary between 1,400 mm per annum in the south to 850 mm in the North.

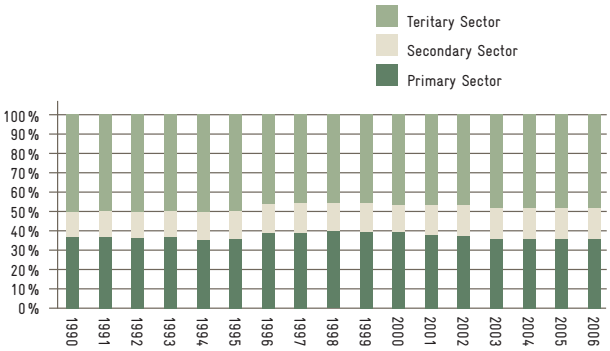
1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Benin gained its independence from France in 1960. After the National Conference and a referendum, several democratic reforms were adopted in February 1990. Free elections were established in 1991, marking the transition to a political multiparty system with a presidential regime. The constitution of Benin guarantees human rights and individual freedom. The total population of Benin (as of 2008) comprises 8,532,000 inhabitants. The population structure includes two distinctive features: a very young population (55.6 % are less than 17 years old) and a feminine dominance of about 51.5 %. The spatial distribution of population is highly irregular, as about 45.5 % of the population are resident in six departments in the South of Benin equaling an area of only 10 % of the country's territory. The share of urban population adds up to 38.85 %.

The GDP of Benin amounted to 1,077 billion Euros in 1998, while in 2005 it accounted for 1,603 billion Euro, at constant market prices in both years comparable to those in 1985. Between 1998 and 2005, the annual growth was about 5.85 %. Figure 2 illustrates the development of the sector-based components of the GDP.

FIGURE 2

Development of GDP by Sectors



Source: INSAE data compiled by the author, as of 2008

According to the 2007/2008 World Human Development Report[1], the country ranks at position 163 out of 177 with a HDI of 0.437 and a GDP per capita of USD 1,141. Table 1 illustrates the levels of poverty on the rural, urban and national level of Benin in 2002 and 2006. The average monetary poverty per inhabitant was analyzed according to the usual indicators of incidence (P0), of depth (P1) and of severity (P2) for the exemplary years of 2002 and 2006.

TABLE 1

Incidence, Depth and Severity of Poverty by Area

	2002			2006		
Areas	P0	P1	P2	P0	P1	P2
Urban (%)	23.60	0.11	0.11	27.02	0.11	0.06
Rural (%)	31.60	0.11	0.06	40.60	0.15	0.08
National (%)	28.50	0.11	0.06	36.80	0.14	0.07

Source: IMF, 2008, p. 26

1 UNITED NATIONS DEVELOPMENT PROGRAM (UNDP)– HUMAN DEVELOPMENT REPORTS (WWW.HDR.UNDP.ORG)

2 ENERGY MARKET IN BENIN

2.1 OVERVIEW OF THE ENERGY SITUATION

Benin is characterized by a predominance of biomass energy in the overall energy mix.

TABLE 2

Energy Mix of Benin

	BIOMASS	PETROLEUM PRODUCTS	ELECTRICITY
Consumption (toe)	1,338,714	866,540	50,628
Contribution (%)	59.40	38.40	2.20

Source: S.I.e. Benin, as of 2006

The major part of the total energy consumption can be allocated to households, with a total of approximately 63.9 %. The transport sector accounts for 23.2 %, the service sector for 10.6 % and the barely developed industry sector of Benin consumes about 2.3 %. Figure 3 visualizes the energy consumption per sector, while Figure 4 presents the detailed consumption of the industry sector.

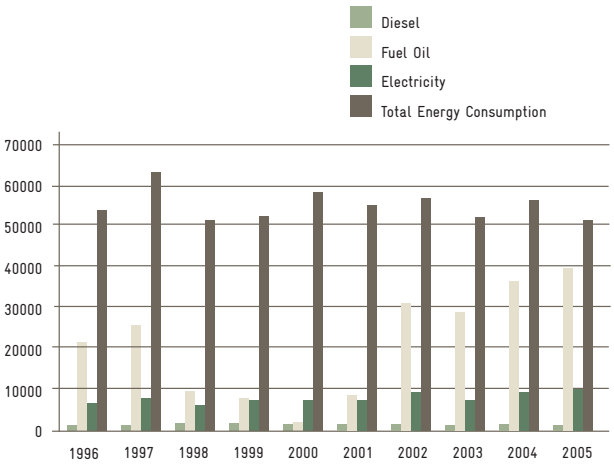
FIGURE 3

Energy Consumption per Sector (toe)

Source: S.I.e. Benin with data from DGE, as of 2006

FIGURE 4

Energy Consumption of the Industry Sector



Source: S.I.e. Benin with data from DGE, as of 2006

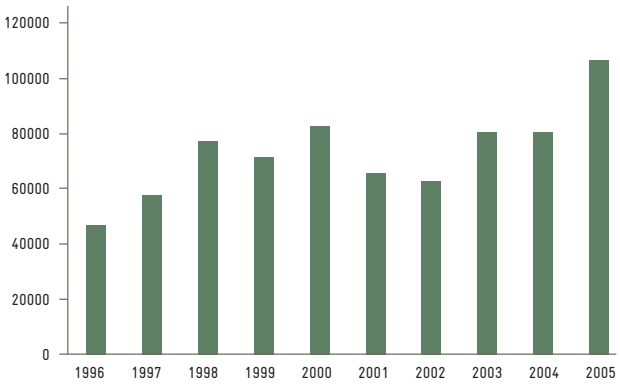
2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity sector of Benin has a total production capacity of 97,484 MW; only 60 MW, however, are continuously available. The existing shortage in energy production capacity results in an insecurity of power supply (mainly caused by a lack of production capacities) and has forced industrial enterprises to set up stand-by power generators of their own. In 2007, the total power output of the National Power Utility was estimated at 180 GWh. The electricity sector of Benin is state-owned and managed by the Benin National Power Utility (SBEE), the exclusive owner of thermal power stations and the national electricity network. Figure 5 shows the national electricity production between 1996 and 2005; Figure 6 presents the electricity consumption by sector.

FIGURE 5

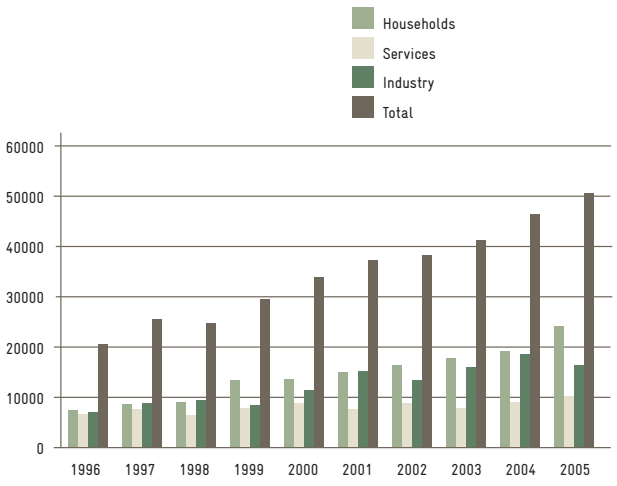
National Electricity Production (MWh)



Source: S.I.e. Benin with data from DGE, as of 2006

FIGURE 6

Electricity Consumption by Sector (MWh)



Source: S.I.e. Benin, as of 2006

Since its foundation in 1973, SBEE has been changing electricity tariffs four times. The tariff structure, however, remained the same. The electricity tariffs are appointed by the Government and are standardized throughout Benin. The detailed electricity prices are summarised in table 3.

Petroleum Sector

Benin has no national oil refinery. Therefore, all petroleum products are imported to Benin via licensed (the national oil company Société Nationale de Commercialisation des Produits Pétroliers – SONACOP) and unlicensed (informal market) importers. As the majority of imports are carried out by unlicensed importers, the respective numbers need to be estimated. The overall amount of imported petroleum products reached 837,000 tons in 2005. Table 4 indicates figures of the national petroleum product consumption of 2005.

TABLE 3

Electricity Tariffs for Different Types of Use

TYPE OF USE	SOCIAL SLICE		SLICE 1		SLICE 2	
	Quantities invoiced	Price/kWh	Quantities invoiced	Price/kWh	Quantities invoiced	Price/kWh
Domestic use (light, air-condition etc.)	0–20 kWh	0,08536 €	21–250 kWh	0,12957 €	>251 kWh	0,14482 €
Professional use (shops, restaurants, hotels etc.)	total consumption	0,134.15 €	total consumption	0,134146 €	total consumption	0,13415 €

Source: SBEE, as of 2008

TABLE 4

National Petroleum Product Consumption in 2005 (tons)

FUEL-OIL	DIESEL	KEROSENE	GASOLINE	BUTANE
40,526	118,190	294,536	376,229	7,609

Source: S.I.e. Benin with data from DGE, as of 2006

TABLE 5

Prices of Petroleum Products

PRODUCT	PRICE
Gasoline	0.533 Euro/litre
Kerosene	0.533 Euro/litre
Diesel	0.572 Euro/litre
LPG	0.640 Euro/kg

Source: Ministry of Industry and Trade, as of February 2009

Benin is highly dependent on foreign imports of petroleum products. In 2005, these imports accounted for 2.2 % of the country's GDP (about 33.54 million €). Benin has several crude oil reserves that are officially subdivided in 17 blocks. Seven blocks have already been granted to companies who are currently actively exploring existing resources. From 1982 to 1998, Benin has exploited a small offshore oil field. The cumulated production is an estimated 22 million barrels of crude oil. Potential reserves are assessed at more than 5 billion barrels of crude oil and more than 91 billion m^3 of natural gas. Therefore, several multinational oil companies are investigating in the availability and sites of local reserves.

Benin's tax policy allows selling electricity and petroleum products at the same price all over the country. Prices are officially fixed by the Government and maintained by cooperating with licensed distributors. The current prices of petroleum products are indicated in table 5.

1 LAW 027-2002/AN OF 9 OCTOBER 2002, REFERRING TO THE AUTHORIZATION OF BURKINA FASO'S ACCESSION TO THE KYOTOPROTOCOL (JOURNAL OFFICIEL NO.47 DU 21 OCTOBRE 2002)

Biomass Sector

The potential resources of wood energy were surveyed in 1999. The potential of wood energy includes contributions generated through National Reforestation Campaigns as well as allocations of the National Wood Resources Office. The objective of the dedicated firewood project is to increase the supply of wood energy on the market by enlarging plantations in the South of Benin. In this respect, the involvement of the National Wood Resources Office also contributes to the reduction of deforestation in the natural forests. Table 6 presents the current and future potential of traditional wood energy, while related prices (as of 2005) are indicated in table 7.

Besides traditional wood energy, a substantial potential of about 5 million tons is identified for agricultural residues. With regard to potential resources for biofuels, there are currently only few production capacities for ethanol. For example, Benin sugar plant "Sucrerie Complant du Bénin" (SUCOBE) produces ethanol at an output capacity of 40,000 tons of sugar and 4,200 m³ of ethanol per year. Furthermore, the YUEKEN Benin International plant has an output of 3,000 m³ of ethanol per year deriving from cassava. Due to the missing distribution infrastructure however, this amount is currently not used for energy or transport purposes.

Currently, Benin is characterized by the preponderance of traditional biomass energy. Future plans aim at modern biomass energy utilization like biogas, biofuels and various residues. In the following, a more detailed overview is presented.

Biogas

The utilization of biogas is currently only planned for the large-scale level. Pilot production units for biogas from animal residues are planned at former state-owned farms with financing from private investors. Several pilot electricity production units and three bigger production units (mainly using household residues) will be gradually implemented at 5 MW per time in 2011, 2018 and 2024.

Biofuels

Considering the assumed demand for diesel and the potential substitution with biodiesel, this development is expected to generate a market for the future. Various vegetable oils like pourghère oil, castor oil, palm oil, cotton, soy and peanut oil could be used for the production of biodiesel. In order to develop a market for biofuels, a regulatory, institutional and legal framework is needed to support the promotion and development of the sector.

In Benin there are few plants that can process vegetable oil to transport fuels. Two plants with a combined capacity of 210,000 tons are located in Bohicon. Furthermore, there is a palm oil plant in Hinvi. The capacities of these plants are not fully exploited yet (currently just about 30 % are being used).

A utilization of ethanol at an admixture rate of 15 % will create a market of about 33,000,000 liters per annum. Regulatory, institutional and legal provisions need to be implemented in order to support the creation of industrial ethanol plants in Benin. A recent survey identified a substantial potential of 46.5 million liters in 2011, 116 million liters in 2015 and 229 million liters in 2020. If the marketplace of the European Union is taken into account, these figures are even higher.

Wood and Agricultural Residues

In Benin, several wood processing plants produce waste and residues that could be used for energy production. The National Wood Resources Office (ONAB) plant in Bohicon, for example, creates about 14,000 m³ waste and residues per year. Currently, these materials are used by households for cooking. They could, however, also contribute to the production of electricity from biomass. With regard to agricultural residues, it is planned to install power production units (5 MW by 2010, 30 MW by 2020) in cotton production areas of Benin.

The cashew nut industry in Benin is growing fast (average growth of 40–50 % per annum during the past 15 years)[2] and is currently the second largest source of agricultural exports (cotton being the most important). The cashew industry offers many attractive features, especially for the utilization of residues for energy production. Up to now, however, the actual processing is still a marginal activity in Benin, with some 97 % of raw cashew being exported. Furthermore, promising by-products such as cashew apple and shells are not being exploited yet. Especially the development of the ethanol production from the apple of cashew nuts in the North Zou and Collines districts is a very promising opportunity for the future.

TABLE 7

Medium Price of Traditional Wood EnergyPrices of Petroleum Products

WOOD	CHARCOAL
0.034 Euro/kg	0.533 Euro/litre

Source: LIFAD Survey, as of 2005

TABLE 6

Potential of Traditional Wood Energy

YEAR	1997	2002	2007	2012	2017	2022	2027
(tons/year)	6,719,469	6,554,064	6,392,754	6,235,436	6,082,012	5,932,386	5,786,462

Source: LIFAD Survey, as of 2005

2 DATA OF THE AFRICAN CASHEW ALLIANCE: WWW.AFRICANCASHEWALLIANCE.ORG.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

Electricity Sector

The Ministry of Energy and Water (Ministère de l'Energie et l'Eau – MEE) is responsible for the overall electricity sector and all related policies in this field. Furthermore, it is in charge of managing the Hydro Power potential as well as all matters related to alternative energy sources in Benin. Besides the Ministry of Energy and Water, three main public operators are involved. The **Communauté Electrique du Bénin (CEB)** is the state-owned international electricity company of Benin and Togo. CEB is fully in charge of the production, distribution and import of electricity in both countries and is therefore jointly owned and managed by Benin and Togo. Furthermore, CEB is responsible for the development of the electricity infrastructure of both partner countries. The **Benin National Power Utility (SBEE)** is largely involved in the overall electricity distribution within the national territory of Benin. SBEE is also responsible for the development and upgrade of the interconnection of the North Togo/North Benin networks. The **Benin Agency for Rural Electrification and Energy Control (ABERME)** was founded in 2004 and is responsible for the implementation of policies in the field of rural electrification. ABERME aims to implement a wide spectrum of energy efficiency measurements in Benin.

Petroleum Sector

The MEE controls and supervises the petroleum sector of Benin. It is the major regulatory institution and decides all matters within this sector. Besides the Ministry of Energy and Water, several oil companies are involved in the petroleum sector of Benin. The national oil company SONACOP, together with several licensed companies such as TOTAL BENIN, TEXACO BENIN S. A. and ORYX BENIN S. A. is in charge of import and distribution activities in Benin. Furthermore, several unlicensed importers and distributors have created an informal market for petroleum products. Decree N° 95–139 of May 3rd 1995 relating to the means of importing and distributing oil products puts the accent on safety measures for the importing, storage and distribution of oil products and their derivatives. Only the State has authority over this activity. The authorities of Benin have just approved of the installation of private companies. Official distributors need a license issued by the **Ministry of Industry and Trade** (Ministère de l'Industrie et du Commerce – MIC) to conduct their business.

Biomass Sector

The Ministry of Environment and Nature Protection is in charge of the management of forest resources and environment problems. The corresponding regulatory framework is currently being updated and improved in order to promote biofuels for local and national transport as well as renewable bioenergy in Benin. In reality, however, the biomass sector of Benin is basically governed by producers and traders of firewood and charcoals, the **National Wood Resources Office (ONAB)** and several wood processing and service companies. Furthermore, a number of NGOs are operating in Benin, especially in the field of reforestation and the rational use of the wood energy.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The existing policies for renewable energy aim to promote and develop the utilization of available RE resources in order to satisfy the demand of energy in remote and rural areas. The objective is to increase the national electricity production and to promote a significant contribution of RE to the overall energy supply of Benin. Therefore, the promotion of locally available RE resources will help to establish an energy supply with broad self-sufficiency. In particular energy from biomass will play a significant role in this process.

The strategy for an improved efficiency of wood energy utilization includes the eased access to cost-effective cooking stoves as well as the substitution of traditional, for example fossil fuel based methods with alternative energy resources. This is to significantly reduce the dependence on wood energy and to create regulated energy markets in the rural areas of Benin. The objective is to diversify the energy mix in order to meet the demand in a more sustainable way. Therefore, it is necessary to establish an adequate institutional, legal and regulatory framework that supports the development and implementation of RE. Although already defined in various policy and strategy documents of Benin, the promising sector RE does not always receive adequate and sufficient attention.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

In order to solve the problem of insufficient energy supply, several national initiatives have been started in Benin. This includes the PV electrification of 38 villages by the Beninese Agency of Rural Electrification with funds from the Islamic Development Bank and the national budget of Benin. Another initiative is the Energy Services Supply Project (PFSE) aiming to increase the access to modern and affordable energy services in urban and rural areas of Benin. Furthermore, the project is to reduce the deforestation, to promote renewable fuels and to diversify the overall energy supply of Benin. The project is financed by the International Development Association (IDA), the West African Development Bank (BOAD), the Nordic Development Fund (NDF), the Benin National Power Company (SBEE), the Benin Electric Community (CEB) and the Government of Benin.

Other initiatives are dealing with the implementation of new gas turbine power stations, the electrification of rural localities, the upgrading of existing Hydro Power plants, the implementation of PV installations and the utilization of modern biomass energy. With regard to increased energy efficiency and the diversification of the energy supply, several dedicated policies and strategies are currently under development. In order to reduce the utilization of small diesel generators, the Government is going to implement a project to interconnect urban and rural areas via the national power grid. This grid expansion includes one power line (161 kV) from Ouake to Bembereke and one (63 kV) from Djougou to Natitingou.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The utilization of traditional biomass contributes significantly to the overall energy mix of Benin. On top of that, a significant potential of sustainable biomass resources is available for heat and electricity production. This includes residues from agricultural products as well as waste from agro-industries, food processing and households. These residues are estimated to be sufficient to produce about 1,500 GWh of electricity. In urban areas of Benin, substantial amounts of household refuse could be used for energy production. According to studies of the city of Cotonou, more than 700 tons of refuse would be available every day. The waste and residues from wood processing plants is identified as another potential source for electricity generation. Another significant potential lies in the cashew nut industry. Up to now, however, the actual processing is still a marginal activity in Benin. Especially energy relevant by-products such as cashew apple and shells are not utilized yet.

4.2 SOLAR ENERGY

The solar energy potential of Benin varies between 3.9 kWh/m² and 6.2 kWh/m², depending on the location. Table 8 presents selected PV installations in Benin.

TABLE 8

PV Installations in Benin

TYPE OF INSTALLATION/FUNDING SCHEME	NUMBER OF INSTALLATIONS	CAPACITY
PV units at villages, funded by Government	14	56 kW
PV units at villages, funded by Government & Islamic Development Bank	24	182 kW
PV unit at public health centres	n.a.	50 kW
Domestic use	n.a.	10 kW
Solar system for telecommunication	50	150 kW

Source: DGE and ABERME, as of 2002

4.3 WIND POWER

According to the available data of the National Meteorological Office, the wind speed varies between 3 and 6 m/s. More detailed information is not available; therefore it is not possible to give a complete overview of the existing potential.

4.4 HYDRO POWER

Benin has a significant potential of Hydro Power that can be used for electricity production. A recent survey shows that the potential of the Oueme River is sufficient to install twenty sites with a total capacity of 760 MW and an annual output of more than 280 GWh. Moreover, approximately 80 other sites are equipped with small-scale hydro power installations for rural electrification.

5 MARKET RISKS AND BARRIERS

In spite of already implemented mechanisms that support the investment in the energy sector, there are still some major obstacles to be found in this sector. It is, for example, difficult to register for a purchase agreement as potential investors have to discuss their application with two state monopolists (CEB for the production and the SBEE for the distribution of energy).

There are also some risks in legal aspects. These are, however, not a major constraint for investment in this field. Outdated technology, the lack of technical knowledge and inadequate finance are major barriers in the implementation of RE in Benin. Also, no incentive measures like exemption from taxes or other benefits are available for potential investors.

The high costs of RE equipment on the one hand and the low level prices for conventional energy on the other hand are not encouraging potential investors at all. Benin has several local experts in the field of RE mostly in technical departments, universities and research centers. There is, however, a need for technical cooperation in the energy sector.

The Government of Benin set up an Investment Facilitation Department in order to support cooperation and investment of the private sector and foreign investors. The Investment Promotion Center was established in order to assist investors in the setting-up of business, the identification of local partners and the correspondence with institutions. The Formalities Center of the Enterprises (CFE) supports investors during the foundation of an enterprise. Furthermore, several other departments are engaged to support the promotion of investment in the energy sector. Benin is implementing structural and economical reforms in order to promote private investment. Table 9 presents the results of the World Bank Ease of Doing Business Survey 2008 for Benin.

TABLE 9

"Ease of Doing Business"–Benin 2008 Ranking

TOPIC	RANKING
Ease of doing business	157
Starting a business	142
Dealing with construction permits	123
Employing workers	117
Registering property	120
Getting credits	141
Protecting investors	148
Paying taxes	162
Trading across borders	130
Enabling contracts	174
Closing a business	109

Source: "Ease of Doing Business", World Bank, as of 2008

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 10

List of Selected Business Partners

INSTITUTION	CITY	FIELD OF ACTIVITY	CONTACT
Electric Community of Benin (CEB)	Lome, Togo	Production, distribution and import of electricity	BP 1368, Lome, Togo Phone: +228 2215795
La Société Béninoise d'Energie Electrique (SBEE)	Cotonou	Import and distribution of electricity	01 BP 123, Cotonou Phone: +229 21312145
Société Nationale de Commercialisation des Produits Pétroliers (SONACOP)	Cotonou	Import, storage and distribution of petroleum products	01.BP 245, Cotonou Avenue Jean-Paul II Phone: +229 21311347
Society Oryx Benin	Cotonou	Import, storage and distribution of petroleum products	Cotonou Phone: +229 21306547
Society TOTAL	Cotonou	Import and distribution of petroleum products	08 BP 701, Cotonou Avenue Jean-Paul II
ENERDAS	Cotonou	Distribution and installation of solar systems and solar equipment	02 BP 8155, Cotonou Phone: +229 21301490
MIERT	Cotonou	Distribution and installation of solar systems and solar equipment	07 BP 1244, Cotonou Phone: +229 21325010
SOLARISS	Cotonou	Distribution and installation of solar systems and solar equipment	05-BP 24522, Cotonou Lot 4053 J Sodjeatinmè
Sucrerie Complant du Bénin (SUCOBE)-Benin sugar plant	Cotonou	Sugar and ethanol producer	BP 6, Cotonou Phone: +229 21305537
Yueken International Benin	Cotonou	Producer of ethanol from cassava roots	071 BP 75, Cotonou Lot 1436 Phone: +229 21384606
Investments Promotion Center (IPC)	Cotonou	Promotion and development of foreign investments in Benin	01 BP 2022, Cotonou Phone: +229 21303062 www.cpibenin.com
Formalities Center of the Enterprises Chambre de Commerce et d'Industrie du Benin	Cotonou	Business creation and modification	01 BP 31, Cotonou Phone: +229 21314386 www.ccibenin.org

TABLE 11

List of Selected Ministries of Benin

MINISTRY	ADDRESS	CONTACT PERSON
Ministry of Energy and Water	Av. Jean Paul VI 01 BP363 Cotonou Phone: +229 312429	Assogba Daniel
Ministry of Industry and Trade	Av. Jean Paul VI 01 BP363 Cotonou Phone: +229 21303024	Senou Louise
Ministry of Agriculture, Animal Husbandry and Fishing	Av. Jean Paul VI 01 BP363 Cotonou Phone: +229 300410	Gbehounou Galbert

7 BIBLIOGRAPHY

- African Cashew Alliance: (www.africancashewalliance.org)
- Association Nationale des Praticiens de la Microfinance du Bénin, Consortium ALAFIA (2002/2005)
- Analysis and Prospective Vision of the Electric Energy Sector in Benin (1998)
- CEB (1984): Report on Hydro Power: Togo and Benin Hydroelectric Potential Resources and Leading Plan of the Production and the Transportation
- Central Intelligence Agency – CIA (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- Code on Water in the Republic of Benin (1987)
- Government of Benin (1997/1998): Compilation of the Laws on the Decentralization (law nº 97 – 028 on the orientation of the organization of territorial administration, law nº 97 – 029 on the organization of the communes, law nº 98 – 005 on the organization of communes having a particular status, law nº 98 – 006 on the communal and municipal electoral system, law nº 98 – 007 on the financial regime of the communes)
- Power Sector Development Policy and Strategy in Benin
- Government of Benin (January 2008): Financial law 2007 – 33
- INSAE (2008): Various sets of data
- LIFAD (1999): Annual Survey
- LIFAD (2005): Annual Survey
- Ministry of Agriculture, Animal Husbandry and Fishing (2008): Strategic Plan for Agricultural Sector Development in Benin
- Ministry of Environment (1998): National Program of Actions for Struggle Against the Desertification
- MEE (2003): Energy Policy and Strategy
- MEE (2004): Rural Electrification Policy
- Head State of Office (2008): Politics and Strategy Document on Electric Energy Sector Development in Benin
- Ministère Charge du Plan, de la Prospective et du Développement/INSAE (2004): Rapport de la Première Session Ordinaire de l'Année 2004, Cotonou (Population Census Report Benin of 2004)
- President Office (2007): Document of the Think-Tank on the Vision of the Electric Energy Sector
- Report on the development of ethanol gel fuel as cooking energy in the WAEMU (2007)
- SBEE (2007): Annual Report
- Direction Générale de l'Énergie – DGE (2006): Energy Information System in Benin
- International Monetary Fund – IMF (2008): Republic of Benin: Growth Strategy for Poverty Reduction, Country Poverty Reduction Strategy Paper for 2007 (www.imf.org/external/pubs/ft/scr/2008/cr08125.pdf)
- UNDP (2009): Human Development Reports (www.hdr.undp.org)
- World Bank (2008): Ease of Doing Business
- Government of Benin (2006): Strategic Orientations of Benin Development (2006–2011) Government Program

8 ANNEX

TABLE 12

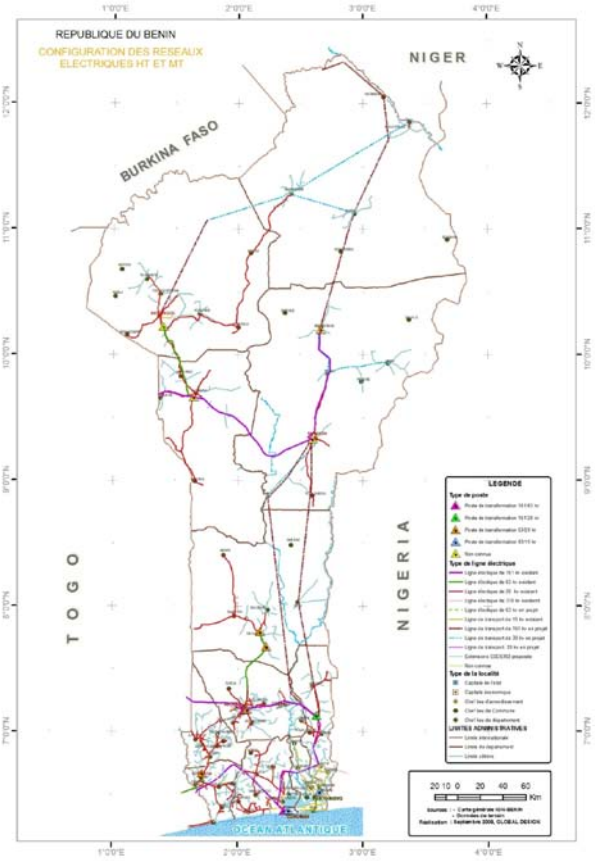
Quantity of Residues and Potential Electricity Production

CROPS	AVAILABLE RESIDUES (TONS)	POTENTIAL (GWH/YEAR)
Local maize	2,453,952	1,962.6
Improved maize	742,233	593.6
Sorghum	518,429	407.1
Small millet	92,044	72,3
Rice	80,872	68.2
Cotton	1,378,619	1,577.7

Source: S.I.e. Benin with data from DGE, as of 2006

FIGURE 7

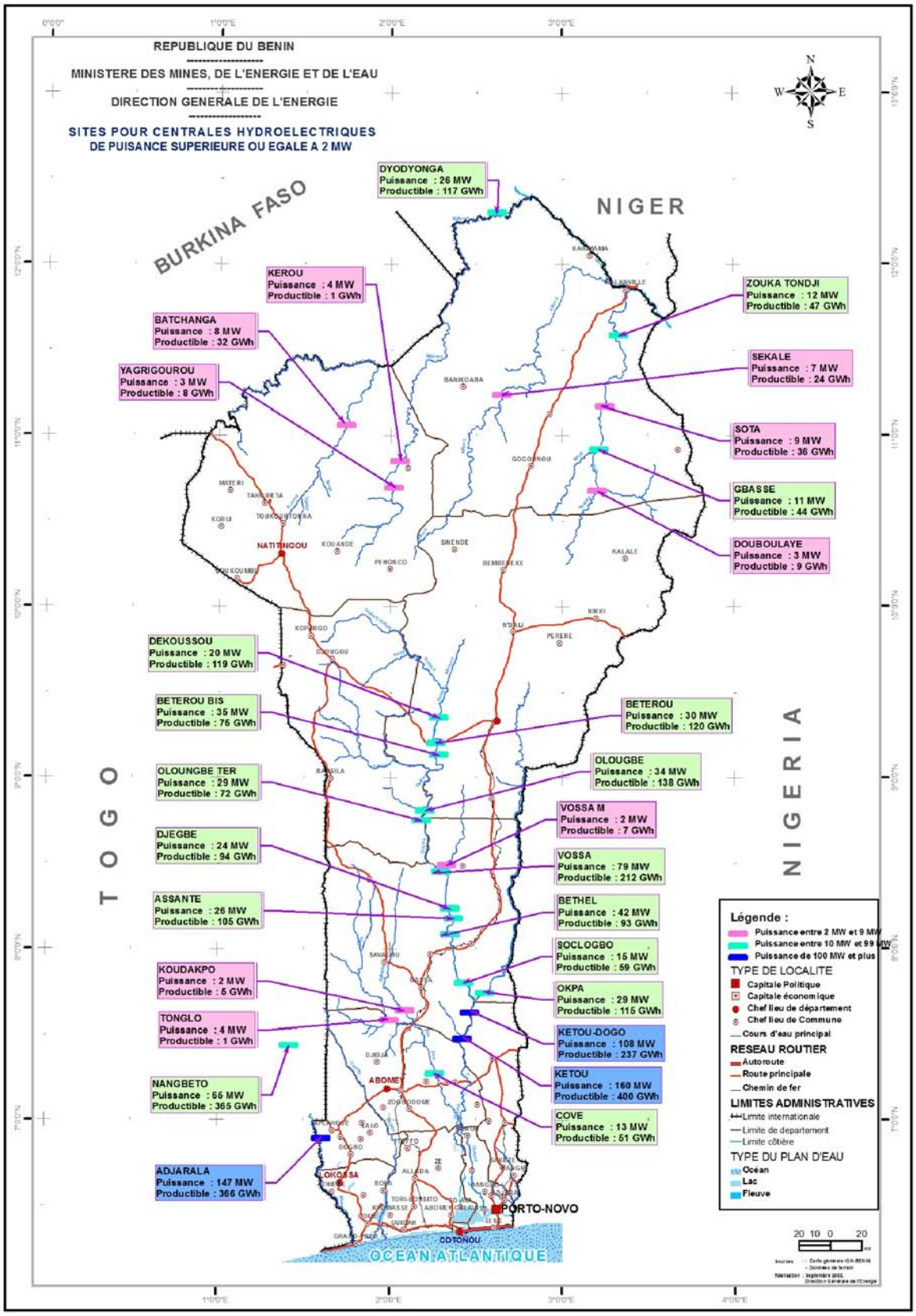
High and Medium Voltage Electricity Grid in Benin



Source: Data compiled by the author, as of 2008

FIGURE 8

Potential Hydro Power Sites in Benin



Source: DGE, as of 2008

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ACRONYMS AND ABBREVIATIONS

BURKINA FASO

ADDAX	Name of supplier based in Geneva
AIJ	Activities Implemented Jointly
APEES	Association Pour la Promotion de l'Exploitation de l'Énergie Solaire (Association for the Promotion and Use of Solar Energy)
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
CCA	Centres de Communication et d'Activités (Centers of Communication and Activities)
CET	Common External Tariff
CFAF	CFA Franc
CIF	Cost, Insurance and Freight price for import/export of petroleum products
CIFAME	Commission Intersectorielle de Facilitation de l'Approche Multisectorielle dans le Domaine de l'Énergie (Interdepartmental Committee for Multisector Approach Facilitation in the Sector of Energy)
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Interstate Committee for Desertification Control)
DDO	Direct De-oxygenation (Fuels for Electricity Generation)
DMN	Direction de la Météorologie Nationale (National Direction of Meteorology)
ERD	Electrification Rurale Décentralisée (Decentralized Rural Electrification)
FDE	Fonds Développement de l'Électrification (Electrification Development Fund)
GDP	Gross Domestic Product
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
IRSAT	Institut de Recherches en Sciences Appliquées et Technologies (Research Institute of Applied Sciences and Technology)
LBN	Libre Blanc National (National White Book Investment Plan)
MEPRED	Mainstreaming Energy for Poverty Reduction and Economic Development Project
n.a.	not applicable
PNGT	Programme Nationale de Gestion des Terroirs (National Community Land Management Program)
PRS	Programme Régional Solaire (Regional Solar Energy Program)
PV	Photovoltaic
RE	Renewable Energies
RPTES	Regional Program for the Traditional Energy Sector
SIR	Société Ivoirienne de Raffinage (name of Ivorian Refinery Company)
SME/SMI	Small and Medium Sized Enterprises/Small and Medium Sized Industries
SSD	Sociétés de Services Décentralisées (Societies of Decentralized Services, e.g. CCA of Gomboro, Bognounou & Bokin)
TPA	Taxe Patronale et d'Apprentissage (Employers' and Learning Tax)
VAT	Value Added Tax
WAEMU	West African Economic and Monetary Union
XOF	West African CFA Franc (as opposed to XAF = Central African CFA Franc)

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
m²	square meter
MW	megawatt (1 MW = 1,000 kW)
MVA	megavolt-ampere
Wp	Watt-peak (1 kWp = 1,000 Wp)

SUMMARY

The Country Study of Burkina Faso is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Burkina Faso. The study is structured as follows:

Chapter one provides **Background Information on Burkina Faso**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Burkina Faso.

Chapter two summarizes facts and figures of **Burkina Faso's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Burkina Faso. This includes an overview of support mechanisms for Photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Burkina Faso.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Burkina Faso.

MAP OF BURKINA FASO

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Burkina Faso is a landlocked country surrounded by Mali in the North, Niger in the East, Benin in the Southeast, Togo and Ghana in the South, and Côte d'Ivoire in the Southwest. The country's territory comprises 274,000 km² with an estimated population of about 13,200,000. The capital of Burkina Faso is Ouagadougou.

Burkina Faso has a primarily tropical climate with two seasons. The dry season lasts from eight months in the North to five or six months in the South, followed by the rainy season with up to 1300 millimeters of rainfall per annum. There are three climatic areas in Burkina Faso: the Sudanian zone with extensive rainfalls during the rainy season, the Sudano-Sahelian zone, located in the centre, and the Sahelian zone with a very short and moderate rainy season. The climatic situation of Burkina Faso includes long dry periods and therefore causes serious problems in view of sufficient water supply.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Burkina Faso's constitution of 2 June 1991 established a semi-presidential government with a parliament. The presence of this new political stability allowed the country to set up various institutions that are now fully capable of acting. During the last decade the democratic process was being consolidated significantly. With approximately 13,340,000 inhabitants from of about sixty ethnic groups, Burkina Faso is one of the most populated countries of West Africa. Approximately 82.6 % of the overall population lives in rural areas. Burkina Faso is one of the poorest countries in the world with more than 40 % of the population still living below the poverty line. The annual per capita income is less than 1,000 Euro. Since the 1990s, Burkina Faso has been starting a series of economic reforms with the support of the World Bank and the International Monetary Fund in order to streamline the economy, stimulate economic growth and to reduce poverty.

2 ENERGY MARKET IN BURKINA FASO

2.1 OVERVIEW OF THE ENERGY SITUATION

Besides the utilization of Hydro Power, the electricity production of Burkina Faso mainly relies on diesel generators. Due to high production costs, fluctuating oil prices and a steadily increasing demand for electricity, Burkina Faso has started to import electricity from its neighbors Ghana and Côte d'Ivoire. Currently, only 10 % of the country are connected and have access to electricity. Due to the lack of fossil fuel resources, the country is completely dependent on fuel imports. In rural areas of Burkina Faso, energy requirements are almost completely met by the utilization of traditional biomass.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity consumption of Burkina Faso is met by local production and imports from Ghana and Côte d'Ivoire. The monopolist SONABEL is fully responsible for the production, import and distribution of electricity in Burkina Faso. Table 1 shows characteristic data of the country's electricity sector.

TABLE 1

Characteristic Data of the Electricity Sector (2004–2007)

YEAR	2004	2005	2006	2007
Electricity imported (kWh)	96,183,557	125,337,589	139,323,910	123,910,359
Thermal production (kWh)	371,789,678	415,751,943	467,728,921	501,295,228
Hydro production (kWh)	101,458,980	100,472,905	80,668,451	111,416,699
Average cost per kWh (XOF)	113.19	117.89	121.21	129.62
Average cost per kWh (EURO)	0.17234632	0.17950268	0.18455781	0.19736311
Number of thermal plants	30	30	29	28
Number of hydro plants	4	4	4	4
Thermal power installed (MVA)	181	204	223	217
Hydro power installed (MW)	32	32	32	32

Source: SONABEL, as of November 2008

As indicated above, the electricity supply of Burkina Faso is still in the process of development. Especially the interconnection of rural areas is an important issue. Within the framework of the Electrification Development Fund (FDE), several villages have now got access to electricity, either via regular connection to the grid of SONABEL or decentralized diesel generators. Regarding this, the challenge is to provide rural areas with reliable and cost effective electricity.

The electricity tariffs in Burkina Faso vary according to the level of consumption and the type of utilization. Table 2 provides an overview of past (up to June 2005) and present electricity prices, tariff structures and consumption levels.

TABLE 2

Electricity Tariffs Provided by SONABEL

TARIFF STRUCTURE	CONSUMPTION LEVEL (kWh)	ENERGY CHARGE (XOF)	1 EURO = 656.759 XOF
		Sept. 2004 until June 2005	July 2006 until now
Tariff 1	Domestic		
Tariff A	0–50	73	75
	51–00	120	128
	Above 100	125	138
	Min. charge	1,132	1,132
Tariff B	0–50	86	96
	51–200	90	102
	Above 200	95	109
	Min. charge	381–637 (dep. on amperage)	457–764 (dep. on amperage)
Tariff 2	Domestic and locomotive tasks		
Tariff C	0–50	86	96
	51–200	95	108
	Above 200	100	114
	Min. charge	1,022–1,144 (dep. on amperage)	1,226–1,373 (dep. on amperage)
Tariff 3	Non-domestic (low voltage)		
Tariff D1 (non-industrial)	Peak Hour	143	165
	Full Hour	77	88
	Min. charge	7,115	8,538
Tariff D2 (Industrial)	Peak Hour	110	140
	Full Hour	51	75
	Min. charge	5,929	7,115
Tariff 4	Non-domestic (average voltage)		
Tariff E1 (non-industrial)	Peak Hour	121	139
	Full Hour	56	64
	Min. charge	7,115	8,538
Tariff E2 (industrial)	Peak Hour	110	118
	Full Hour	51	54
	Min. charge	5,929	7,115
Tariff 5	Street lighting		
Tariff F	Unique tariff	120	122
	Min. charge	n.a.	n.a.
One phase	5 A to 15 A	0	381
	Above 20 A	0	637
Three phase	10 A to 15 A	0	1,022
	Above 20 A	0	1,144

Source: SONABEL, as of November 2008

Petroleum Sector

The state-owned company SONABHY has supply contracts with the Ivorian Refinery Company (SIR) and ADDAX, a supplier based in Geneva. Furthermore, petroleum products are bought at international spot markets and imported through the Port of Lomé. Additional imports come from the Tema refinery in Ghana. SONABHY has two depots in Burkina Faso, one in Bingo (Ouagadougou) and the other in Bobo Dioulasso. The price structure of petroleum products is fully regulated by the Ministry of Trade. Fuels for electricity generation (DDO) as well as for cooking purposes are subsidized. For all other purposes, petroleum products are regularly taxed.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

For the planning and regulation of the energy sector, various ministries are involved in Burkina Faso. The legal and regulatory framework of the energy sector is managed by the Ministry of Energy in close cooperation with the ministries in charge of trade, finance and environment. Moreover, the sectors of education, health, agriculture and hydraulics, also being related to the energy sector, are involved through the corresponding ministries in charge.

Electricity Sector

In November 2007, the Parliament adopted law N° 027/AN[1] in order to regulate the general electric energy supply of Burkina Faso. This law is to enhance the qualitative and quantitative security of energy supply. It also aims at the reduction of the overall electricity costs by liberalizing the production and distribution of electricity within Burkina Faso because currently the electricity sector is dominated by the monopolist SONABEL. In the overall reorganization of the electricity sector, several authorities are involved:

- The Ministry of Energy (responsible for energy policy, general control and planning)
- The Ministry of Trade (responsible for the fixation of the electricity price)
- Independent control authorities for electricity price fixation and consumer protection
- Authorities issuing regulations to support the overall price setting process
- Authorities providing fund management for the development of rural electrification

Petroleum Sector

The supply of petroleum products is fully organized and controlled by SONABHY, a state-owned company. The Ministry of Trade supervises SONABHY with regard to import and trade issues, while the Ministry of Finance coordinates and controls all financial matters. The Burkina Bureau of Mines and Geology is in charge of the quality control for retailed petroleum products. The overall tasks of SONABHY can be summarized as follows:

1 LAW 027-2002/AN OF 9 OCTOBER 2002, REFERRING TO THE AUTHORIZATION OF BURKINA FASO'S ACCESSION TO THE KYOTO PROTOCOL (JOURNAL OFFICIEL NO.47 DU 21 OCTOBRE 2002)

- Import, storage, conditioning and marketing of petroleum products and gas
- Construction of storage infrastructures to guarantee sufficient distribution
- Support of research activities for alternative energy resources and energy conservation

Biomass Sector

The biomass sector of Burkina Faso 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 Burkina Faso.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Despite the considerable potential of RE resources in Burkina Faso, up to now, there are no policies or strategic directions for the utilization of RE. However, a guiding principle for PV was expressly outlined in a program to supply basic energy services. Adopted in 2007, the Strategy for Rural Electrification strongly supports solar energy for the electrification of rural areas currently lacking connection to the SONABEL grid. The implementation of PV projects supports the promotion of solar energy and could help to achieve a supportive policy framework for RE in Burkina Faso. A list of selected projects and programs can be found in Chapter 8 (Annex). Table 3 provides an overview of already existing support mechanisms for PV.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The new regional policy supporting the access to energy services for rural areas of Burkina Faso, known as the Regional White Paper, was approved of and adopted on 12 January 2006 by the ECOWAS Authority of Heads of States. The regional policy aims at an effective contribution of energy to achieve the Millennium Development Goals (MDG) and to reduce poverty. In order to reach this goal, all members of ECOWAS need to develop appropriate policies for energy services.

Recently, a national multiple stakeholder group, the Interdepartmental Commission of Multisector Approach Facilitation in the Sector of Energy (CIFAME) was formed by the Ministry of Mines and Energy by ministerial decree 06–21/MCE/SG/DGE[2] of 5 May 2006. After several meetings, the commission drafted the National White Paper (LBN) focusing on the provision of modern energy services to the entire population of Burkina Faso by the year 2020. Therefore, renewable energy is considered to be a major contributor to this ambitious goal.

TABLE 3

Existing Support Mechanisms for PV Solar Energy

TYPE	PROJECTS
Beneficiary	– ERD Ganzourgou PV component, subsidies 40 % to 45 % – PV FONDEM/Kouritenga Appropriations, subsidizes 35 % to 45 %
Management committee	– National Community Land Management Program II (PNGT II)415.751.943 – Burkina Faso Plan – Activities Implemented Jointly (AIJ)/Regional Program for the Traditional Energy Sector (RPTES) – Spanish project – Regional Solar Energy Program I (PRS I), subsidizes 100 % of equipment costs
Users Association	– Kouritenga Energy services, subsidizes 90 % of equipment costs
Group or co-operative society	– COOPEL Electric systems, subsidizes 60 % of equipment costs
Private promoter	– Societies of Decentralized Services (SSD) ex. CCA of Gomboro, Bognounou & Bokin, subsidizes 100 % of equipment costs

Source: Césaire SOME, Modes of Funding Basic Energy Services for Burkina Faso, MEPRED, as of 2008

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

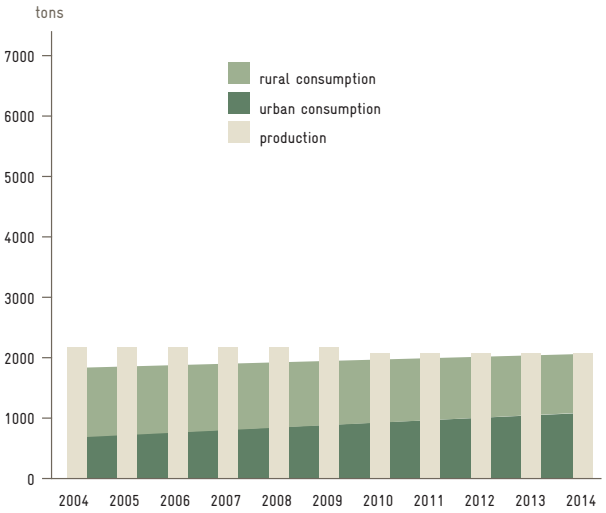
In many provinces of Burkina Faso, especially in the Sudano-Sahelian and Sudanian Zone, sufficient biomass resources are available.[3] Particularly the forest areas of the East, the West and Southwest are offering substantial biomass resources. An analysis of the correlation between rural/Urban consumption and production is shown in Figure 2 and Figure 3.

Within the framework of the "Biogas for Better Life" initiative, a feasibility study was carried out by GTZ in 20074 in order to identify the potential for biogas installations. The study envisages the installation of 15,000 biogas production units at farms and another 20,000 units in semi-urban households.5 The costs of such biogas installations vary between CFAF 450,000 and CFAF 650,000, depending on size and location. Moreover, it is foreseen to implement 2,000 biogas production facilities for agro-business SME/SMIs by 2015. A total of 25,000 units are to be realized by 2015 and more than 100,000 units by 2030. Table 4 presents the number of the projected biogas installations in Burkina Faso.

2 CIFAME, AS OF 2009
3 SEE ALSO COMPETE, 2008
4 GTZ, 2007
5 EXISTING INSTALLATIONS ARE BASED ON MULTIPLE TECHNOLOGIES (FLOATING DRUM, PLUG FLOW, FIXED DOME, BATCH, SEMI-BATCH). SEE ALSO GTZ, 2007, P. 43

FIGURE 2

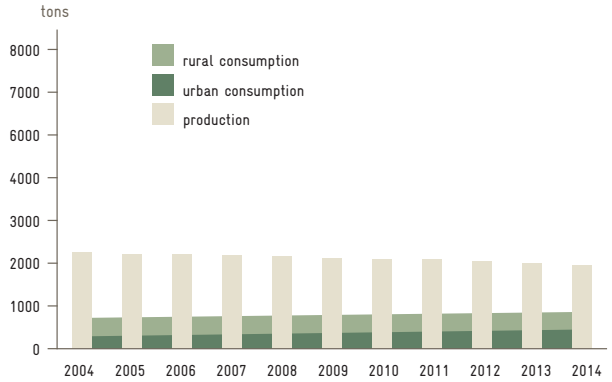
Rural/Urban Consumption and Production: Sudano-Sahelian Zone



Source: The Second Phase of National Plan of Electrification, as of 2006

FIGURE 3

Rural/Urban Consumption and Production: Sudanian Zone



Source: The Second Phase of National Plan of Electrification, as of 2006

TABLE 4

Projected Biogas Producing Units (2008–2030)

YEAR	2008	2009	2010	2011	2012	2013	2014	2015	2030
Phases	Pilot Phase		Implementation Phase						
Stages	0	I	II	III	IV	V	VI	Midterm	Long term
Demonstration	50	50							
Rural households	0	250	1000	2500	3000	3500	3750	14000	90267
Peri-urban households		100	400	1000	1500	3000	4000	10000	20000
Agro-business		100	120	160	170	200	250	1000	1343
Total	50	500	1520	3660	4670	6700	8000	25000	111610

Source: GTZ, as of July 2007

TABLE 5

Solar PV Installation Situation in 1998 and in 2002

YEAR	1998		2002	
Energy Services	Capacity (Wp)	Part (%)	Capacity (Wp)	Part (%)
Water pumping	209	19	205.20	15
Telecommunication	220	20	218.88	16
Lighting	671	61	0	0
Video and television	0	0	41.04	3
Lighting and refrigeration	0	0	902.88	66
Total	1,100	100	1,368	100

Source: Energy Services Financing, National White Paper, MEPRED, as of May 2008

4.2 SOLAR ENERGY

Burkina Faso has strong potential in the field of solar energy. According to a study of the Research Institute of Applied Sciences and Technology (IRSAT) and the Direction of National Meteorology (DMN), the average potential is estimated at 5,5 kWh/m²/day for 3,000 to 3,500 hours per annum. Currently, PV solar systems are used for refrigeration, water pumping, communication, lighting, video and television. Table 5 provides an overview of capacities installed in 1998 and 2002.

4.3 WIND POWER

Due to the western location of Burkina Faso, the potential for wind power is very limited. The average wind speed ranges between 1 and 3 meters per second, while the maximum only to be obtained in the North of the country. Therefore, a large-scale utilization of wind energy is not advisable. However, small-scale generators at suitable sites and for selective purposes (e. g. water pumping, desalination systems etc.) might be reasonable.

4.4 HYDRO POWER

A survey of hydroelectric sites was done within the EDF-SONABEL – Centre National d'Equipement Hydraulique (National Centre of Hydraulic Equipment) study. The study covers large-scale hydroelectric sites as well as small-scale installations. The capacity ranges between 65 and 550 kW with 5 to 15 GWh/year and 550 to 1,700 kW with at least 5 GWh/year. The study shows that the Hydro Power potential of rural areas is sufficient for a decentralized electricity production. The study identifies some sites where the estimated production cost ranges between CFAF 100 and 175 per kWh, several other sites with estimated costs of at least CFAF 200 per kWh. The current hydroelectricity utilization covers about 20 % of the national electric consumption (incl. imports from Ghana and Côte d'Ivoire).

TABLE 6

Distribution of the Mini/Micro Hydro Sites in Burkina Faso

LOCATION	CAPACITY (MW)
Center, South	2.5
Boucle du Mouhoun	2.5
Southwest	5
Center, East	1.2
Center, West	6.25
East	7.5
Cascades	5
Sahel	3.125
Hauts Bassins	3.125

Source: Inventory of Burkina Faso Hydroelectric Sites, EDF-SONABEL-CNEH, as of March 1999

5 MARKET RISKS AND BARRIERS

Regarding market risks and barriers, there are several issues to be considered in Burkina Faso. Besides corruption, the lack of local expertise and outdated technical equipment, high costs for research and development as well as mostly capital intensive technologies[6] are substantial barriers for the broad implementation of RE. Due to the lack of financial resources, many companies in Burkina Faso need to operate with supplier credits or documentary credits. National financial institutes hardly contribute to the financing of projects aiming at the provision of energy services for rural areas. As to the access of rural population to basic energy services, only people banks – "Caisses Populaires" – offer very limited credits to facilitate the acquisition of PV kits. As other financial institutions charge high interest rates, such credits are not suitable to finance PV equipment. Even though there are microfinance institutions in Burkina Faso – which in general provide more adequate financial support services to low income groups and also SMEs – their credits are only granted for short term periods limited to a maximum of three years.

According to the World Bank's Ease of Doing Business report of 2008, Burkina Faso moved from position 164 in June 2007 to 148 in 2008. The country is one of the ten world leaders in regulatory reforms aiming to facilitate business activities. Burkina Faso, for example, reduced the corporate tax rate from 35 to 30 percent and the dividend tax from 15 to 12.5 percent. Table 7 provides an overview of the country specific rating.

In terms of tax incentives, the import of energy equipment is subject to the WAEMU common external tariff (CET). The country's value added tax (VAT) rate is currently 18 % while the employers and training tax (TPA) is 4 % (8 % for foreigners).

TABLE 7

Burkina Faso – Ease of Doing Business 2008 Rankings

SELECTED INDICATOR	RANKING
Ease of doing business	148
Starting a business	113
Dealing with construction permits	106
Employing workers	57
Registering property	148
Getting credit	145
Protecting investors	142
Paying taxes	132
Trading across borders	173
Enforcing contracts	110
Closing a business	110

Source: Ease of Doing Business, World Bank, as of 2008

6 SMALLER AND SMALLEST APPLICATIONS ARE LESS COST-INTENSIVE IN SOME RESPECTS. OFTEN INITIAL INVESTMENTS, HOWEVER, ARE STILL HIGH FOR THE CORRESPONDING USER GROUPS SUCH AS LOW-INCOME PRIVATE CLIENTS OR SMES.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 8

RE Companies and Stakeholders in Burkina Faso

ORGANIZATION	FIELD OF ACTIVITY	LOCATION/CONTACT
CB Energie	Supply, installation and maintenance of solar systems	Dédougou Phone: +226 20 52 10 cbenergie@yahoo.fr www.cb-energie.com
MICROSOW	Supply & maintenance of solar systems, solar cookers, charging units for cell phones	Somgandé Phone: +226 5035 63 22 info@microsow.com www.microsow.com
SOLTECH	Supply and installation of solar energy and electricity equipment, energetic audit and training	Ouagadougou Phone:+226 50 34 23 02 Email: nasol@fasonet.bf
OMA-SENISOT SA	Solar energy installation, installation of electricity	Ouagadougou Phone: +226 50 31 42 69 oma.senisot@fasonet.bf
Sahel Énergie Solaire	Solar pumps and community systems within the Regional Solar Energy Program, electrification of 150 departmental administration centers	Ouagadougou Phone: +226 50 30 69 73 energie.solaire@fasonet.bf
K&K International	Solar lighting, solar pumps and refrigerators	Ouagadougou Phone: +226 50 31 17 68 joachim@voila.fr
INTELFAC	Solar water heating systems, PV systems in health facilities and households	Ouagadougou Phone: +226 50 36 37 88 progi@fasonet.bf
ATESTA	Installation of solar systems at social housings	Ouagadougou Phone: +226 50 36 35 79 atesta@fasonet.bf
TLE NAFA	Supply and installation of solar cookers	Bobo-Dioulasso Phone: +226 20 98 11 69 sanoukaridia2002@yahoo.fr
Association for the Promotion and Use of Solar Energy (APEES)	Oil and solar energy cookers, installation of solar energy collectors and solar water heating systems	Bobo-Dioulasso apees.bobo@fasonet.bf
Institute of Applied Research in Sciences and Technologies (IRSAT)	Production, installation and control of photovoltaic systems	Phone: +226 50 35 70 31 wereme@yahoo.fr

Source: data compiled by the author

Currently, there are several ongoing investment initiatives and projects in the field of RE such as the Regional Solar Energy Program Phase II (funded by the European Union), the Regional Biomass Energy Program (funded by a Dutch cooperation through WAEMU) and the National White Paper Investment Plan. Concerning transregional banking institutions, the ECOWAS Community Investment and Development Bank (BIDC) raises funds dedicated to the development of RE in ECOWAS member states. Table 9 provides an overview of ongoing RE investments in Burkina Faso.

TABLE 9

Donor Aid Investments in Renewable Energies by Stakeholders

STAKEHOLDER	SOURCE OF TARGETED RENEWABLE ENERGY
World Bank	Photovoltaic and solar thermal energy (dryers, water heaters), biofuels, sustainable wood energy, fuel efficient stoves
Dutch cooperation	Biogas, modern valorization of traditional biomass
NGOs, Associations	Photovoltaic and solar thermal energy (dryers, cookers), Jatropha Curcas
Private promoter	Photovoltaic and solar thermal energy (dryers, cookers), Jatropha Curcas
BMZ via GTZ	Fuel efficient stoves
Danish cooperation	Sustainable forestry, sustainable wood energy
Luxembourg cooperation	Sustainable forestry, sustainable wood energy
Japanese cooperation	Sustainable forestry, sustainable wood energy
European Union	Institutional cooperation in the field of sustainable forestry
Canadian Development Agency	Training program in the field of solar energy, cooperation with the University of Ouagadougou

Source: Ease of Doing Business, World Bank, as of 2008

7 BIBLIOGRAPHY

- CIFAME (2008): Investment Plan of the National White Paper
- Commission Intersectorielle de Facilitation de l'Approche Multisectorielle dans le domaine de l'Energie – CIFAME (2009): Organisation de la CIFAME (www.cifame.org/index_fichiers/Page346.htm)
- COMPETE (2008): National Policies and Strategies on Bioenergy in Africa. Case Study: Burkina Faso (www.compete-bioafrica.net/policy/.../COMPETE-032448-NationalBioenergyPolicy-BurkinaFaso-0801.pdf)
- Government of Burkina Faso (2005): Legislation on the Electricity Sector in Burkina Faso, Loi N° 016-05 sur la Réglementation Générale de l'Approvisionnent du BF en Énergie Électrique (www.mines.gov.bf/SiteMines/documents/autres/decret-fonds.pdf)
- Government of Burkina Faso (1998): Legislation on the Provision of Electricity in Burkina Faso, Loi N°016-05 Portant Réglementation Générale de l'Approvisionnement du Burkina Faso en Énergie Électrique (www.mines.gov.bf/SiteMines/documents/autres/loi-060-98-an.pdf)
- GTZ (2007): Feasibility Study for a National Domestic Biogas Program in Burkina Faso
- MEPRED (2008): Models of Funding Basic Energy Services in Burkina Faso, Césaire Some
- MEPRED (2008): Energy Services Financing, National White Paper
- Ministry of Economy and Finance (2005–2007): Burkina Faso. Poverty Reduction Strategy Paper. Priority Actions Plan
- Ministry of Mines and Energy (2002): Letter for the Development Policy of the Energy Sector (www.mines.gov.bf/SiteMines/textes/lpde.pdf)
- Ministry of Mines and Energy (2006): National Plan of Electrification; The Second Phase of National Plan of Electrification
- Ministry of Mines and Energy (2007): Rural Electrification Strategy Document
- Ministry of Mines and Energy (2009): Rapport National d'Investissement Burkina Faso (www.mines.gov.bf/SiteMines/index.jsp)
- National Geographic Institute (2003): Map of Burkina Faso
- OECD/AfDB (2002) African Economic Outlook. Burkina Faso, page 59–70
- Ouedraogo, B. (2008) Bioenergy, Agriculture and Rural Development. National Report on Burkina Faso. Study Commissioned for input to the Regional Report on Bioenergy, Agriculture and Rural Development in UEMOA Countries (in prep.)
- SAWADOGO, A./Government of Burkina Faso (1997) Code on Environment from January, (www.sos-dechets.bf.refer.org/imprimersans.php3?id_article=52)
- SONABEL (2004–2007): Activity Reports (www.sonabel.bf)
- SONABHY (2006): Activity Report
- World Bank (2008): Ease of Doing Business (www.doingbusiness.org)
- Ministère du Commerce, de la Promotion de l'Entreprise et de l'Artisanat / Ministry of Trade, Promotion of Entrepreneurship and Handikrafts (http://www.commerce.gov.bf, as of 2008)

8 ANNEX

LIST OF SELECTED PROJECTS AND PROGRAMS (ALREADY IMPLEMENTED)

1. The Regional Solar Energy Program (PRS) is a region-wide project implemented by the Standing Interstate Committee on Desertification Control (CILSS) in the years 1990–1998. The program aimed to set up:

- Photovoltaic equipment for water pumping (800 Wp to 3.6 kWp)
- Photovoltaic equipment for electricity generation (120 Wp) at schools and community centers
- Photovoltaic standard lamps for street lighting
- Electrical equipment (refrigerators, color TVs, radio cassette players, etc.)

Project Costs:
- Installed systems: 3,412,000,000 XOF
- Supportive actions: 28,180,000 XOF
- Total cost of PRS I: 3,440,180,000 XOF

Funding Scheme:
- European Union funding the total costs
- Governmental fund raising with taxes, serving to finance maintenance costs

2. The „Spanish" Project is a project supporting PV installations. It was implemented in the years 1998–2000. The project is laid out to provide:

- Photovoltaic equipment for electricity generation (120 Wp) at schools and community centers
- Photovoltaic powered street lighting

Project Costs and Funding:
- 5,950,000,000 XOF subsidized by the government of Spain

3. A Joint Project within the Regional Program for Traditional Energy Sector supplied photovoltaic equipment for 6 villages and was implemented in the years 1998–2004. The installed equipment included:

- Photovoltaic equipment for electricity generation at schools and community centers
- Photovoltaic lamps for street lighting
- Total installation of 9.45 kWp

Project Costs and Funding:
- 500,000,000 XOF, funded by Norway under the administration of the World Bank

4. The National Community Land Management Program (PNGT) running from 2002–2005 focused on the implementation of PV equipment in schools, literacy centers, hospitals etc. The overall achievements included 262 PV installations:

- 27 installations at schools (lighting purposes)
- 76 installations at literacy (lighting purposes)
- 125 installations at hospitals and health care centers (lighting purposes)
- 3 installations at hospitals and health care centers (refrigeration purposes)
- 4 water pumping installations
- 27 individual installations of PV kits

Project Costs and Funding:
- There is no reliable information available.

5. The Burkina Faso PV Plan was implemented in the years 1999–2007 and funded about 130 individual PV installations for schools, community centers, hospitals and healthcare centers, offices etc.

Project Costs and Funding:
- There is no reliable information available.

6. The Ganzourgou Decentralized Rural Electrification (ERD) project was realized between 2000 and 2001. Within the project, two different types of PV kits were tested.

Project Costs and Funding:
- Total costs of 300,000,000 XOF financed by the French Development Agency and the people banks (Caisses Populaires) of Burkina Faso

7. The National White Book Investment Plan (LBN) corresponds to the objectives of the Regional White Book and will be implemented in the years 2008–2015. It mainly aims to provide modern energy services to semi-urban and rural areas of Burkina Faso.

Project Costs and Funding:
- About 65 to 90 billion XOF invested by The World Bank,
- the Government of Burkina Faso, SONABEL and international cooperation initiatives

4. The National Community Land Management Program (PNGT) running from 2002–2005 focused on the implementation of PV equipment in schools, literacy centers, hospitals etc. The overall achievements included 262 PV installations:

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- 125 installations at hospitals and health care centers (lighting purposes)
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- 27 individual installations of PV kits
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Project Costs and Funding:
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- the Government of Burkina Faso, SONABEL and intern
- tional cooperation initiatives

TABLE 10

Sectoral Contribution to GDP Growth (in %) to (2003–2007)

YEAR	2003	2004	2005	2006	2007
Primary sector	2.94	–0.87	3.50	0.26	–0.13
Food crops	–2.74	–2.05	2.56	0.50	0.85
Cash crops	0.36	0.82	0.22	–0.81	–1.43
Livestock	5.25	0.25	0.56	0.44	0.32
Forestry	0.06	0.09	0.13	0.10	0.12
Fishing	0.01	0.01	0.02	0.01	0.01
Secondary sector	2.16	1.25	1.28	1.18	1.79
Mining	0.01	0.04	0.09	0.18	0.55
Modern drinks and tobacco	0.20	0.31	0.52	–0.13	–0.06
Cotton shelling	0.70	0.50	–0.61	0.01	–0.63
Electricity, gas and water	0.45	–0.19	0.25	0.14	0.27
Other modern processing industries	0.78	0.25	–0.12	–0.74	1.08
Informal processing industries	–0.42	0.51	0.51	1.05	0.07
Building works	0.45	–0.17	0.65	0.66	0.52
Services sector	3.38	3.29	2.22	3.37	1.52
Market services	2.01	2.88	1.96	2.55	0.89
Trade	0.60	0.44	0.45	0.03	0.10
Transport	0.22	0.57	0.17	0.34	0.20
Mail and telecommunications	0.12	0.22	0.10	0.08	0.02
Financial services	0.13	0.20	0.11	0.15	0.01
Other market services	0.95	1.44	1.12	1.95	0.55
Non-market services	1.38	0.42	0.26	0.82	0.64
Import duties and taxes	–0.37	1.11	0.19	0.82	0.73
SIFIM	–0.10	–0.15	–0.09	–0.12	–0.01
G.D.P. (Market price)	8.0	4.6	7.10	5.5	3.9

Source: data compiled by the author

TABLE 11

Price Structure of Petroleum Products at Ouagadougou (Bingo) Depot (July 2008)

PRICE XOF PER LITER 1 Euro = 656.759 XOF	GASOLINE	PARAFFIN OIL	GAS OIL	DDO (ELECTRICITY PRODUCTION)
1. CIF price at coastal depots	310.49	328.33	357.67	352.32
2. Charges at coastal depots	15.55	15.53	15.19	15.45
3. Transport and transit	43.70	43.70	43.70	43.70
4. Importers expenses and spreads	28.41	28.39	28.31	27.92
5. Outside depot excluding taxes	398.15	415.95	444.87	439.39
6. Customs duties and taxes	40.51	24.05	45.89	25.61
7. Petroleum products dues	125.00	0.00	50.00	0.00
8. Value-added taxes	96.34	0.00	92.24	0.00
9. Outside depot including all taxes	660.00	440.00	633.00	465.00
10. Subsidy	0.00	0.00	0.00	0.00
11. Distributors expenses and spreads	36.00	25.00	40.00	31.00
12. Retailers expenses and spreads	24.00	25.00	22.00	5.00
13. Pump selling price	720.00	490.00	695.00	501.00

Source: Ministry of Trade, Promotion of Entrepreneurship and Handikrafts, as of July

TABLE 12

Price Structure of Petroleum Products at Bobo Dioulasso Depot (July 2008)

PRICE XOF PER LITER 1 Euro = 656.759 XOF	GASOLINE	PARAFFIN OIL	GAS OIL	DDO (ELECTRICITY PRODUCTION)
1. CIF price at coastal depots	310.49	342.42	357.67	352.32
2. Charges at coastal depots	11.17	10.95	10.92	10.70
3. Transport and transit	38.04	38.04	38.04	38.04
4. Importers expenses and spreads	28.18	26.08	27.94	27.80
5. Outside depot excluding taxes	387.88	417.49	434.57	428.86
6. Customs duties and taxes	39.72	24.51	45.12	25.14
7. Petroleum products dues	125.00	0.00	50.00	0.00
8. Value-added taxes	94.40	0.00	90.31	0.00
9. Outside depot including all taxes	647.00	442.00	620.00	454.00
10. Subsidy	0.00	0.00	0.00	0.00
11. Distributors expenses and spreads	40.00	24.00	35.00	32.00
12. Retailers expenses and spreads	21.00	24.00	19.00	2.00
13. Pump selling price	708.00	490.00	674.00	488.00

Source: Ministry of Trade, Promotion of Entrepreneurship and Handikrafts, as of July 2008

COUNTRY CHAPTER: CAMEROON

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ACRONYMS AND ABBREVIATIONS

CAMEROON

AER	Agence de l'Énergie Rural (Rural Electricity Board)
AES-Sonel	AES Corporation – Société Nationale d'Électricité du Cameroun (National Electrical Society of Cameroon)
ARSEL	Agence de Régulation du Secteur de l'Électricité (Electricity Regulation Board)
CCNUCC	Convention-cadre des Nations Unies sur les Changements Climatiques (United Nations Conventions on Climatic Changes)
CDM	Clean Development Mechanism
CEMAC	Communauté Économique et Monétaire de l'Afrique Centrale (Monetary and Economic Community of Central Africa)
CPLC	Cameroon Power and Lighting Company
CREF	Cameroon Renewable Energy Fund
E+CO	Investment company for local energy businesses in Africa, Asia & Latin America
ERA	Environnement Recherche Action au Cameroun (Environmental Studies Action of Cameroon)
FCFA	Franc de la Communauté Financière d'Afrique (CFA Franc; 1 Euro = 655,957 FCFA)
GDP	Gross Domestic Product
IEA	International Energy Agency
INS	Institut National de la Statistique du Cameroun (National Institute of Statistics)
MDG	Millennium Development Goals
MINEE	Ministère de l'Eau et de l'Énergie du Cameroun (Ministry of Energy and Water Resources)
MINIMIDT	Ministère de l'Industrie, des Mines et du Développement Technique (Ministry of Industry, Mines and Technology Development)
MSE	Medium Size Enterprise
n.a.	not applicable
NEAPRP	National Energy Action Plan for the Reduction of Poverty
pm	post meridiem
PRSP	Poverty Reduction Strategy Paper
RE	Renewable Energies
SCDP	Société Camerounaise de Dépôt Pétroliers (Cameroon Petroleum Depot Society)
SNH	Société Nationale des Hydrocarbures (National Hydrocarbons Corporation)
SNI	Société Nationale d'Investissement du Cameroun (National Investment Corporation)
SONARA	Société Nationale de Raffinage (National Refinery Corporation)
SONEL	Société Nationale d'Électricité (National Electricity Corporation)
UNDP	United Nations Development Program
USD	United States Dollar
WAEMU	West African Economic and Monetary Union

MEASUREMENTS

€	Euro (1 Euro = 655.957 FCFA)
d	day
GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh)
km²	square kilometer
kVA	kilovolt ampere
kW	kilowatt
kWh	kilowatt hour
m²	square meter
m³	cubic meter
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
°	degree
t	tons
TJ	terajoule
toe	tons of oil equivalent
TWh	terawatt hour

SUMMARY

The Country Study of Cameroon is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Cameroon. The study is structured as follows:

Chapter one provides **Background Information on Cameroon.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Cameroon.

Chapter two summarizes facts and figures of **Cameroon's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Cameroon. This includes an overview of support mechanisms for photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Cameroon.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Cameroon.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Cameroon is a unitary republic of Central and Western Africa and is bordered by Nigeria in the West; Chad in the Northeast; the Central African Republic in the East and Equatorial Guinea, Gabon, and the Republic of the Congo in the South. With a total area of about 475,000 km² the country extends over 1,200 km from latitude 2° North to 13° North and over 800 km from longitude 3° East to 16° East. Cameroon is divided into 10 provinces that are again divided in divisions, subdivisions and districts.

Cameroon represents all major geographical, climatic and vegetation related characteristics of the African continent, i. e. coastal, desert, mountain, rainforest, and savannah regions. The coastal plain extends over 150 kilometers from the Gulf of Guinea and is characterized by a hot and humid climate with a short dry season. The southern plateau is dominated by the equatorial rainforest with a less humid climate than the one in the coastal plain. In general, Cameroon has a humid climate with extensive rainfalls of up to 3,000 mm/year in the Northwest and up to 8,000 mm on the slopes of Mount Cameroon.

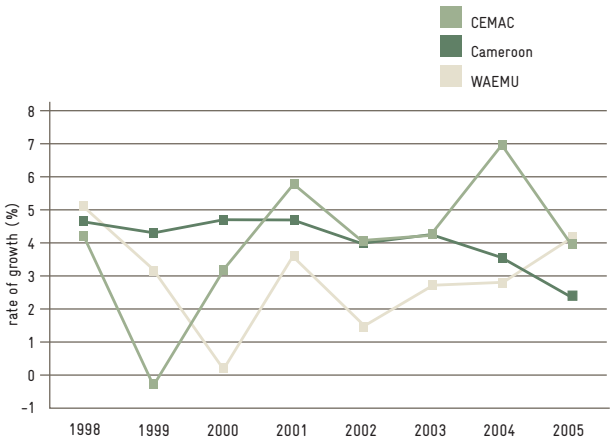
1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

In comparison with other African countries, Cameroon enjoys a substantial political and social stability. Nevertheless, corruption and poverty are still major problems to be solved. The economic development of Cameroon – as in most developing countries – is mainly based on the primary sector. With the production and export of primary products like cocoa, coffee, cotton, banana, pineapple rubber etc., Cameroon's agricultural sector is the largest in Central Africa. Incomes from farming and agricultural resources and the profits from the oil and forestry sectors, provide a solid basis for economic development in Cameroon. In 2002, the Gross Domestic Product (GDP) was estimated at 11.6 billion €, accounting for almost 50 % of the entire CEMAC zone with 25.34 billon €. The growth of GDP averaged 4 % during the period 1998–2005, almost the same level of growth as in the CEMAC zone, but above the average growth rate of 2.9 % in the West African Economic and Monetary Union (WAEMU/UEMOA) zone. Figure 2 presents the trend of GDP growth in 1998–2005.

With the implementation of the Poverty Reduction Strategy Paper (PRSP) in 2006, Cameroon reached the completion point permitting creditors of Cameroon to grant debt alleviations of USD 28,000 million. In the overall socio-economic development, the availability of energy plays a crucial role. The improvement of economic profitability is necessary to attract private investors, to increase economic activity and to reduce poverty.

The initial analysis of the poverty reduction document made clear that too little attention had so far been given to the energy sector. In order to cope with this shortcoming, the Government of Cameroon – together with the United Nations Development Program (UNDP) and the World Bank – adopted a national energy plan[1] to reduce poverty and improve the access to energy in rural and urban areas of Cameroon.

FIGURE 2
Trend of GDP Growth in Cameroon, CEMAC and WAEMU



Source: Banque de France, Rapport Annuel de la Zone Franc, as of 2001, 2002, 2003, 2005

1 PLAN D'ACTION NATIONAL ÉNERGIE POUR LA RÉDUCTION DE LA PAUVRETÉ (HTTP://GO.WORLDBANK.ORG/KFS10MN8V0)

2 ENERGY MARKET IN CAMEROON

2.1 OVERVIEW OF THE ENERGY SITUATION

The energy supply of Cameroon is mainly met by petroleum products and electricity. In the overall energy assessment of Cameroon, household cooking continues to be the prime factor in energy consumption. Cameroon has a comparatively high RE potential. Especially the country's Hydro Power potential offers a number of opportunities for future development. Table 1 provides the country's energy mix, table 2 presents an overview of the country's energy production and consumption by sector and source.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Hydroelectricity Sector

Cameroon has the second highest hydroelectric potential in Africa (after the Democratic Republic of Congo with about 774 TWh/year)[2]. The hydroelectric potential of Cameroon is estimated at 294 TWh/year. Table 3 presents an overview of the hydroelectricity potential.

TABLE 1

Energy Mix of Cameroon

YEAR	1990	1995	2000	2002
Consumption of petroleum products (TJ)	38,560.0	36,383.0	40,403.0	41,449.3
Consumption of electricity (97 % hydro)	8,438.4	7,837.2	9,788.4	9,133.2
Consumption of biomass (TJ	159,987.0	183,000.0	208,740.0	218,137.0
Total consumption (TJ)	206,985.0	227,220.0	258,931.0	268,720.0

Source: IEA, as of 2005

TABLE 2

Overview of Energy Production and Consumption Figures by Sector and Source

TYPE OF SOURCE (TOE)	1990	1995	2000	2001	2002	2003
Production of crude oil	7,930.0	6,208.0	7,346.0	7,025.0	6,439.0	6,419.0
Production of RE	3,820.5	4,370.0	4,984.7	5,094.4	5,209.1	5,322.3
Production of charcoal	n.a.	n.a.	49.5	50.5	51.5	52.5
Thermal production of electricity	3,526.0	2,752.0	3,268.0	5,762.0	10,148.0	13,416.0
Hydroelectricity	228,416.0	236,758.0	296,012.0	298,800.0	273,652.0	303,408.0
Production of petroleum products	838.0	1,220.0	1,543.0	1,49.00	1,177.0	1,401.0
Export of crude oil	–7,067.0	–4,945.0	–5,717.0	–5,452.0	–5,146.0	–4,957.0
Export of petroleum products	–42.0	–343.0	–545.0	–519.0	–275.0	–467.0
Consumption of petroleum products	921.0	869.0	965.0	946.0	990.0	1,010.0
Industry sector	n.a.	n.a.	n.a.	n.a.	67.0	63.0
Transport sector	603.0	593.0	647.0	662.0	721.0	732.0
Consumption of electricity	201,584.0	187,222.0	233,834.0	226,352.0	218,182.0	241,402.0
Industry sector	116,874.0	109,994.0	130,376.0	122,980.0	96,148.0	108,876.0

Source: IEA, as of 2005

Petroleum Sector

Even though Cameroon is the seventh largest producer in Africa, the national production of hydrocarbons is modest. About 56 oilfields are currently in operation with an overall production of 84,000 barrels per day. Within the petroleum sector, the focus is on the rational management and the recovery of production associated gas (850 million m³ per annum). The foreseen decrease in oil production (about 50 % in less than 20 years) stimulated the National Hydrocarbons Corporation (SNH) to take care of this issue. An active campaign towards the promotion of alternative energy resources aims at the doubling of available energy resources within a period of five years. Table 4 presents imports and exports of petroleum products.

Biomass Sector

Biomass energy is used in both, the industrial and the residential sector of Cameroon. About 75 % of the residential sector's energy consumption is covered by biomass resources. Within the industrial sector of Cameroon, more than 90 % of the overall energy requirements are covered by energy from biomass. Since 2005, the utilization of biodiesel from palm oil has been developing as a new and promising market. Currently, the produced biodiesel is mainly used for agricultural purposes. Almost 108,000 hectares of land are used for the oil palm cultivation. From 2001–2006, the cultivation area was enlarged by about 30,000 hectares in order to extend the existing cultivation area. The key issue for the future is to adopt and apply principles and criteria for sustainable palm oil production. Table 5 presents the consumption of biomass for energy purposes.

2 UNECA, 2009

TABLE 3

Hydroelectricity Potential in Cameroon

REGION	SITE/RIVER	NATURAL POTENTIAL (TWH)	DEVELOPMENT POTENTIAL (TWH)	HYDRO POWER PLAN (MW)
Sanaga	Sanaga	162	72	5,600
	Mbam	n.a.	n.a.	1,600
Southwest	Nyong	17	7	700
	Ntem	22	8	1,000
	Other Region	8	3	500
West	Wouri (Noun)	10	5	3,300
	Katsina	9	5	n.a.
	Manyu Munaya	6	2	n.a.
	Other Region	7	2	650
East	Dja	13	4	n.a.
	Boumba	8	2	n.a.
	Kadei	5	1	n.a.
	Other Region	2	1	350
North	Benoue Faro	14	2	n.a.
	Vina du Nord	10	2	n.a.

Source: MINEE, as of 2006

TABLE 4

Exports and Imports of Petroleum Products

YEAR	1990	1995	2000	2001	2002	2003
Crude oil (1,000 t)	7,930	6,208	7,346	7,025	6,439	6,419
Export of crude oil (1,000 t)	–7,067	–4,945	–5,717	–5,452	–5,146	–4,957
Import of crude oil (1,000 t)	–42	–343	–545	–519	–275	–467
Production of petroleum products (1,000 t)	838	1,220	1,543	1,490	1,177	1,401
Final consumption of petroleum products (1000 t)	921	869	965	946	990	1,010
Consumption in the transport sector (1,000 t)	603	593	647	662	721	732

Source: IEA, as of 2005

TABLE 5

Consumption of Biomass (in tons)

YEAR	1999/2000	2000/2001	2001/2002	2002/2003	2003/2004
Firewood	9,120,070	9,375,432	9,423,210	9,468,152	9,288,530
Charcoal	81,303	83,580	84,790	86,100	90,500

Source: MINEE, Cameroon Statistics Directory, as of 2006 and INS, 2006

TABLE 6

Production and Consumption of Electricity by Sector (in million kWh)

YEAR	2000/2001	2001/2002	2002	2003	2004	2005
Global production	3,534,599	3,300,587	3,413,104	3,686,444	3,919,679	4,003,825
Thermal	61,023	118,728	110,511	157,619	190,364	231,552
Hydro Power plan	3,473,576	3,181,859	3,302,593	3,528,826	3,729,315	2,772,273
Network transmission	3,443,524	3,271,202	3,374,998	3,654,626	3,885,116	3,956,161
Consumption	2,799,249	2,511,997	n.a.	2,802,320	3,094,773	3,264,407
Low voltage	751,480	773,449	n.a.	846,128	977,889	1,071,965
Mid – low voltage	618,157	620,287	n.a.	707,553	724,103	747,815
Special customers	1,429,611	1,118,261	n.a.	1,248,639	1,392,781	1,444,626
Number of subscribers	452,994	484,563	493,766	505,361	507,838	528,049
Low voltage subscribers	1,151	1,154	1,207	1,214	1,258	n.a.
High voltage subscribers	5	5	3	3	3	3

Source: AES-SONEL, Cameroon Statistics Directory, as of 2006 and INS, 2006

Overall Energy Consumption

The overall energy consumption per inhabitant is estimated at 0.4 toe and 200 kWh of electricity produced with Hydro Power. Due to the limited availability of sufficient data, consumption figures are only valid for 2002 and 2003. In 2003, about 65,595 GWh of RE (94.4 % from biomass and 5.6 % from Hydro Power) were produced in Cameroon. In the same year, the residential sector's energy mix consisted of 75 % RE, essentially biomass (48,938 GWh) and hydroelectricity (428 GWh). The industrial sector consumed almost 17.4 % of RE, especially biomass (1,0150 GWh) and hydroelectricity (1,266 GWh). Table 6 presents an overview of the electricity production and consumption by sector.

Electricity Prices

In Cameroon, electricity tariffs are established at national level by a joint decision of the Ministry of Energy and the Ministry of Trade in agreement with AES-Sonel and ARSEL. The tariffs are standardized throughout the day but vary in two seasonal tariffs (dry season with higher prices compared to the rainy season). The price for average voltage is distinguished in two billing periods, the rush-hours (between 6–11 pm) and the slack period. The actual price for electricity is determined according to the overall consumption and the subscribed tariff. High voltage tariffs are directly negotiated between the individual consumer and the producer. The various electricity tariffs of Cameroon are presented in Tables 6 a–d.

TABLE 6A

Low Voltage Tariff for Domestic Use

NORMAL PRICE	>200	FIXED PRICE SCALE	65.00	75.00
STRUCTURE OF PRICE		FIXED PRICE BT		
		FIXED PRICE	TARIFFS (FCFA/KWH[3]) 157,619	
Domestic use	Monthly consumption in kWh	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
Social price	<50	n.a.	50.00	50.00
Reduced price	Between 51 and 200	n.a.	60.00	67.00
Normal price	>200	n.a.	65.00	75.00
Street lighting		n.a.	40.00	46.50

Source: ERA – Cameroon, as of 2007

TABLE 6B

Low Voltage Tariff for Professional Use

PRICING STRUCTURE		LOW VOLTAGE PRICE SCALE		
		PRICE SCALE	PRICE (FCFA/KWH – CONVERSION RATE SEE[3])	
Professional use	Monthly consumption in kWh	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
First phase	<180	2,000	63.00	50.00
Second phase	>180	2,000	55.00	60.00

Source: ERA – Cameroon, as of 2007

TABLE 6C

General Average Voltage Price

AVERAGE VOLTAGE PRICING STRUCTURE		GENERAL AVERAGE VOLTAGE PRICE SCALE		
		MONTHLY PRICE	PRICE (FCFA/KWH – CONVERSION RATE SEE[3])	
Duration (hour)	Period	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
<200	Peak hour: 6 pm to 11 pm	2,500	54.00	67.50
	Off-peak hour: 11 pm to 6 pm		43.00	53.75
>200	Peak hour: 6 pm to 11 pm	4,200	49.00	61.25
	Off-peak hour: 11 pm to 6 pm		40.00	50.00

Source: ERA – Cameroon, as of 2007

TABLE 6D

Zone Industrial Average Voltage Price

AVERAGE VOLTAGE PRICING STRUCTURE		GENERAL AVERAGE VOLTAGE PRICE SCALE		
		MONTHLY PRICE	PRICE (FCFA/KWH – CONVERSION RATE SEE[3])	
Duration (hour)	Period	FCFA/kVA Subscribed energy power	Rainy season (01/07 to 31/12)	Dry season (01/01 to 30/06)
< 200	Peak hour: 6 pm to 11 pm	2,500	35.00	43.75
	Off-peak hour: 11 pm to 6 pm		30.00	37.50
>200	Peak hour: 6 pm to 11 pm	4,200	32.00	40.00
	Off-peak hour: 11 pm to 6 pm		25.00	31.25

Source: ERA – Cameroon, as of 2007

3 MONETARY CONVERSION RATE (AS OF MARCH 2009): 1€ = 655.957 FCFA

Price of Petroleum Products

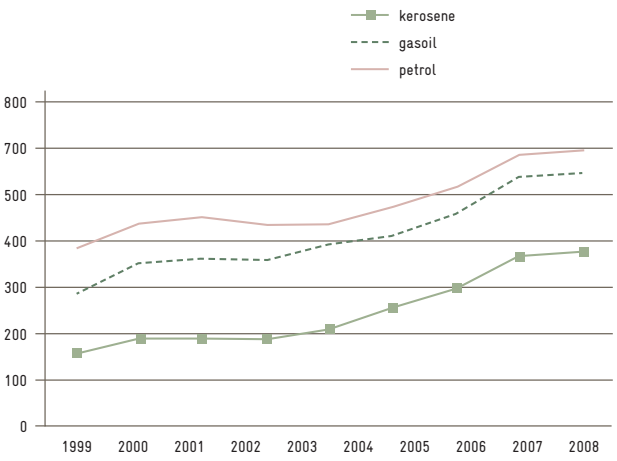
The actual price of petroleum products is fixed by the Government and depends on the fluctuation of the international crude oil price. Figure 3 presents the price trend of various petroleum products. The current prices of the main petroleum products are presented in Table 7.[4]

Market Strategies

In order to improve the framework conditions of the energy market in Cameroon, several strategies are to be implemented. This includes the development of new electricity production facilities (mainly for Hydro Power), the modernization of the national electricity network and distribution infrastructure and the promotion of modern energy services (with special focus on rural areas). Therefore, the National Energy Action Plan for the Reduction of Poverty (NEAPRP) aims to provide modern energy services to 1,263 education centers, 923 health centers and 191 drinking water supply networks. Within the petroleum sector of Cameroon, the Government aims to liberalize the market and promote private investments. Several reforms are already being implemented in order to improve the overall market for oil refinery sector. Up to now, no Governmental strategy has been realized for the promotion of RE.

FIGURE 3

Price Trend of Petroleum Products (July 1999–July 2008)



Source: INS, as of 2006, and Cameroon Tribune, as of 29 July 2008

TABLE 7

Prices of Petroleum Products

Product	End Consumer Price	Additional Charge
Gasoline	594 FCFA	5 to 15 FCFA
Diesel	549 FCFA	5 to 15 FCFA
Lamp oil	350 FCFA	5 to 20 FCFA

Source: ERA – Cameroon, as of 2007

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The energy sector of Cameroon consists of several market actors and institutional stakeholders. Law 1998/022 of 24 December 1998 was passed to reform the institutional framework of the electricity sector in Cameroon.

The **National Electricity Corporation (SONEL)** is exclusively in charge of the electricity supply in urban areas of Cameroon, whereas the electricity supply in rural areas is not regulated at all.

The **Ministry of Energy and Water Resources (MINEE)** defines policies in the overall energy sector and grants concessions and licenses to market actors. Other tasks include the development of the energy sector, the planning of rural electrification and the promotion of RE. The main focus of activities is on the electricity sector. Up to now, only the Energy Master Unit, a service of the department of electricity, is taking initial steps towards the promotion of RE.

The **Electricity Regulation Board (ARSEL)** supervises and regulates the electricity sector, ensures the financial stability and approves of investments. Further tasks include the management of concessions and licenses, the authorization of electricity supply in rural areas, consumer protection and the promotion of private investments.

The **Rural Electrification Board** ensures the promotion of modern electricity services by granting operators and consumers technical and financial assistance in order to develop and implement RE for rural electrification strategies.

The **National Operator AES-Sonel** is the main electricity producer and supplier in Cameroon. The company is controlled by the AES Corporation, the Government of Cameroon and the AES Cameroon Holding.

The petroleum sector of Cameroon is dominated by the **National Hydrocarbon Corporation (SNH)**, the **National Refinery Corporation (SONARA)** and the **Société Camerounaise de Dépôt Pétroliers (SCDP)**. The distribution sub-sector has been liberalized, and activities are being shared between multinational companies like MOBIL, TOTAL and TEXACO. On top of that, several approved national companies[5] are active in the petroleum sector of Cameroon.

4 MONETARY CONVERSION RATE (AS OF MARCH 2009): 1€ = 655.957 FCFA.

5 PECTEN CAMEROON, NOBLE ENERGY, PETRONAS CARIGALI SDN BHD, PERENCO CAMEROUN, KOSMOS ENERGY, ADDAX PETROLEUM CAMEROON, GLENCORE EXPLORATION LTD, AFEX GLOBAL LTD, STERLING OIL & GAS, EUROIL LTD, RSM PRODUCTION CORPORATION, RODEO RESOURCES, PETROVIETNAM EXPLORATION PRODUCTION LTD, PRONODAR LTD.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The Government of Cameroon has already developed a strategy aiming at the modernization of the country's electricity sector. Even though this includes several measures to facilitate the introduction of RE, no fiscal incentives are available so far.

For the provision of modern energy services to rural areas of Cameroon, the Government has implemented the Rural Electrification Board. The board's task is to support the allocation of licenses for electricity production in order to increase the production capacity in rural areas of Cameroon.

The investment company E+CO and the National Investment Corporation (SNI) have created the Fund for Modern and Renewable Energy Resources (Cameroon Renewable Energy Fund – CREF). The fund's mission is to increase the availability of modern energy services through the provision of capital and expertise for the development of energy projects in the field of Hydro Power and biomass energy. Moreover, CREF offers an opportunity to mobilize concession-based financing and private sector investments. The involvement of new market actors aims to promote the development of a production and distribution infrastructure and to ease the transfer of knowledge and modern technologies.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The recent reform of the national electricity sector of Cameroon aims to liberalize the overall electricity sector. After a transitional period of five years, the monopolist SONEL will be privatized. Moreover, the wholesale market for electricity will be liberalized in order to allow consumers to choose freely between several suppliers.

The free access for new market actors and operators through competitive calls for tender is supplemented by the creation of a solid management structure for the distribution network. The enhanced involvement of the local authorities aims to improve the implementation of policies for rural electrification. This includes the adoption of the National Rural Electrification Plan and the Energy Plan for Poverty Reduction.

For the implementation of the Clean Development Mechanism (CDM), Cameroon has ratified the United Nations Framework Convention on Climate Change on 19 October 1994 and the Kyoto Protocol on 23 July 2002. Moreover, Cameroon has created a designated national authority for CDM in 2006 while the Ministry of Environment and Nature Protection established a national committee for the implementation of CDM projects. The criteria and indicators defined for the promotion of a sustainable development in Cameroon serve as a basis for approving of future CDM projects.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

For small and medium size enterprises operating in the forest sector, there are numerous opportunities to produce energy from biomass. In 2006, 66 units with a transformation capacity of 2.7 million m^3 were identified. Nine of the sites were equipped with a biomass drying machine and with gasoline generators for the production of the required in-house electricity.

An inventory of the electricity in-house production structures in 2006 identified the new energy technologies already in use. The most used technologies are based on cogeneration, namely of steam turbines using gas or biomass. The cogeneration technologies from biomass are mainly applied in the food industry sector. The overall capacity of steam turbines using biomass is estimated at 12.8 MW. This shows that local enterprises already have a good grasp of this technology. Table 8 presents an overview of companies that already have implemented steam turbines for energy cogeneration.

The identified biomass potential of Cameroon mainly originates from national agro- and wood industries. Table 9 presents available biomass residues from wood transformation activities. Table 10 presents available biomass residues for the most relevant crops.

TABLE 8

Companies Using Steam turbines for Energy Cogeneration

COMPANY	UNITS	TOTAL CAPACITY (kW)
PAMOL (Lobe)	1	310
PAMOL (Mudemba)	1	450
SPFS (Fermes Suisses, Edea farms)	1	1,124
SOSUCAM (Nkoteng)	1	9,054
SODECOTON	1	400
Global	8	12,801

Source: ERA – Cameroon, as of 2007

TABLE 9

Biomass Residues of the Wood Transformation Sector

SECTOR	COMPANIES	ANNUAL CAPACITY (m^3)
Simple sawmills and sawmills with drier	45	1,475,000
Integrated sawmill with carpentry	13	792,000
Roll-out factory, jib board or cutting	8	412,000
Global	66	2,679,000

Source: ERA – Cameroon, as of 2007

TABLE 10

Available Biomass Residues from Crops

CROP	RESIDUES	ANNUAL CAPACITY (m^3/ tons)
Rubber	Timber	132,000 m^3
Cotton	Cotton/seed cake	147,642 tons/45,780 tons
Robusta coffee	Chaff	145,900 tons
Sugar cane	Bagasse/molasses	244,750 tons/32,040 tons
Palm oil	Stalks/palm kernel shells	57,695 tons/28,847 tons

Source: ERA – Cameroon, as of 2006

4.2 SOLAR ENERGY

The solar energy potential is abundant, but not sufficiently developed (South: up to 4 kWh/d/m²; North: up to 5.8 kWh/d/m²). Currently, only about 50 small PV installations are implemented in Cameroon. The sites include several health care centers, telecommunication relay stations, isolated train stations, churches and police stations. Only very few PV modules are installed at private households (as of 2006, only 6 installations were identified).

4.3 WIND POWER

The potential for wind power is but marginal. In the North and in some coastal zones there are some favorable sites for wind energy. Currently, only two rapid wind turbines are installed at a hotel in Douala.

4.4 HYDRO POWER

The potential for small Hydro Power installations (up to 1 MW) is estimated at 1.115 TWh, mainly in the eastern and western regions of Cameroon. In spite of the considerable potential, small Hydro Power installations are almost non-existent in Cameroon. Very few are located in the North and the Southwest of the country. Projected investments for the construction of Hydro Power installations are estimated at 1,330.7 million Euros (80 % of the global investment). 38.1 million Euros are to be invested in the construction of small Hydro Power installations that will guarantee the electricity supply for seven isolated areas of Cameroon. Table 11 presents future investments in the Hydro Power sector of Cameroon.

TABLE 11

Future Investments in the Hydro Power Sector of Cameroon (2005–2015)

SITE/CAPACITY	INVESTMENT (MIO €)
Edea/Song Loulou (30 MW)	76.22
Lom Pamgar (170 MW)	76.22
Nachtigal (280 MW)	228.67
Warak (75 MW)	114.33
Song Dong (280 MW)	266.78
Meve ‚Elé (200 MW)	304.9

Source: Ngnikam, as of 2007

5 MARKET RISKS AND BARRIERS

The development of industrial and commercial activities in the field of RE in Cameroon is currently hindered by several constraints. In general, the institutional environment of Cameroon does not encourage investments at all. This is due to insufficient investment regulations and a lack of standards and quality control mechanisms. The misjudgment of potential risks for RE projects makes it almost impossible to collaborate with traditional financial institutes. Therefore, many progressive projects are blocked due to inadequate financing mechanisms.

The lack of basic prerequisites makes it very difficult to establish a national market for RE. Unreliable infrastructure, insufficient distribution networks, anticompetitive commercial framework as well as administrative bottlenecks and financial insecurity are the most important risks and barriers.

Recently, the institutional landscape of electricity production and electricity supply has been revised. New laws for the liberalization of the overall electricity sector are already implemented. The company AES-Sonel emanated from the privatization of Sonel and now holds a concession for the supply sector.

As of now, the production and distribution for large-scale consumers (more than 1 MW of subscribed capacity) is fully open to competition. The rural areas of Cameroon are not affected by the concession, therefore the production, transport and distribution of electricity is entirely liberalized. Since there are only very few large-scale consumers, the most profitable urban zone is almost exclusively supplied by AES-Sonel which again creates a monopoly.

New operators are forced to join the market at the conditions of AES-Sonel. As the cost of transportation within the existing network has not been defined yet, there are several uncertainties that prevent investments.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 12
Local Business Partners

INSTITUTION	CONTACT	FIELD OF ACTIVITY
RWKING Corporation	P.O Box 4022 Douala Phone: +237 33 42 59 45 Fax: +237 33 42 22 85 rwking@rwkingcam.com	Specialized in the supply and maintenance of industrial equipment and energy equipment
OMNIUM SIRA	P.O Box 15474 Douala Street Drouot Phone: +237 33 37 74 86 Fax: +237 33 37 74 83 secretariat@omnium-sira.com	Supplier and service provider in the field of RE
MAGUYSAMA Technologies	P.O Box 5033 Douala Phone: +237 33 40 92 81 Fax: +237 33 40 92 81 maguysama@maguysama.fr	Energy supply systems for private and commercial applications
Environnement Recherche Action au Cameroun (ERA – Cameroun)	P.O Box 3356 Yaoundé Phone: +237 22 31 56 67 secretariat@era-cameroun.com	NGO active in the bioenergy sector
Cameroon Power and Lighting Company (CPLC)	P.O Box 2425 Douala Phone: +237 99 82 92 39 cplcsa@yahoo.fr	Supplier of solar equipment
GECOSER	P.O Box 20440 Yaoundé Phone: +237 22 21 23 62 Fax: +237 22 20 04 79 gecoser@yahoo.fr	Supplier of solar equipment

TABLE 13
Sector-specific Ministries and Corporations of Cameroon

MINISTRY/CORPORATION	CONTACT	FIELD OF ACTIVITY
Ministry of Energy and Water Resources (MINEE)	Minister's Cabinet: Phone: +237 22 22 34 00 Fax: +237 22 22 61 77 Department of Electricity: Phone: +237 22 22 20 99	Definition of policies regarding energy, granting concessions and licenses, promotion of RE
Ministry of Industry, Mines and Technology Development (MINIMIDT)	Phone: +237 22 22 38 71 Fax: +237 22 22 95 86	Definition of policies regarding mines and technology development, control of industrial installations
Electricity Regulation Board (ARSEL)	P.O Box. 6064 Yaoundé Phone: +237 22 21 10 Fax: +237 22 21 10 14	Supervision and regulation of the electricity sector
Rural Electricity Board (AER)	P.O Box 30704 Yaoundé Phone: +237 22 21 23 84 Fax: +237 22 21 23 81	Promotion of rural electrification
National Investment Corporation (SNI)	P.O Box. 423 Yaoundé Phone: +237 22 22 44 22 Fax: +237 22 23 13 32 sni@sni.cm	Financing of development projects and projects in the electricity sector
National Hydrocarbon Corporation (SNH)	P.O Box.955 Yaoundé Phone: +237 22 20 19 10 Fax: +237 22 20 98 61	P.O Box.955 Yaoundé Phone: +237 22 20 19 10 Fax: +237 22 20 98 61

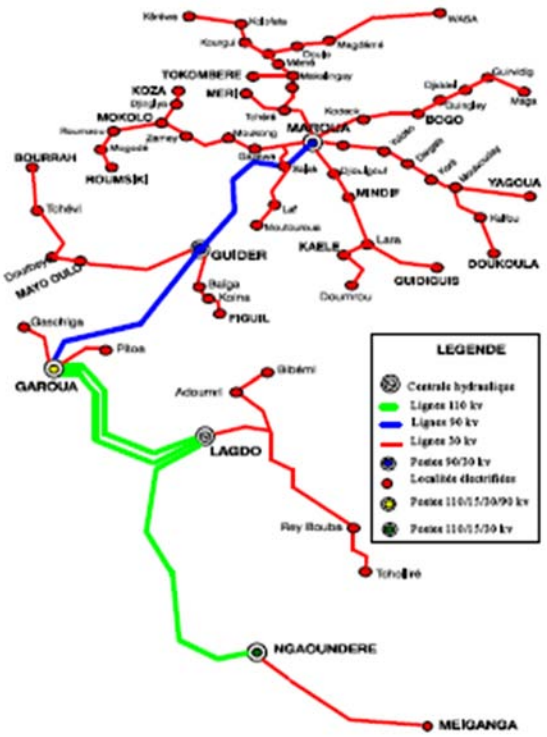
7 BIBLIOGRAPHY

- ARSEL (2006): Energy Survey Work Document
- CEMAC (2006): Action Plan for the Promotion of Energy in the CEMAC Zone (final report of the study realized by "IED")
- Central Intelligence Agency – CIA (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- ERA – Cameroon, ENEFIBIO (2006): The Cameroon Preliminary Report
- (www.cgdev.org)
- ERA – Cameroon, ENEFIBIO (2007): Cameroon Medium Size Enterprises (MSE) Investigation Report, EU, COPENER ProgramIEA (2005): Statistics of Energy of the Non-member Countries of OCDE 2002–2003
- International Rivers (2005): LOM PANGAR DAM, CAMEROON. Drought Could Cripple Cameroon's Hydro-Heavy Energy Sector (www.irn.org/programs/lom-pangar/pdf/050105lpfact.pdf)
- MINEE (2006): Long-term Development Plan of the Electricity Sector 2006
- MINEPAT (2003): Cameroon: Progress of the Millennium Goals for Development (MGD)
- Ministry of Environment and Forestry (2001): Initial National Communication of Cameroon within the Framework of the United Nations Conventions on Climatic Changes (CCNUCC), Yaoundé
- National Institute of Statistics – INS (2003): Second Investigation in Cameroon Done in Households: Poverty and Gender in Cameroon in 2001
- National Institute of Statistics – INS (2004): Third Health Population Investigation (EDS III)
- National Institute of Statistics – INS (2002): Second Investigation in Cameroon Done in Households: Poverty and Job Market in Cameroon in 2001
- National Institute of Statistics – INS (2002): The Living Conditions of the Population and the Poverty Profile in Cameroon in 2001
- National Institute of Statistics – INS (2006): Cameroon Statistical Yearbook 2006, Yaoundé
- Ngnikam, E. (2007): Reinforcing the Resilience to the Climatic Change, Cameroon Report Yaoundé
- Ngnikam, E. (2006): World Observatory of Energy Viability: Cameroon Report, Yaoundé
- Ngnikam, E., Tanawa E. (1998): World Observatory of Energy Viability: Cameroon Report (available on the website of Helio International, www.helio-international.org)
- Republic of Cameroon (2005): Strategy Reduction Poverty Paper (the June 2005 revised version), Yaoundé
- Republic of Cameroon (2003): Strategy Reduction Poverty Paper, Yaoundé
- Tamba, J. C., Tchatchouang; Doua, R. (2007): The Central Africa, the Paradox of Resources: Extractives Industries, Governance and Social Development in the CEMAC States
- The World Bank (2007): Plan d'Action National Énérgie pour la Réduction de la Pauvreté (http://go.worldbank.org/KFS10MN8V0)
- United Nations Economic Commission for Africa – UNECA (2009): African Transport & Energy Infrastructure Atlas (http://geoinfo.uneca.org/africaninfrastructure/?pageToDisplay=energy)

8 ANNEX

FIGURE 4

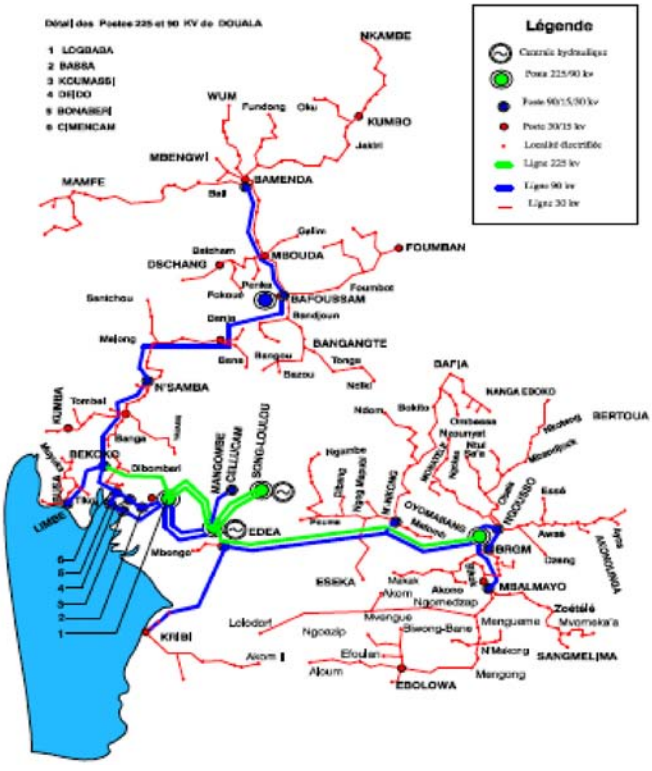
Map of the Northern Electricity Network of Cameroon



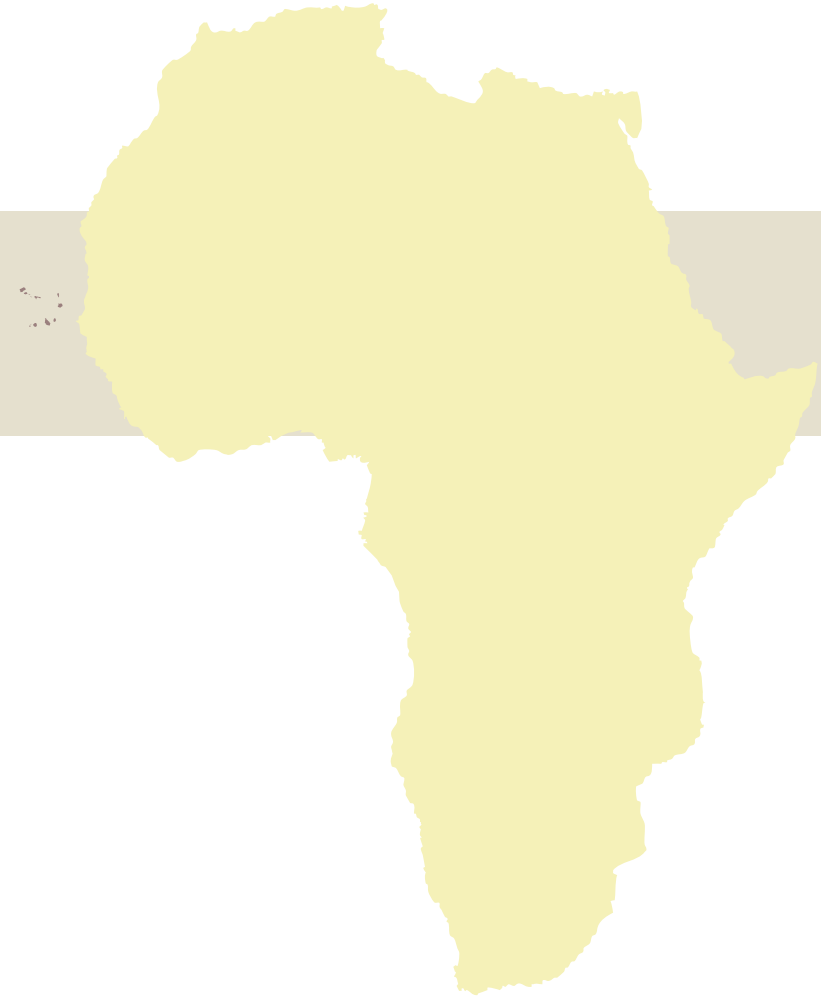
Source: MINEE, as of 2006

FIGURE 5

Map of the Southern Electricity Network of Cameroon



Source: MINEE, as of 2006



COUNTRY CHAPTER: CAPE VERDE

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ACRONYMS AND ABBREVIATIONS

CAPE VERDE

ARE	Agência de Regulação Económica (Agency for Economic Regulation)
CVE	Cape Verdean Escudo (1 Euro = 1,010 CVE)
DGIE	Direcção Geral da Indústria e Energia (General Direction of Industry and Energy)
GDP	Gross Domestic Product
HDI	Human Development Index
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
ONG/NGO	Organisation Non Gouvernementale (Non Governmental Organization)
PAICV	Partido Africano da Independência de Cabo Verde (African Party for the Independence of Cape Verde)
PAIGC	Partido Africano da Independência da Guiné e Cabo Verde (African Party for the Independence of Guinea-Bissau and Cape Verde)
PROMEX	Centro de Promoção Turística, do Investimento e das Exportações de Cabo Verde (Center for Tourism and Export Promotion of Cape Verde)
PRS	Programme Régional Solaire (Solar Regional Program)
PV	Photovoltaic
RE	Renewable Energies
UNDP	United Nations Development Program
USD	United States Dollar

MEASUREMENTS

€	Euro (1 Euro = 1,010 Cape Verdean Escudo)
km	kilometer
km²	square kilometer
kWh	kilowatt hour
m/s	meters per second
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
°C	degree Celsius
toe	tons of oil equivalent

SUMMARY

The provision of modern energy services is a crucial aspect for economic development and the enhancement of social standards. The limited access to energy in general and modern energy services in particular, is a massive barrier towards future development of semi-urban and rural areas.

Likewise the lack of appropriate policies and regulations are significant constraints towards the development of an efficient market for Renewable Energies.

The Country Study of Cape Verde is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Cape Verde. The study is structured as follows:

Chapter one provides **Background Information on Cape Verde.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Cape Verde.

Chapter two summarizes facts and figures of **Cape Verde's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Cape Verde. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Cape Verde.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most **relevant Renewable Energy Business Information and Contacts** of Cape Verde.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Cape Verde is an archipelago off the western coast of Africa, located between the equator and the Tropic of Cancer at 15°02' North and 23°34' West. It is situated about 455 km from the West African coast (Dakar, Senegal) and 1,400 km South South-West of the Canary Islands.

With a surface of 4.033 km², it consists of ten major islands and about eight islets. The relief is mountainous and of volcanic origin. Cape Verde has a Sahelian climate tempered by the oceanic position of the country.

Rainfalls vary from 300 mm/year in the South West to 1,500 mm/year in the North East of the island. Rainfall is very irregular from one year to another and poorly distributed in space. The driest areas are located at the coast. They receive an average of 0 to 300 mm of water per year. The slopes under wind receive more rain and areas of altitude above 600 m may receive up to 800 mm of rain per year. The rainy season is between July and October in low altitude, but mountain areas may also receive small rains during the dry season. The seasons are marked by the alternation of winds from North and East during the dry season (November to July) and by marine winds in South East South direction during the rainy season. In the dry season, the winds of the North provide a cool climate and weather, while winds of continental North East – corresponding to the Harmattan[1] – bring a dry climate. These winds can be violent during the winter for several days. Extreme temperatures remain within a relatively restricted interval because of the oceanic position of the territory. These temperatures rarely exceed 38 °C in summer, while minimum temperatures around 0 °C can be observed at high altitudes e. g. on the volcano of Fogo, particularly during the months of December and January. The average temperature per month varies between 22 °C and 28 °C. It is higher during the wet season, sometimes softened by the ocean, with maximum values in September and minimum values in February.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Cape Verde is a former Portuguese colony and one of the first countries in Sub-Saharan Africa to switch from a single-party to a pluralistic democratic system. During the first years after independence (achieved in 1975), the political landscape is dominated by the African Party for the Independence of Guinea-Bissau and Cape Verde (PAIGC), transformed in 1981 after the separation from Guinea Bissau to the African Party for the Independence of Cape Verde (PAICV).

The population of the Cape Verde is estimated at 487,118 inhabitants in 2006. 53 % of the population is female. In the two major urban centers – Praia and Mindelo – approximately 39 % of the population are concentrated. 700,000 inhabitants of Cape Verde constitute the Diaspora and live abroad. The growth rate of the population between 2000 and 2006 is 1.8 %. The life expectancy is 72.3 years while the rate of schooling is 72 % (for young people) and 79 % (for adults).

FIGURE 1

Map of Cape Verde

In spite of the good development of its economy (see below), the unemployment of young people under 25 years is 21.1 % in Cape Verde. The general poverty rate rose from 30 % in 1989 to 37 % in 2002, while the rate of extreme poverty changed from 14 % to 20 % over the same period. 70 % of the poor and 85 % of very poor live in rural areas. In general, poverty rate and unemployment are on the decline.

The economy of the Cape Verde is characterized by the prevalence of the following sectors: tourism (177 hotels), fishing (14 % of the population), construction, trade and services of public administration. The agricultural sector is fragile, but constitutes the principal activity of the rural population by employing more than 50 % of the working population. Insufficiency of local resources is compensated by the flow of goods and services from outside the country, financed by international cooperations in form of gifts and loans and by the Diaspora (the latter is providing approximately 140 million USD per year).

The revenue per capita has risen from 190 USD in 1975 to 2,316 USD in 2006. Primary school enrolment is about 100 % while life expectancy is over 70 years. There has been a strong and continuous improvement in human development. The Human Development Index (HDI) increased from 0.587 in 1990 to 0.722 in 2006[2]. Today, Cape Verde has already achieved some of the Millennium Development Goals (MDP) while it is on target to achieve the rest by 2015. Between 2001 and 2006, the Gross Domestic Product (GDP) showed an average growth of 6.2 % (10.9 % in 2006) while inflation remained weak at around 2 %. Table 1 presents an overview of the economy of Cape Verde.

1 THE HARMATTAN IS A DRY AND DUSTY WEST AFRICAN TRADE WIND, BLOWING SOUTH FROM SAHARA INTO THE GULF OF GUINEA BETWEEN THE END OF NOVEMBER AND THE MIDDLE OF MARCH (WINTER).

2 UNDP, AS OF 2006

TABLE 1
Cape Verde Economy Overview (2001–2006)

	2001	2002	2003	2004	2005	2006
GDP growth (%)	6.1	5.3	4.7	4.4	5.8	10.9
Inflation (%)	3.4	1.9	1.2	61.9	0.4	5.4
Budgetary deficit (%)	4.8	3.4	3.4	1.3	4.0	4.7

Source: Bank of Cape Verde and National Institute of Statistics, as of 2007

2 ENERGY MARKET IN CAPE VERDE

2.1 OVERVIEW OF THE ENERGY SITUATION

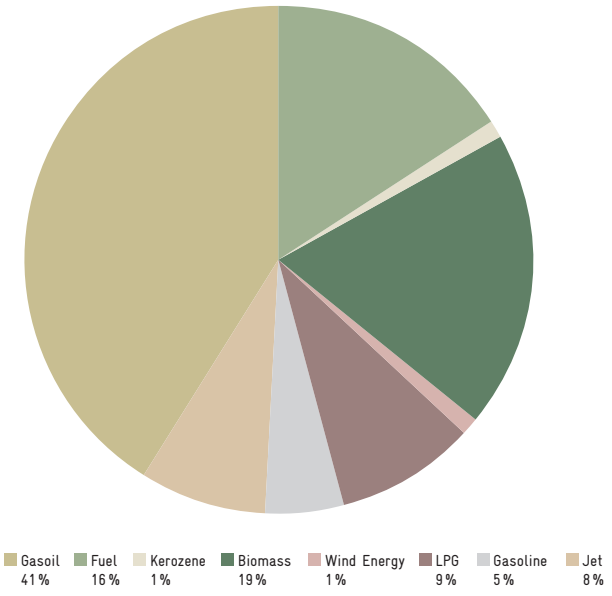
The energy sector of Cape Verde strongly depends on imported petroleum products, primarily imported oil. The use of solar power is quite negligible. The electrical network covered 60 % of the country in the year 2000 (against 25 % in 1990).

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

The energy sector of Cape Verde comprises of three sub-sectors: petroleum, electricity with RE and biomass. Figure 2 presents the energy mix of Cape Verde.

The main energy consumers are the transport sector (47 %) and the residential sector (34 %). A major part of the energy consumption is for domestic use, transport, electricity production and water desalination.

FIGURE 2
Energy Mix of Cape Verde



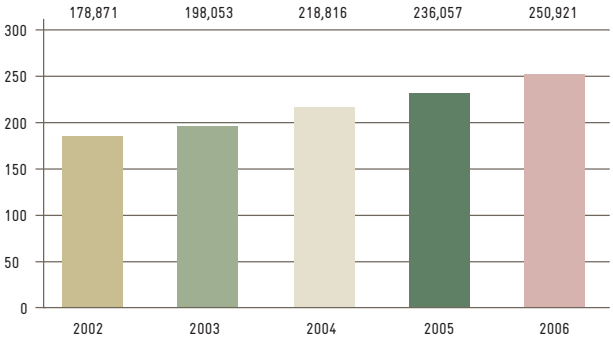
Source: Direction General of Industry and Energy of Cape Verde, as of 2003

Electricity Sector

Concerning electrical power, the overall production registered a growth rate of 8.8 % between 2002 and 2006. The main company Electra produced 236,000 MWh in 2005 and 250,000 MWh in 2006. Cogeneration capacities of steam turbines at water desalination plants contributed a total of 4.4 %. Figure 3 presents the annual increase of electricity production.

The electricity production by wind power went down from 16 % in 1995 to 3 % in 2005 in the total production of electricity. This decrease is due to the lack of investments in the wind energy production during this period. Electricity tariffs are fixed according to decree No. 03/2008. Table 2 presents an overview of current electricity tariffs.

FIGURE 3
Evolution of Electricity Production (1,000 MWh)



Source: Direction General of Industry and Energy of Cape Verde, as of 2006

TABLE 2
Electricity Tariffs

CATEGORY	PRICE (CVE/kWh)[3]
up to 40 kWh	23,91
>40 kWh	33,41
Street lighting	19,31
Special low voltage	25,75
Medium average	20,91

Source: Direction General of Industry and Energy of Cape Verde, as of 2008

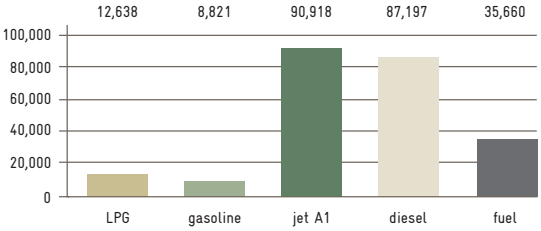
Petroleum Sector

Cape Verde has no proven oil reserves. Therefore, the country has to import petroleum products to meet its requirements. The overall fuel demand of Cape Verde includes diesel, gasoline, kerosene for cooking, LPG, lubricants, marine diesel and Jet A1. Diesel (43,378 toe) and LPG (12,927 toe) are the most important in terms of oil product consumption. The major consumption of LPG is due to the country's lack of biomass resources (firewood and coal). Figure 4 visualizes the amount of imported petroleum products while table 3 presents the prices for different petroleum products.

3 1 EURO = 1,010 CAPE VERDEAN ESCUDO (CVE)

FIGURE 4

Imports of Petroleum Products in toe



Source: Direction General of Industry and Energy of Cape Verde, as of 2004

TABLE 3

Prices for Petroleum Products[4]

PRODUCT (IN CVE/LITER)	GASOLINE	DIESEL	DIESEL ELECTRICITY GENERATION	MARINE DIESEL	KEROSENE
Price (March 2003)	145.80	106.30	94.30	78.70	78.60
Price (January 2009)	160.00	112.40	105.07	84.60	83.50

Source: ARE, as of 2009

Biomass Sector

Due to the climatic conditions, Cape Verde has a very low biomass potential. The total production was estimated at 22,264 toe in 2004. This is a problem for households, especially in rural areas with the urgent need for biomass energy for cooking purposes.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The management of the energy sector in Cape Verde is under the control of the **General Direction of Industry and Energy** (Direcção Geral da Indústria e Energia – DGIE) of the **Ministry of the Economy, Growth and Competitiveness** and the multisector **Agency for Economic Regulation** (Agência de Regulação Económica – ARE). The DGIE is responsible for the formulation and the implementation of the policy, while the ARE is in charge of regulatory issues. The National Assembly enacts the laws and provides the statues under which the agency manages the energy sector.

In the petroleum sector, the National Company Fuel – ENACOL and Shell Cape Verde are responsible of the commercial system of supply.

For the production and the distribution of electric power and water produced by desalination, the Company of Electricity and Water (Electra) is fully in charge.

The biomass sector is managed by the Ministry of Environment, Rural Development and Marine Resources. This ministry also ensures the implementation of the production, the assembly of the wind pumps and the construction of improved stoves. It coordinates the Solar Regional Program – PRS (phase 1 and 2) of the European Union.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The Government of Cape Verde already took important measures to create incentives for the implementation of RE. Article 16 of the law nº 20/VII/2007, for example, allows the import of RE equipment such as solar panels, wind generators etc. with remarkable tax exemptions. The Government further intends to strengthen the role of RE within its upcoming energy policies. The major objective is to reduce the high dependence on imported fossil fuels. The Government thus intends to meet 50 % of the overall energy needs (as opposed to presently 3.2 %) by 2020 through RE resources[5] . In the same period, the Government wants to reduce energy costs that are currently about 70 % above the European Union average.

The strategy for implementing this ambitious program is to open the energy market to national and international private sector investments and to reorganize and privatize Electra. Using the various existing international instruments for RE management and promotion and creating a national conscience in favor of RE are the key elements of this strategy. The development of incentives for RE is a key objective of this policy; it will increase the participation of the private sector and facilitate the building and securing of the RE sub-sector in the country. Cape Verde will only achieve its vision of a fossil-fuel-free future through the investment in, and the development and adoption of technologies and innovative approaches that will reduce its energy use and dependency on oil products. It is why the country has decided to develop special partnerships with innovative firms in the area of RE and alternative energy. Capacity building will be facilitated, especially through the University of Cape Verde, to increase national capabilities. Strategic experimentation and public-private partnership will be encouraged.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

The implementation of Cape Verde's energy policy will reinforce the rural electrification. Thus, after having invested 500 Million CVE in the rural electrification over the 2005–2008 period, the Government intends to considerably increase the investments in this sub-sector of the energy sector. For providing rural energy services, the Government has decided the promotion of concessions. There will be two concession areas: one comprising the Santiago Island and the other comprising the remaining nine inhabited islands of Cape Verde. The concessions will not have geographic monopolies, but will be free to operate wherever chosen within a designated concession area. Concessions will be allowed for ten years and will be awarded via a competitive tender for which detailed bidding documents have been prepared. Concessions will have three

4 COSTS OF FUEL IN CAPE VERDE HAVE FALLEN STRONGLY IN 2009; SEE ALSO WEBSITE OF ARE (WWW.ARE.CV › ELECTRICIDADE › COMBUSTÍVEIS › TRANSPORTES)

5 SEE ALSO REN21, VIEWED IN SEPTEMBER 2009

main responsibilities: (i) sell off-grid electrification systems for either cash or credit, (ii) sell electricity or electricity services by a fee-for-service arrangement for consumers and (iii) manage publicly owned equipment. For isolated sites where the extension of the network is difficult or impossible, innovating solutions of electrification for these zones will be developed with focus on applications for solar energy.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

Due to the existing climatic conditions, the status and future potential of biomass energy in Cape Verde is very low.

4.2 SOLAR ENERGY

The potential of solar energy of Cape Verde is very high. The solar irradiation is one of the highest of the ECOWAS countries: 6 kWh/m²/day. Due to the high potential of solar energy, it is intended to cover 2 % of the total energy consumption by 2010. Up to now, there are several successful PV-based applications for water pumping, lighting and telecommunication systems.

4.3 WIND POWER

The average wind velocity in Cape Verde is more than 6 m/s; thus Cape Verde is one of the rare ECOWAS countries with an unuaually high and interesting potential for wind energy. Cape Verde has been exploiting wind energy mainly for electricity production and desalination since 1995. This proves that the economic potential for this resource is substantial.

4.4 HYDRO POWER

Like the biomass potential, there is almost no (economically feasible) potential for Hydro Power.

5 MARKET RISKS AND BARRIERS

Cape Verde offers many advantages in view of business activities for the development of RE. Over the last years, successful investment strategies gained up to 1 billion USD (as was the case in 2007). Trough the commitment of the Cape Verde Government adequate taxation, tariffs and financial mechanisms in favor of RE have been promoted.

This is mainly due to the existence of a reliable legal framework with guarantees for intellectual property rights and guaranteed safety for investments. In addition to this, Cape Verde offers good infrastructural prerequisites (three international airports, ports, hotels, the University of the Cape Verde, a large number of specialized educational institutions etc.).
The conditions for setting up a company are very flexible in Cape Verde. The Government adopted the Foreign Investment Law (Law No. 89/IV/93)[6] and the Industrial Statute (Decree Law No. 108/89)[7] establishing general conditions, rights and guaranteed measurements for investments in the country.

The Foreign Investment Law defines the conditions for foreign direct investment in any sector of economic activities. All sectors are open to investment unless the enterprise is a threat to national security, the environment or public health or violates domestic laws and regulations (see section IV.3 (d) for further discussion on the Foreign Investment Law).

The new investment policy ensures that applicable procedures are open, efficient and transparent. Investors can easily obtain clear guidance on these procedures from the Center for Tourism and Export Promotion of Cape Verde (PROMEX), a Government department under the supervision of the Ministry of Economy, Growth and Competitiveness in charge of promoting trade and investment opportunities in Cape Verde.

Cape Verde offers quite a range of investment incentives and guarantees for foreign investors, companies in free trade zones and companies producing goods and services exclusively for exports.

6 PUBLISHED IN THE OFFICIAL BULLETIN 13/12/93
7 PUBLISHED IN THE OFFICIAL BULLETIN 30/12/89

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 4

Local Business Partners

NAME	CONTACT/ADDRESS	PROFILE
Association of the Friends of the Nature (ONG)	S/C Direction of Environment and Sustainable Development Phone: +238 261 8984	Capacity building and distribution of RE products
General Direction of Industry and Energy	Phone: +238 261 48 00 Fax: +238 261 33 15 abrao.lopes@govcv.gov.cv	Energy policy (fossil and RE)
Direction of Environment and Sustainable Development	Phone: +238 261 89 84	Environment and energy policy (biomass)
National Institute of Management of Hydraulic Resources	Phone: +238 261 24 13 prs_cv2@yahoo.fr	Hydraulic and energy policy (solar and wind pumping)
Fuel ENACOL	Phone: +238 251 1120 Fax: +238 231 4873	Distribution of oil products
Authority Regulation (ARE)	Phone: +238 260 0424 Fax +238 261 6053 are@are.cv	Regulation of energy sector and other sectors such as water, communication etc.
Electra	Phone: +238 230 3030 Fax. +238 232 44 46	Electricity production, transport and distribution

7 BIBLIOGRAPHY

- BAD/OCDE (2008): Perspectives Économiques en Afrique 2008: Le Cap Vert
- Banque Mondial/ PNUD (without year): Étude de Stratégies pour l'Énergie Domestique
- Cap Vert-UE (2007/08): Document de Stratégie de Coopération pour la Période 2001-2007
- DGIA of Cape Verde (2004): Rapport Bilan Énergétique du Cap Vert
- DGIE (2008): Document de Politique Énergétique du Cap Vert
- ECOWAS (2005): White Paper on Access to Energy Services
- World Bank (2000): Regulatory Approaches to Rural Electrification and Renewable Energy: Case Studies from Six Developing Countries (Working Paper), Eric Martinot and Kilain Reiche
- Gouvernement du Cap Vert (2001): Mémoire à la 3éme Conférence des Nations Unies sur les Pays les Moins Avancés, Bruxelles
- Institut National des Statistiques du Cap Vert (2006): Cap Vert en Chiffres
- DGIE (1996): Politiques et Stratégies de l'Énergie et de l'Environnement, Lopes Back Santos
- M. Abdallah SAMBA, CILSS/AGRHYMET, Niamey et M. Inussa BARRY, Consultant National Cap Vert (2008): Rapport de la Mission Conjointe CILSS/FAO/FEWS-NET/Gouvernement d'Évaluation de la Campagne Agricole 2008/2009 au Cap Vert, Praia
- CEAN, IEP-Université Montesquieu-Bordeaux IV (without year): Politique Institutionnelle au Cap Vert, Boubacar Issa Abdourhamane
- Ministry of Environment of Cape Verde (1999): National Communication on the Climatic Changes
- Ministry of Finances of Cape Verde (1990): Rapport de l'Aide Bilatéral
- N. N. (2004): National Assessment of the Barbados Program "Action + 10" Review, Praia
- Prof. Ogunalde Davidson (2008): Scaling Up-Market for Renewable Energy in Africa, Thematic Background Paper for International Conference on Renewable Energy in Africa, Dakar
- N. N. (2004): Rapport sur les OMD: Cap Vert – une Évaluation des Efforts
- Renewable Energy Policy Network for the 21st Century – REN21 (2009): various publications (www.ren21.net/pledges/detail.asp?id=1031)
- United Nations Development Program – UNDP (2006): Human Development Report
- Agência de Regulação Económica (Agency for Economic Regulation) – ARE: (www.are.cv)

COUNTRY CHAPTER: CÔTE D'IVOIRE

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ACRONYMS AND ABBREVIATIONS

CÔTE D'IVOIRE

AIPO	African Intellectual Property Organization
ANARE	Agence Nationale de Régulation de l'Électricité (National Regulatory Agency)
ANDE	Agence Nationale de l'Environnement (National Environmental Agency)
BNETD	Bureau National d'Étude Technique et de Développement (National Office for Technological Studies and Development)
CACI	Cour d'Arbitrage de Côte d'Ivoire (Côte d'Ivoire Arbitration Court)
CET	Common External Tariff
CFAF	CFA Franc (1 Euro = 655,957 CFAF)
CICA	Cour d'Arbitrage de Côte d'Ivoire englische Erklärung ergänzen
CIE	Compagnie Ivoirienne d'Électricité (The Ivorian Electricity Company)
CIPREL	Compagnie Ivoirienne de Production d'Électricité (The Ivorian Electricity Production Company)
CME	Centre des Métiers d'Electricité (Electricity Trade Center)
CNR	Canadian National Resources International CI
CNRA	Centre National de Recherche Agronomique (National Center for Agricultural Research)
CTFT	Centre Technique Forestier Tropical (Technical Center for Tropical Forestry)
EDF	Électricité de France (Electricity of France)
GDP	Gross Domestic Product
GESTOCI	Société de Gestion des Stocks Pétroliers de la Côte d'Ivoire (Petroleum Product Management Company of Côte d'Ivoire)
I2T	Institut de Technologie Tropicale (Tropical Technology Institute)
IMF	International Monetary Fund
IPP	Independent Power Producer
IREN	Institut de Recherche sur les Energies Renouvelables (Research Institute on Renewable Energies)
MDP	Mécanisme pour un Développement Propre (Clean Development Mechanism – CDM)
MP	Member of Parliament
NGO	Non-governmental Organization
OIPI	Office Ivoirien de la Propriété Industrielle (Ivorian Industrial Property Office)
PETROCI	Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (National Petrol Society)
SIR	Societé Ivoirienne de Raffinage (Ivorian Refinery Society)
SMB	Société Multinationale des Bitumes (Multinational Bitumen Society)
SODEDAM	Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique (Society for Airport Operation and Development, Aviation and Meteorology)
SODEFOR	Société pour le Développement Plantations Forestières (Forest Plantation Development Society)
SOGEPE	Société de Gestion du Patrimoine du Secteur de l'Electricité (Company for the Management of the Electricity Sector's Patrimony)
SOPIE	Société d'Opération Ivoirienne d'Electricité (National Electricity Operation Society)
UN	United Nations
VAT	Value Added Tax
WAEMU	Western African Economic and Monetary Union
WAPP	West African Power Pool

MEASUREMENTS

bbl/d	barrels per day
kWh	kilowatt hour
m/s	meter per second
m^2	square meter
m^3	cubic meters
MW	megawatt
MWh	megawatt hour
toe	tons of oil equivalent
TWh	terawatt hour

SUMMARY

The Country Study of Côte d'Ivoire is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Côte d'Ivoire. The study is structured as follows:

Chapter one provides **Background Information on Côte d'Ivoire**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Côte d'Ivoire.

Chapter two summarizes facts and figures of **Côte d'Ivoire's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Côte d'Ivoire. This includes an overview of support mechanisms for photovoltaic PV as well as existing regulations, incentives and legislative framework conditions for other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Côte d'Ivoire.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Côte d'Ivoire.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Located in West Africa and in the intertropical zone, Côte d'Ivoire has a land area of 322,462 km². It is bordered by the Atlantic Ocean in the South and shares borders with Ghana in the East, Burkina Faso and Mali in the North and Guinea and Liberia in the West. The country is influenced by two air masses: a moist equatorial air mass called Monsoon and a dry tropical air mass coming along with a drying wind named Harmattan, with a saturation of 65–90 %.

There are four major climate zones in Côte d'Ivoire, namely an equatorial climate (or Attiean climate), a semi-damp tropical climate (or Baoulean climate), a dry tropical climate (or Sudano-Guinean climate) and a wet tropical climate (or mountain climate). Three types of vegetations can be found in the country: One vegetation area spans over the southern half of the country and the coastal basin; the Sudanese area in the North is characterized by a scattered vegetation covering (savannah). In-between these regions, a pre-forest area spans East to West with dense bush formations and gallery forests along watercourses.

The geography of Côte d'Ivoire includes plains in the South with swampy areas and a few hills no higher than 200 meters. Plateaus covering the center and the North form isolated hills or hill chains with a height of 200 to 500 meters. In the West of the country, there are chains of mountains with a height of more than 1,000 meters and single peaks of 1,300 meters and even 1,752 for Nimba Mount, the highest summit.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

In Côte d'Ivoire, a new constitution has been drafted in 2000, providing three separated powers: the executive power held by a Government headed by a President, the legislative power held by the parliament which consists of Members of Parliament (MPs) from several political parties and a judicial power. The political and social unrests, violence, coups d'état and rebellions did not allow the population to reap the fruit of this democratic system. The administrative system is decentralized and run by elected local representatives. Examples are the General Councils at regional level and municipalities (mayors) for the direct management of the population's needs. Since its independence, the country has been establishing a free market economic system.

Côte d'Ivoire has an estimated population of 20,807,216 inhabitants (as of 2008) with over 26 % of immigrants coming mainly from neighboring countries. There are around 60 ethnic groups belonging to four major affiliations: Gurs, Mandés, Akans and Krus. Côte d'Ivoire is a lay country with several coexisting religious denominations, the major ones being Islam (38.6 %), Christianity (35.8 %) and Animism (25.6 %). The country has two capital cities: Yamoussoukro, the political capital, and Abidjan, the economic capital. Moreover, Côte d'Ivoire is characterized by a significantly high urbanization rate and a population with about 40.3 % of its members being 15 years and under.

MAP OF CÔTE D'IVOIRE

The economy of Côte d'Ivoire has been experiencing a slow decline since the outbreak of an armed rebellion in September 2002. As a consequence, most of the foreign aid flow was interrupted (except for humanitarian assistance), thus increasing the internal and external debt burden and inducing a severe downturn in foreign and domestic investments. The Gross Domestic Product (GDP) growth rate was 0.9 % in 2006 and 1.7 % in 2007. The IMF anticipates a positive GDP growth rate of 3.8 % in 2008. The Ivorian economy is largely dependent on external factors such as weather conditions and international raw material prices. The standard of living of the population and the state of infrastructure has deteriorated since 2002. The inflation rate was approximately 2.5 % in 2007.

The economy of the country rests on agriculture providing jobs for two thirds of the national manpower and contributes to the GDP to the tune of 20 %. Côte d'Ivoire is the leading world cocoa exporter with a yearly production of several million tons. Some mining activities such as gold, diamond and manganese mining are also conducted in the country. In 2005, however, the UN Security Council banned diamond export because it served to fund arms procurement. Industrial and material development sectors account for approximately 22 % of the GDP while the tertiary sector contributes 57 %.

Côte d'Ivoire is the hub for trade activities in Western Africa, and foreign trade accounts for 90 % of the GDP. Côte d'Ivoire is a member of WAEMU (Western African Economic and Monetary Union) applying a common external tariff (CET). It is also a member of the CFAF Zone. Its top three export partners are France, the United States and the Netherlands. Cocoa is the country's main export good (generating 40 % of its export receipts). In terms of import, the top three partners of Côte d'Ivoire are France, Nigeria and Singapore. The main import goods are fuels and oils, vehicles, ships and vessels, grains and machinery.

2 ENERGY MARKET IN CÔTE D'IVOIRE

2.1 OVERVIEW OF THE ENERGY SITUATION

Côte d'Ivoire's oil industry started to take off in 2001 during the period of civil war. By 2007, oil exports accounted for 28 % of the Governments export revenues. The majority of Côte d'Ivoire's electricity is generated through stations powered with natural gas and hydroelectricity accounting for around 20 %. More than half of the domestic energy needs are met by combustible renewable resources and waste, mainly in the form of biomass. Table 1 presents the production/consumption figures of Côte d'Ivoire.

TABLE 1

Energy Production/Energy Consumption

TYPE OF ENERGY	2004	2005	2006	2007
Production				
Electricity (MWh)	5,403,895	5,570,205	5,543,9164	5,515,481
Electricity (MWh)	5,403,895	5,570,205	5,543,9164	5,515,481
Petroleum products (1,000 tons)	1,302	2,044	3,135	2,418
Natural gas (million m³)	1,555	1,738	1,708	1,398
Consumption				
Electricity (MWH)	2,989,808	3,004,062	3,262,877	3,432,915
Petroleum products (1,000 TONS)	799	695	813	833
Natural gas (MILLION M³) 1,708	1,555	1,738	1,708	1,398

Source: Direction Générale de l'Energie (Energy Information System), as of 2004–2007

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

As of 2005, Côte d'Ivoire had installed an electric generation capacity of 1,210 megawatts (MW). In 2005, Côte d'Ivoire generated about 5.4 billion kWh of electricity, while consuming about 2.9 billion kWh. Electricity is exported through the West African Power Pool (WAPP). Most of the electricity is generated through conventional thermal power stations (> 70 %), with hydroelectricity supplying the remainder. The 288 MW Azito Power Station, in operation since 1999, is located in Abidjan's suburbs and produces more than a third of the country's electricity. The phased construction of a third turbine in Azito has been delayed. Côte d'Ivoire's main hydroelectric plants include Ayame I and II, Kossou, Taabo, Buyo and Grah. Table 2 presents the electricity production capacities; Table 3 indicates the current electricity tariffs.

TABLE 2

Electricity Production Capacities

HYDRAULIC POWER PLANTS	INSTALLED POWER (MW)
Ayamé 1	20
Ayamé 2	30
Kossou	174
Taabo	210
Buyo	165
Grah	5
Total	**604**
THERMAL POWER PLANTS	
Vridi	100
Ciprel	210
Azito	288
Total	**606**
Overall	**1,210**

Source: Société d'Opération d'Electricité, SOPIE, as of 2008/2009

TABLE 3

Electricity Cost (in CFAF)

LOW VOLTAGE COST	
Household use	Price ET
Fixed price per kWh	1,176
Nominal tariff rate/kWh	36.05
General tariff rate/kWh	57.43

PRICE FOR LOW VOLTAGE	
Professional use	Price ET
Fixed price	1,664.98
1st price band	92.59
2nd price band	78.75

CATEGORY OF SUBSCRIBER	MEDIUM VOLTAGE COST	HIGH VOLTAGE COST
Short-term use		
Fixed price/kW/year	18,850.76	46,658.33
kWh cost for busy hours	63.59	57.01
kWh cost for peak hours	98.40	104.41
kWh cost for non-busy hours	45.68	32.15
General use		
Fixed price	25,936.38	63,120.76
kWh cost for busy hours	51.71	38.46
kWh cost for peak hours	75.95	104.41
kWh cost for non-busy hours	46.09	32.15
Long-term use		
Fixed price	37,686.39	79,563.98
kWh cost for busy hours	53.47	34.42
kWh cost for peak hours	67.91	38.46
kWh cost for non-busy hours	46.48	32.71

Source: Agence Nationale de Régulation de l'Électicité (ANARE), prices including VAT, as of 2008/2009

Petroleum Sector

Côte d'Ivoire has proven crude oil reserves of 100 million barrels; the vast majority is located offshore. Oil production increased from around 15,000 barrels per day (bbl/d) in 2002 to approximately 62,000 bbl/d in 2006. Production problems at the so-called Baobab field constrained the oil production in 2007 to almost 52,000 bbl/d. The production is expected to increase to 70,000 bbl/d by 2009 following repairs at three of the five shut-in wells at the Baobab field. Côte d'Ivoire currently has one refinery: the SIR (Société Ivoirienne de Raffinage) located in Abidjan with a capacity of 65,000 bbl/d. The refinery receives crude oil from West African and other countries, then exports products to neighboring countries (detailed production figures are available in the Annex/Table 10 of this report). An oil pipeline connects the SIR refinery to the so-called Lion and Panther fields. The state currently owns 47.3 % of SIR; other partners include the Government of Burkina Faso, Total, Shell, ExxonMobil and Chevron. A petroleum product depot, adjacent to SIR, stores petroleum products for domestic use as well as for export (to Mali, Burkina Faso, Niger and Chad). Other fuel depots are located in Bouake and Yamoussoukro. In 2006, the national oil consumption reached 26,000 bbl/d with about 36,000 bbl/d being exported. Table 4 presents the current prices for petroleum products.

TABLE 4

Price of Oil Products

PRODUCT	PRICE (CFAF)
Butane (12.5 kg bottle)	4,500
Unleaded gasoline	790
Kerosene (jet)	495
Diesel	685
DDO	793.61
FO180	471.99

Source: Direction des Hydrocarbures, as of November 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The institutional framework of the overall energy sector is rather complex as several ministries have direct or indirect influence on this keysector.

The **Ministry of Mining and Energy**, through its technical body named **Office for the Promotion of Energy Efficiency** (Bureau des Économies d'Énergie) and through the **Sub-Directorate of Energy Control and Renewable Energies** (Sous-Direction de la Maîtrise de l'Énergie et des Énergies Renouvelables), ensures the promotion of energy efficiency actions and RE development actions. For that purpose, the two bodies jointly carry out the following actions:

- Monitoring of the "Improved Stoves Popularization Program"
- Monitoring of power billing for public buildings in consultation with the Laboratory of Construction and Civil Engineering (Laboratoire du Bâtiment et des Travaux Publics) of the Ministry of Economic Infrastructures
- Monitoring of the use of residues in some industrial companies
- Monitoring of the activities of charcoal producers in cooperation with the National Center for Agricultural Research (Centre National de Recherche Agronomique) of the Ministry of Higher Education and Research
- Monitoring of experimental solar stations in cooperation with the Research Institute on Renewable Energies (Institut de Recherche sur les Energies Renouvelables) of the Ministry of Higher Education and Research

The **Ministry of Agriculture and Forestry** also ensures control of wood and charcoal sub-sectors.

The **Ministry of Higher Education and Research** coordinates the activities of the research centers involved in the energy sector, i. e. the Research Institute on Renewable Energies (IREN), the Tropical Technology Institute (Institut de Technologie Tropicale – I2T) and the National Center for Agricultural Research (CNRA).

The petroleum sector of Côte d'Ivoire is regulated and supervised by the Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (Petroci). In 1998, Petroci was divided into four units: Petroci Holding (responsible for portfolio management of the oil sector), Petroci Exploration/Production (responsible for upstream hydrocarbon activities), Petroci-Gaz (responsible for the natural gas sector), and Petroci Industries Services (responsible for all other related services).

The electricity sector of Côte d'Ivoire includes the following market actors:

- SOGEPE manages the asset base and financial flow of the power sector.
- SOPIE supervises the provision of facilities with focus on the implementation of the rural electrification program.
- The National Regulatory Agency (Agence Nationale de Régulation – ANARE) is the regulatory authority for the electricity sector.
- The Ivorian Electricity Company (Compagnie Ivoirienne d'Électricité – CIE) has been granted concession for the power utility and exploits electricity generation, conveyance and distribution facilities.
- Private electricity generation operators (Independent Power Producers – IPP) including CIPREL and AZITO ENERGY and new IPPs such as EEI and LAUCHAN are about to sign an agreement with the Government, which contributes considerably to the implementation of the energy policy.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The development of RE is hindered by a lack of comprehensive planning as Côte d'Ivoire does not have a clearly defined energy policy with substantial financial means to promote RE. On the institutional level, the management of RE is incumbent on the Energy Directorate and is ensured through the Sub-Directorate of Energy Control and Renewable Energies (see 2.3). Several operators and institutions (ministries, research institutes and centers, etc.), however, are active in this sector without genuine coordination. In 2005, the decision to establish a Renewable Energy Directorate (Direction des Énergies Renouvelables) within the Ministry of Mining and Energy has set a distinctive hallmark in the official RE development policy.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

As already mentioned, there is a massive lack in legal and fiscal framework conditions for the implementation and promotion of RE. Up to now, there are no specific regulations, incentives or legislative framework conditions available. The new regulations currently being drafted at the Ministry of Mines and Energy will, however, provide the necessary environment to develop the RE sub-sector in Côte d'Ivoire.

Several private enterprises are getting involved in rural electrification after securing the approval of SOPIE, the principal contractor for the provision of electrical facilities. In order to obtain this approval, all enterprises applying have to give evidence of their financial and technical capacities.

The National Authority (AN-MDP) is responsible for the MDP (Mécanisme pour un Développement Propre - Clean Development Mechanism (CDM)) implementation in Côte d'Ivoire. The AN-MDP Focal Point is housed at the National Environmental Agency (Agence Nationale de l'Environnement – ANDE). The National Work Plan on the MDP has been validated since May 2003.

Several projects (development of household wastes, sustainable forest management etc.) are currently being evaluated in order to classify them as projects liable to be funded within the opportunities provided by the MDP.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

Biomass energy is the most common energy source in Côte d'Ivoire. Up to 60 % of the overall energy requirements are covered by this energy source, including:

- Fuel wood and charcoal for households, small restaurants, bakeries, arts and crafts centers (smithies, jewelry-making shops, potteries etc.).
- Agricultural and forest residues for the production of steam and/or electricity in some agro-business companies (oil works, sugar refineries etc.) and sawmills

The anaerobic generation of biogas was experimented with in several pilot projects, but was not implemented in regular operation up to now. Currently, some private investors are applying for the authorization to produce electricity from household wastes, especially in Abidjan. The main sources of supply in fuel wood are natural forests, savannah woodlands and tree and bush savannahs, productive farms as well as fallows and tree plantations.

Comprising 16 million hectares of moist forests at the beginning of the previous century, the forest stand has diminished to presently 6.38 million hectares including 4.2 million hectares of highly degraded forests and two million hectares of protected areas. Resources from agro-industrial residues, crops and plantations are estimated at over 4.3 million toe per year. They represent a key energy source and the most directly useable RE potential. Table 5 presents the available biomass potential.

TABLE 5

Biomass Potential

GEOGRAPHIC AREA	FORM OF ENERGY	VALUE IN TOE
North	Bagasse	120,000
	Sugar cane molasses	30,000
	Cotton seed shell	10,475
Center and South	Cobs, palm fiber and shell	100,000
	Shell, coffee hull	32.15
General use	Cocoa beans	74,000
	Cocoa cops and shells	25,000
	Rice husk	10,000
	Urban waste	104.41
District of Abidjan		>1,000,000 tons

Source: Direction Générale de l'Énergie, 2008

4.2 SOLAR ENERGY

Côte d'Ivoire enjoys abundant sunshine with a good sunshine average, estimated at 4–5 kWh/m²/day with a daily sunshine time of 6 hours (more detailed information can be found in the Annex/Figure 3 of this report). Despite this satisfactory potential, solar energy has not been developed significantly up to now. Some PV solar energy systems have been implemented in the framework of small-scale projects developed by private initiatives or NGOs for electricity supply for households, schools and health facilities. Moreover, several telecommunication facilities have also been equipped with PV solar energy systems for stand-alone energy supply. Thermal solar energy is sometimes used for water heating and solar drying purposes while solar ovens and cookers have not yet started being popularized. Recently, some private operators have started activities basically oriented towards the import, sale and installation of solar equipment.

4.3 WIND POWER

There are no wind measurements available beside those for civil aviation compiled by the "Société d'Exploitation et de Développement Aéroportuaire, Aéronautique et Météorologique (SODEXAM) services. These measurements taken at 12 m above the ground generally range from 1–2 m/s. San Pedro on the western shoreline and Korhogo in the North record wind frequencies between 20–35 % for wind speeds above 6 m/s. Bouake in the Center,and Tabou on the western shoreline are swept by winds with frequencies from 20–45 % and speeds faster than 4 m/s. There are no other wind tapping projects known to date except those in Touba and Korhogo.

4.4 HYDRO POWER

Up to now, four large identified hydroelectric sites have not been developed yet. These sites have a power capacity ranging from 5–288 MW. Several other sites have potential for small Hydro Power plants with capacities of 0.5–5.0 MW, but have also not been exploited yet. The potential identified in the context of a study conducted by Électricité de France in 1980 adds up to an estimated theoretical hydroelectricity capacity of 46 TWh. The economically exploitable potential equals 12.4 TWh, i. e. 27 % of the theoretical potential. Table 6 presents the available Hydro Power potential of Côte d'Ivoire. A detailed map of Hydro Power potential is available in the Annex of this report (Figure 4).

TABLE 6

Hydroelectric Potential

SITE	RIVER	POTENTIAL CAPACITY (MW)
Soubré	Sassandra	288
Ndielesso	Comoé	100
Malamalasso	Comoé	90
Louga	Sassandra	280
Singrobo	Bandama	67
Kokumbo	Bandama	78
Bouloubré	Sassandra	156
Daboitié	Bandama	91
Gribo popoli	Sassandra	112
Tiassalé	Bandama	51

Source: based on a study conducted by Électricité de France, as of 1980

5 MARKET RISKS AND BARRIERS

The business environment in Côte d'Ivoire is ruled by national and regional legal institutions and instruments:

- The OHADA Treaty is a legal purview regulating business law in the sixteen states signed in to the treaty including Côte d'Ivoire. It comprises common legal rules designated as the "Uniform Acts".
- The Labor Code developed in 1995 aims at three goals: enabling companies to meet their requirements in terms of manpower and competitiveness; preserving the workers' fundamental rights; rehabilitating enterprises and confirming their prominent place in the economic and socio-development process through their capacity to generate wealth and employment.
- The Environment Code of 1996 is the legal basis of the environmental protection and preservation policy in Côte d'Ivoire. The Rural Land Code was passed in 1998 and is amended in Article 26 in 2004.
- The Côte d'Ivoire Arbitration Court (Cour d'Arbitrage de Côte d'Ivoire – CACI) and the Common Ohada Justice and Arbitration Court (Cour Commune de Justice et d'Arbitrage de l'OHADA) are redress bodies in case of conflicts.

Côte d'Ivoire is allied with several European Union countries through bilateral agreements tending to avoid double taxation and to prevent tax evasion in terms of income tax. The Ivorian Industrial Property Office (Office Ivoirien de la Propriété Industrielle – OIPI) is the national entity cooperating with the African Intellectual Property Organization (AIPO), which protects intellectual works such as inventions, brands, drawings or industrial design or trademarks. It ensures an effective control of counterfeiting and unfair competition.

There are several private and public universities in the country. Public universities and engineering colleges like the Institut Polytechnique Houphouët Boigny, as well as research centers like the CNRA and Institut de Technologie Tropicale (I2T) also serve as centers of cooperation with external organizations and provide for incentives to invest in Côte d'Ivoire. This type of investment encouragement has been reinforced since the outbreak of the September 2002 crisis to support the private sector.

- Special privileges are granted by the four specific legal texts: the Investment Code, the Mining and Oil Code, the Law Establishing Information and Communication and the Law Establishing a Biotechnology Free-Trade Zone.
- Common law privileges are recorded in the General Tax Code and are applied every year by a Tax Schedule to the Appropriation Act.
- Customs measures: The WAEMU Treaty has established a common market by the enforcement of the Common External Tariff (TEC). Third party countries are in general subject to the following import duties: custom duties ranging from 0–20 %, a statistics due of 1 % in general and the Community Solidarity Levy of 1 % of the total value of the products

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 7

Authorities and Societies in the Energy Market

NAME	ADDRESS	PROFILE
Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (PETROCI)	Building Les Hévéas 14, Boulevard Carde Plateau BP V194 Abidjan Phone: +225 20 20 25 00 Fax: +225 20 21 68 24 info@petroci.ci	Ensures the promotion of the Ivorian sedimentary basin and the development of its oil and gas resources through the exploration and exploitation of the Ivorian oil and gas deposit in partnership with key international companies
Société de Gestion des Stocks Pétroliers de la Côte d'Ivoire (GESTOCI)	GESTOCI Abidjan 15 BP 89 Abidjan 15 Phone: +225 21 75 98 00 Fax: +225 21 2717 82 gestoci@gestoci.ci	Ensures the management of security stocks for a SIR shutdown period of 60 days and also manages the means of transport between the three depots Abidjan, Bouaké, Yamoussoukro
Société d'Opération Ivoirienne d'Electricité (SOPIE)	II Plateaux 7ème Tranche 01 BP 8529 Abidjan 01 Phone: +225 22 52 76 00 Fax: +225 22 52 76 13 courrier@sopie.ci www.sopie.ci	Supervision of works in the electricity sector
Autorité Nationale de Régulation du Secteur de l'Electricité (ANARE)	Tour EECI 16 BP 1106 Abidjan Phone: +225 20 20 63 18 Fax: +225 20 20 61 14 recours@anare.ci	Monitoring of compliance with regulations and conventions; arbitration of conflicts between the players of the electricity sector; defense of consumers' interests
Société de Gestion du Patrimoine du secteur de l'Electricité (SOGEPE)	Tour EECI 01 BP 1345 Abidjan 01 Phone: +225 20 20 60 00 sogepe@sogepe.ci	Management of the power sector assets and financial flows
Société Ivoirienne de Raffinage (SIR)	Vridi Boulevard Petit Bassam 01 BP 1269 Abidjan 01 Phone: +225 20 20 25 00 Fax: +225 20 21 68 24 info@sir.ci	State-of-the-art refinery with two atmospheric distribution units, and one of the only two hydrocrackers existing in Africa
Société Multinationale des Bitumes (SMB)	Vridi Boulevard Petit Bassam 12 BP 622 Abidjan 12 Phone: +225 21 23 70 70 www.smb.ci	Specialized in bitumen production.
Société des pour le Développement Plantations Forestières (SODEFOR)	01 PB 3770 Abidjan 01 Phone: +225 22 44 46 16 Fax: +225 22 44 02 40	Reforestation program to fight deforestation, to enhance bush fire control, to participate in public sales and to control quota of timber for export
Bureau National d'Etude Technique et de Développement (BNETD)	04 BP 945 Abidjan 04 Phone: +225 22 44 28 05 Fax: +225 22 44 56 66 www.bnted.sita.net	Development and implementation of public or private investment projects of all kinds in all sectors of economy (including energy)
Agence Nationale de l'Environnement (ANDE)	II Plateaux, 7ème tranche 08 BP 09 Abidjan 08 Phone: +225 22 42 70 93	Protection of the environment and promotion of RE
Chambre de Commerce et de l'Industrie de Côte d'Ivoire	6, Avenue Joseph Anoma 01 BP 1399 Abidjan 01 Phone: +225 20 33 16 00 Fax: +225 20 32 39 42 demma@chamco-ci.org	Training and information concerning economy, finance and commerce (for members)
Cour d'Arbitrage de Côte d'Ivoire (CICA)	Phone: +225 20 31 90 73 Fax: +225 20 21 72 56 acoulibaly@fnisci.net webad@fnisci.ci	Management and handling of enquiries related to energy development projects
Bourse de Sous-Traitance et de Paternariat de Côte d'Ivoire	Phone: +225 20 33 88 94 Fax: +225 20 32 02 60 secretariat@bstp-ci.com	Promotion of the market of subcontractors, development of conditions for an optimal use and performance of business capacities

TABLE 8

Private Companies and Organisations

NAME	ADDRESS	PROFILE
Groupe EOULEE	Marcory, Zone 4C 20 BP 347 Abidjan 20 Phone: +225 21 25 41 44	Management of the Akouédo dumpsite (biomass)
Groupe THANRY	Rue de l'Indenié Abidjan Plateau 01 BP 3916 Abidjan 01 Phone: +225 20 21 31 33 Fax: +225 20 21 71 00	Wood processing, generation of industrial steam and electricity out of industrial agro-industrial residues
Compagnie Ivoirienne d'Electricité (CIE)	1, Avenue Christiani, Treichville 01 BP 6923 Abidjan 01 Phone: +225 21 23 33 00 Fax: +225 21 23 35 88 www.cie.ci info@cie.ci	Concession holder of a national utility with 12 regional directorates for the generation, conveyance, distribution, export and import of electrical energy
AZITO ENERGIE	II Plateaux, rue K57 Lot 33 BP 1296 Cedex 1 Phone: +225 22 40 02 40 Fax: +225 22 41 75 18 www.azitoenergie.com info@azitoenergie.com	Second independent electricity producer with an installed capacity of 296 MW
Compagnie Ivoirienne de Production d'Électricité (CIPREL)	Building SIDAM 01 BP 4039 Abidjan Phone: +225 20 31 97 95 Fax: +225 20 32 80 27	First independent electricity produce with an installed capacity of 210 MW
Canadian National Resources International CI (CNR)	01 BP 8007 Abidjan 01 Building Kharrat Phone: +225 20 31 00 15 Fax: +225 20 31 00 40	Exploration and production of crude oil and natural gas; operating company of the Espoir & Baobab oil fields
DEVON Côte d'Ivoire	04 BP 827 Abidjan 04 Phone: +225 20 25 40 40 Fax: +225 20 22 62 29 Koyate.fatou@dvn.com	Exploration and production of crude oil and natural gas; operating company of the Espoir & Baobab oil fields
FOXTROT International	15 BP 324 Abidjan 15 Phone: +225 21 21 76 00 Fax: +225 21 21 76 31	Exploration and production of crude oil and natural gas

TABLE 9

Research and Training Centers

NAME	ADDRESS	PROFILE
Centre National de Recherche Agronomique (CNRA)	Abidjan, Km 17, Route de Dabou 01 BP 1740 Abidjan 01 Phone: +225 23 47 24 24 Fax: (225) 23 47 24 11 www.cnra.ci info@cnra.ci	Agricultural research, technological research, biotechnologies, agricultural produces conservation, processing, bioenergies
Centre Technique Forestier Tropical (CTFT)	08 BP 33 Abidjan 08 Phone: +225 22 44 28 58	Technical training in forest management
Centre des Métiers d'Électricité (CME)	Phone: +225 22 40 34 12	Training of high level technicians, skilled workers and staff for Ivorian companies and countries in the sub-region; training for development and continuous education
Société Ivoirienne de Technologie Tropicale (I2T)	04 BP 1137 Abidjan 04 Phone: +225 21 27 91 51	Development of agricultural by-products (coconut cops) for stand-alone generation of electricity from gas generator

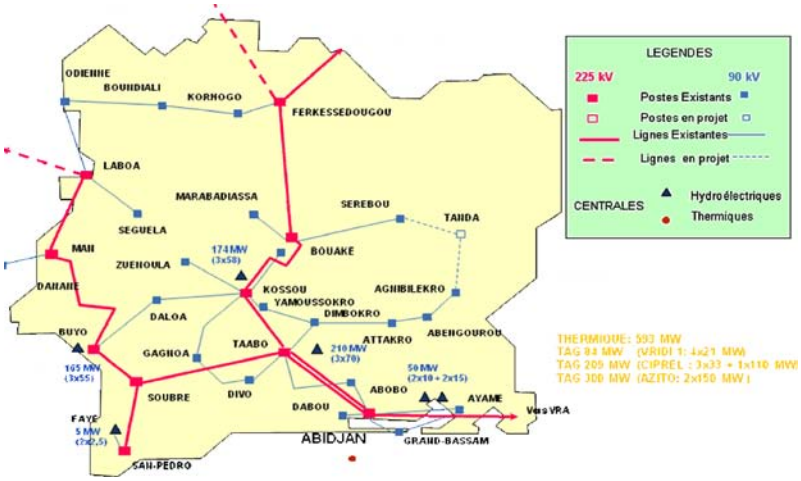
7 BIBLIOGRAPHY

- BBC (2009): Country profile (http://news.bbc.co.uk/2/hi/africa/country_profiles/1043014.stm)
- Centre de Promotion des Investissements en Côte d'Ivoire – CEPICI (2009): Accueil CEPICI (www.cepici.ci, last viewed October 2009)
- Central Intelligence Agency – CIA (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- Direction Générale des Douanes – Direction de l'Informatique (2009): Douanes de Côte d'Ivoire. Site Officiel (www.douanes.ci)
- Énergie Electrique de la Côte d'Ivoire (2008): Rapport Annuel
- Gallagher, Kevin (2008): Handbook on Trade and Environment
- International Energy Agency (2008): Energy Statistics of Non-OECD Countries
- International Monetary Fund – IMF (1996): Côte d'Ivoire – Statistical Annex
- Le Système d'Information Énergétique (2008): Rapport 2008
- NASA (2008): Scientific Centre on Atmospheric Data (http://eosweb.larc.nasa.gov)
- OECD/African Development Bank (2003/2004): African Economic Outlook
- Présidence de la République de Côte d'Ivoire (2007): Le site Officiel de la Présidence de la République de Côte d'Ivoire (www.cotedivoirepr.ci, last viewed October 2009)
- Profil Environnemental de la Côte d'Ivoire (2006): Final Report
- United Nations Department of Economic and Social Affairs (2005): Statistics Pocketbook
- United Nations Statistics Division – UNSD (2006): Energy Statistics Yearbook
- USA International Business Publications (2008): Energy Policy, Laws & Regulation Handbook
- World Bank (2009): Climate Change and the World Bank Group
- World Bank (2006): World Development Indicators
- World Bank (1996): Lending for Electric Power in Sub-Saharan Africa

8 ANNEX

FIGURE 2

Electricity Network of Côte d'Ivoire



Source: unknown

FIGURE 3

Overview of Sun Energy Potential

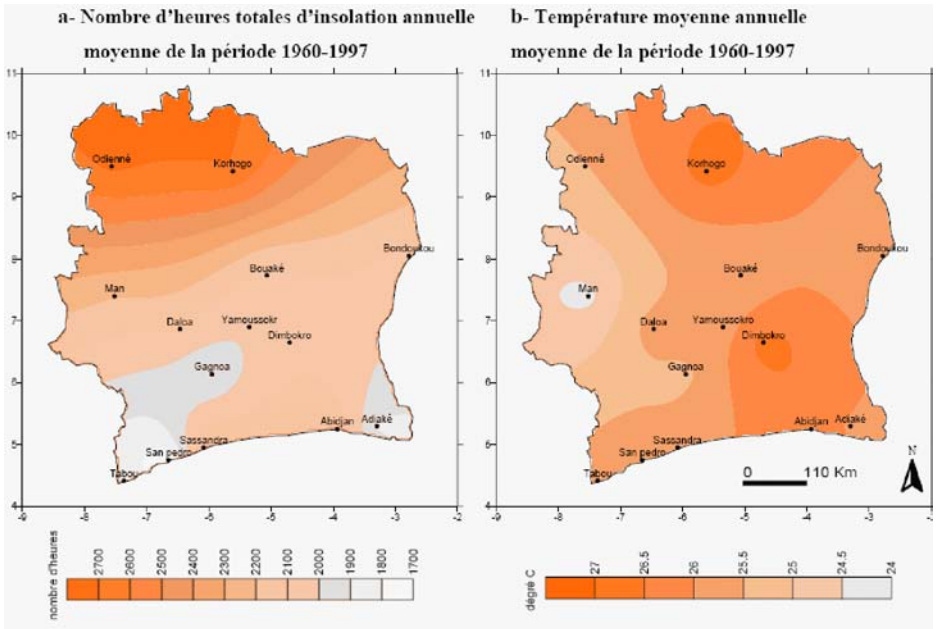


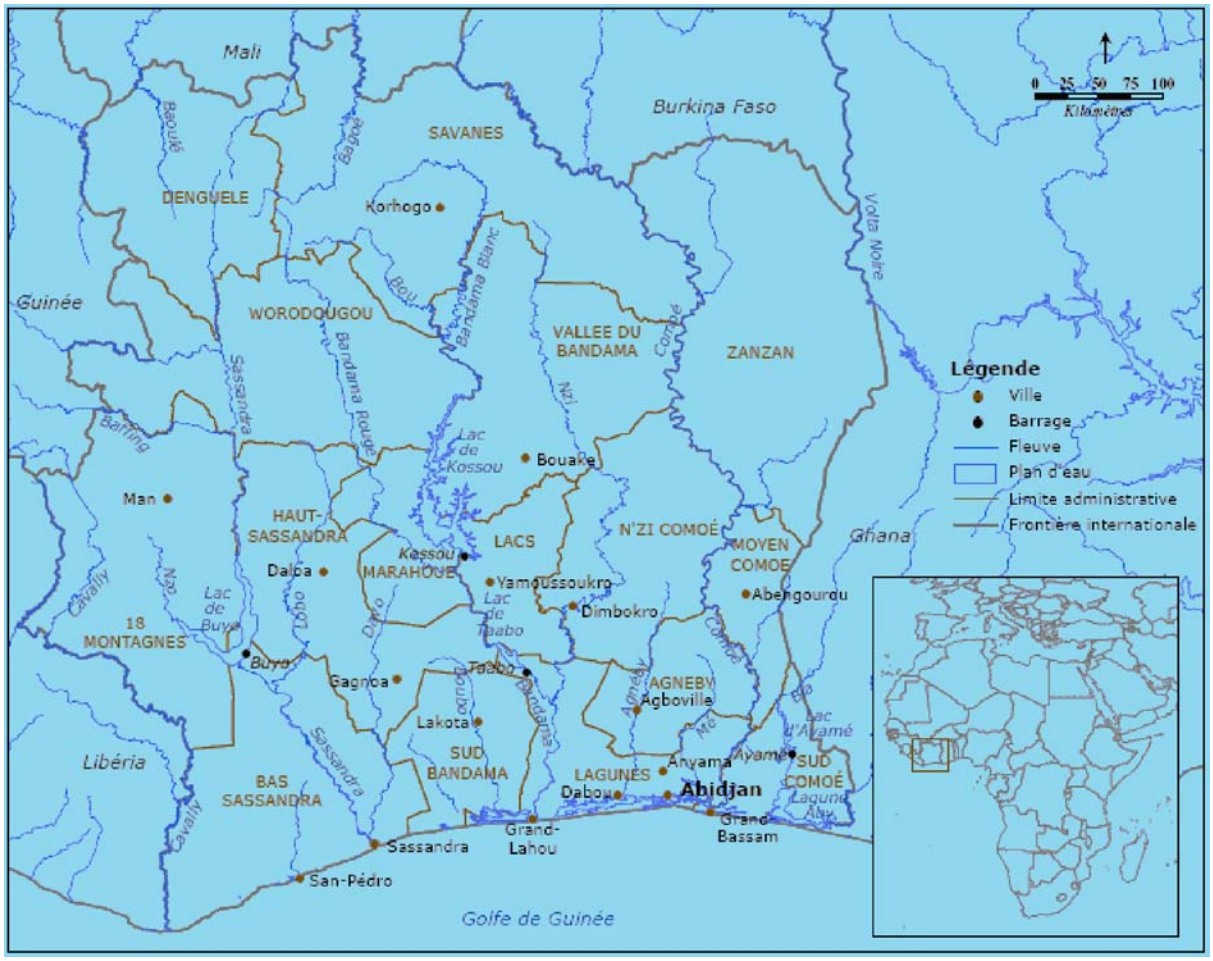
Tableau 4 : Température (°C) et insolation (heures) moyenne de1977 à 1999

Stations	Paramètres	J	F	M	A	M	J	Jt	At	S	O	N	D	année
Abidjan	Température	26,7	27,5	27,8	27,9	27,5	26,1	24,9	24,0	24,5	26,0	27,3	27,0	26,4
	Insolation	212	206	218	216	202	130	133	110	134	197	221	207	2191
Daloa	Température	25,7	27,2	27,3	26,9	26,4	25,5	24,5	24,4	24,9	25,4	25,6	24,9	25,7
	Insolation	212	204	201	210	209	162	116	111	140	183	181	177	2111
Korhogo	Température	26,6	28,9	29,3	28,7	27,5	25,9	24,9	24,7	24,9	26,0	26,8	26,2	26,7
	Insolation	273	243	230	225	244	209	160	162	183	240	256	258	2690

Source: unknown

FIGURE 4

Map of Available Hydro Power Potential



Source: unknown

TABLE 10

Production Figures of Petroleum Products (SIR–2007)

PRODUCT	2007	2006	Variation (%)
Butane	83,588	76,367	9.46
Unleaded gasoline	564,284	604,840	–6.71
Kerosene (paraffin/jet)	932,828	975,842	–4.41
Gasoil	1,088,501	1,209,526	–10.01
DDO	146,530	58,990	148.40
HVO	74,033	84,411	–12.29
Fuel oil	289,309	521,446	–44.52
Total for petroleum products	3,179,073	3,531,422	–9.98

Source: Direction des Hydrocarbures, as of 2008

COUNTRY CHAPTER: GAMBIA

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ACRONYMS AND ABBREVIATIONS

GAMBIA

CFL	Compact Fluorescent Lamp
CRR	Central River Region
DMCI	Development Management Consultant International
DoSPEMR	Department of State for Petroleum, Energy and Mineral Resources
DoSFEA	Department of State for Finance and Economic Affairs
DoSFNRE	Department of State for Forestry, Natural Resources and the Environment
DoSLGL&RA	Department of State for Local Government, Lands & Religious Affairs
EE	Energy Efficiency
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIPFZA	Gambia Investment Promotion and Free Zone Agency
GREC	Gambia Renewable Energy Centre
HFO	Heavy Fuel Oil
ICT	Information and Communication Technologies
IPP	Independent Power Producer
LAG	Local Government Area
LPG	Liquefied Petroleum Gas
LRR	Lower River Region
NAWEC	National Water and Electricity Company
NBR	North Bank Region
NEA	National Environment Agency
PRSP	Poverty Reduction Strategy Paper
PURA	Public Utilities Regulatory Authority
PV	Photovoltaic
R&D	Research and Development
SPA	Strategy for Poverty Alleviation
UNIDO	United Nations Industrial Development Organization
URR	Upper River Region
USD	United States Dollar
WR	Western Region

MEASUREMENTS

€	Euro (1 Euro = 33.21 Dalasi)
GWh	gigawatt hour
km	kilometer
km²	square kilometer
kW	kilowatt
kWh	kilowatt hour
kWp	kilowatt peak
m	meter
m²	square meter
m³	cubic meter
mm	millimeter
MW	megawatt
°C	degree Celsius
s	second

SUMMARY

The Country Study of Gambia is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Gambia. The study is structured as follows:

Chapter one provides **Background Information on Gambia**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Gambia.

Chapter two summarizes facts and figures of **Gambia's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Gambia. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning also other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Gambia.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Gambia.

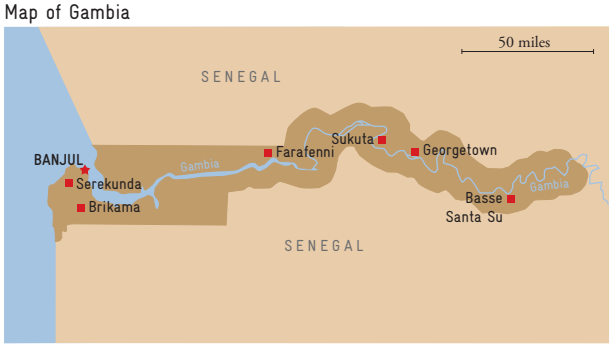
1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Gambia is located in the valley of the Gambia River on the West coast of Africa stretching as a narrow band of land approximately 480 km long and varying in width from 48 km near the estuary of the river to 24 km inland with an overall land area of 10,689 km². The country is bordered on three sides by Senegal and dissected by the Gambia River into North and South Bank. The current population of 1.36 million (as of 2003) is estimated to grow by 2.77 % per year.

FIGURE 1

Map of Gambia



Stretching between latitude 13°3' and 13°49' North and longitude 16°48' and 13°47' West, Gambia is situated in the South of the Sahel zone, a region which is largely semi-arid with only one rainy season in the year and a dry period of 6–7 months. The wet season starts in June and ends in September, while the dry season lasts from October till May. Average daily temperatures in the dry season are 30 °C and fall slightly to 27 °C in the wet season. There are three main agro-ecological zones: (i) the Sahelian zone which is a small concave in the extreme North of the Central River Region (CRR North) with a rainfall of less than 600 mm, (ii) the Sudano-Sahelian zone with a rainfall ranging from 600 to 900 mm covers the remaining parts of CRR North, all of CRR South, the Lower River Region (LRR) and parts of the North Bank Region (NBR), the Upper River Region (URR) and the Western Region (WR) and (iii) the Sudano-Guinean Zone which occupies the western ends of WR and NBR with a rainfall of 900 to 1,210 mm.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Gambia gained independence from Britain in 1965, became a republic in 1971 and was one of the very few multiparty democracies in Africa at that time. A military coup in 1994 briefly interrupted the country's democratic process, which was restored in 1996 through Presidential elections followed by National Assembly elections in 1997 completing the return to a civilian government.

Administratively, the Gambia is divided into five regions or provincial divisions (Western Region, North Bank Region, Lower River Region, Central River Region and Upper River Region) plus Banjul. Gambia has eight Local Government Areas (LGAs): Janjanbureh (Georgetown), Kuntaur, Kanifing, Banjul, Basse, Brikama, Kerewan and Mansa Konko. The next level of administrative division is the district level, which comprises of a total of 39 districts. In addition, there are two municipalities: Banjul City Council and Kanifing Municipal Council. Politically, the relevant units are the LAGs, districts, wards and villages.

The economy is primarily agrarian, with agriculture employment equaling about 70 % of the labor force and accounting for about 30 % of the Gross Domestic Product (GDP). The services sector accounts for over 50 % of the GDP resulting from re-export trade and tourism. Financial Services and Information and Communication Technologies (ICT) are also emerging and gaining importance. The manufacturing sector contributes 5 % to the GDP reflecting the low level of manufacturing activities. This is very little compared to average levels registered in the region of the ECOWAS (Economic Community of West African States or CEDEAO – Communauté Économique Des États de l ,Afrique de l'Ouest). With an average GDP growth rate of 5 %, Gambia has one of the most liberalized and best performing economies in the West African sub-region. The country is well positioned as a trading hub for the West Africa – Europe trade and transshipment. Sustained economic growth has, however, been constrained by the prevailing undiversified economic base, poor infrastructure, particularly roads/transportation and energy, slow pace in the implementation of policies and reforms, low levels of human capital and the lack of a culture of public-private partnership.

Gambia is among the poorest countries in the world with a per capita income of about 302 USD per year and ranked 155 out of 177 in 2005. The population was 1.3 million people in 2003 as compared to 1.03 million in 1993 equaling a growth rate of 2.8 % in this period. The population density grew from 97 to 128 persons per m² over the same period, representing one of the highest in Africa. About 61.2 % of the population mainly living in rural areas are considered as poor. High levels of unemployment in the urban areas have contributed an increase in urban poverty. Significant progress was made in gender parity, education, water and sanitation as well as moderate gains in health services. The country has been implementing programs addressing poverty since 1994 when the launch of its First Strategy for Poverty Alleviation (SPA) took place. Poverty reduction, however, continues to be evasive as the number of people living in poverty is rising rather than decreasing. Moreover, poverty studies conducted in 1998 and 2003 indicate that in addition to the increase in the prevalence and severity of poverty, inequality is also on the increase.

Using the upper poverty line, based on per capita consumption, the head count index (i.e. the percentage of poor people) is calculated at 61.2 %. The poverty gap is calculated at 25.9 % whilst the poverty severity accounts for about 14.3 %. Data obtained in 2003 indicate that the overall poverty has been on the increase in both rural (from 61 % in 1998 to 63 % in 2003) and urban (from 48 % to 57 %) areas. The rise in rural poverty is partly associated with the poor performance of the agricultural sector particularly as it relates to declining

productivity and the farmers' lack of access to markets and other social services due to poor rural infrastructure. The rise in urban poverty is attributed to the lack of employment opportunities.

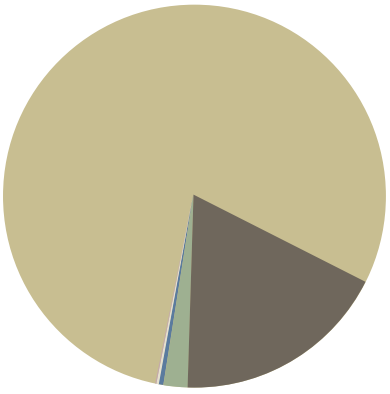
2 ENERGY MARKET IN GAMBIA

2.1 OVERVIEW OF THE ENERGY SITUATION

Gambia relies almost entirely on biomass fuels and imported petroleum products to meet its energy requirements. As part of the Government's efforts to build a sound and sustainable socio-economic infrastructure, this policy was introduced in June 2005[1] to provide the framework for the provision of an efficient, reliable and affordable energy supply to support the socio-economic development of the country. Figure 2 presents the energy mix of Gambia while Table 1 provides an overview of the evolution of the national energy mix.

FIGURE 2

Energy Mix of Gambia



Source: DoSPEMR for Energy, as of 2008

TABLE 1

Evolution of the Energy Mix of Gambia (1,000 TOE)

YEAR	BIOMASS/ FUELWOOD	ELECTRICITY	PETROLEUM	LPG	RE	TOTAL
1996	295.940	4.190	72.160	1.160	0.070	373.530
1997	304.820	5.330	71.720	1.210	0.080	383.170
1998	313.960	6.160	76.980	1.260	0.090	398.460
1999	323.380	7.170	81.880	1.310	0.110	413.850
2000	333.090	6.850	86.890	1.360	0.110	428.300
2001	343.080	8.770	83.770	1.420	0.110	437.150
2002	353.370	9.900	83.100	1.470	0.121	447.960
2003	363.970	8.860	82.460	1.530	0.132	456.950
2004	374.890	7.170	84.730	1.590	0.133	468.510
2005	386.140	9.440	86.040	1.660	0.134	483.410
2006	397.720	10.370	95.880	1.720	0.134	505.830

Source: DoSPEMR for Energy, as of 2008

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

Until August 2006, the electricity power supply of Gambia was highly inadequate, erratic and extremely unreliable. The electricity generation increased tremendously after the commissioning of the power plant in Brikama (4 x 6.5 MW Deutz generators running on HFO) in August 2006. The first truly Independent Power Producer (IPP) power plant of 25 MW has an output capacity of 22 MW. This new installation adds to the existing installed capacity at the main power station at Kotu about 28 MW to provide an available capacity of 50 MW in the Greater Banjul Area. Table 2 presents figures on the production, consumption and distribution losses of electricity in Gambia. Table 3 includes the current electricity tariffs.

TABLE 2

Electricity Production, Consumption and Distribution Losses

YEAR	PRODUCTION	CONSUMPTION	LOSSES (GWH)	LOSSES (%)
1995	83.9	56.8	27.1	32.3
1996	86.0	48.7	37.3	43.3
1997	110.5	62.0	48.5	43.9
1998	122.2	74.8	47.4	38.8
1999	128.7	92.4	36.3	28.2
2000	137.9	90.7	47.2	34.2
2001	147.9	114.6	33.3	22.5
2002	163.1	128.4	34.7	21.3
2003	150.6	107.7	42.9	28.5
2004	128.1	93.3	34.8	27.1
2005	156.3	109.7	46.6	29.8
2006	162.6	120.6	42.0	25.8

Source: NAWEC, as of 2008

TABLE 3

Electricity Tariffs (Dalasi/kWh)[2]

APPLICATION	0–40 KWH	41–600 KWH	601–1,000 KWH	>1,000 KWH
Domestic	2.02	6.83	7.58	9.07
Commercial	9.43	9.43	9.43	9.43
Maximum demand	10.43	10.43	10.43	10.43
Agriculture	9.07	9.07	9.07	9.07
Local authority (urban)	9.07	9.07	9.07	9.07
Local authority (rural)	9.07	9.07	9.07	9.07
Central government	9.07	9.07	9.07	9.07
Prepayment domestic	6.83	6.83	6.83	6.83
Prepayment commercial	9.43	9.43	9.43	9.43
Prepayment maximum demand	10.43	10.43	10.43	10.43

Source: NAWEC, as of 2008

1 NATIONAL ENERGY POLICY, AS OF 2005

2 1 EURO = 33.21 DALASI

Petroleum Sector

Gambia is heavily dependent on imports to meet its requirements of petroleum products. These include Liquefied Petroleum Gas (LPG) as a cooking fuel substitute and diesel and HFO for generating electricity. This is the second most important source of energy in the country accounting for about 18 % of the total primary energy needs as specified in the 2006 energy balance. In 2006, The Gambia imported 128 thousand metric tons of petroleum products, and there has been an increasing trend since 1995. Table 4 presents an overview of imported petroleum products. Table 5 presents the prices of various petroleum products.

TABLE 4

Import of Petroleum Products (1,000 tons)

YEAR	DIESEL	GASOLINE	KEROSENE	HFO	TOTAL
1995	27.00	17.58	12.30	13.53	70.38
1996	40.14	16.00	14.00	10.80	80.94
1997	35.60	15.89	18.18	23.44	93.11
1998	40.66	15.12	19.06	22.18	97.02
1999	47.01	15.47	17.17	24.44	104.09
2000	56.56	14.51	13.56	18.83	103.46
2001	57.17	13.27	11.19	25.59	107.22
2002	52.44	12.33	16.18	35.39	116.34
2003	48.93	13.48	17.86	31.13	111.40
2004	49.79	17.71	14.90	30.95	113.35
2005	45.80	19.60	18.20	31.76	115.36
2006	48.23	20.73	24.63	34.36	127.51

Source: Shell Marketing Gambia Ltd., as of 2008

TABLE 5

Prices of Petroleum Products (Dalasi/liter)[3]

PERIOD	GASOLINE	DIESEL	KEROSENE
Up to 10/01/03	15	12	7
11/01/03–08/10/04	19	18	9
08/10/04–15/08/05	22	21.5	9
15/08/05–23/04/07	27	25	12
23/04/07–20/05/08	30	28	21
20/05/08 to date	33	32	26

Source: Energy Division, DoSPEMR for Energy, as of 2008

Biomass Sector

More than 90 % of the population depend on fuel wood as their domestic energy source for cooking. This situation and the fast-growing number of inhabitants especially in the urban areas contribute to the rapid deforestation. Table 6 indicates the evolution of fuel wood consumption.

TABLE 6

Evolution of Fuel Wood Consumption (1,000 m³)

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
653.0	672.6	692.8	713.6	735.0	757.0	779.7	803.1	827.2	852.0	877.6	903.9

Source: DoSPEMR for Energy, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The energy sector of Gambia is controlled by the **Department of State for Petroleum, Energy and Mineral Resources (DoSPEMR)** created in September 2007. It serves as the main policy adviser regarding all aspects of energy. Prior to this period, the energy sector was under the purview of the Office of the President from February 2002. Previous to that, the energy sector was under the Department of State for Trade, Industry and Employment. The **Public Utilities Regulatory Authority (PURA)** was created by the Government of Gambia in order to regulate the electricity, water and telecommunication sectors of the country.

The Petroleum Act (2004) on exploration and production was enacted to rule the administration and management of the upstream sector of the petroleum industry. The Commissioner on Petroleum Exploration and Production administers this Act. Currently a license has been issued to the company of "Buried Hill of Canada" for some blocks in the identified potential area. The DoSPEMR has drafted a bill for petroleum products that was expected to be validated in late 2008. Until now, the management of the downstream petroleum has not had a coordinated management structure at central Government level. The **Department of State for Finance and Economic Affairs (DoSFEA)** sets the price of the products according to the taxes levied on petroleum products importation as a tax-based economy. LPG prices are not regulated and there is no Government tax levied.

The **Gambia Renewable Energy Centre (GREC)** is the technical supporter of the DoSPEMR responsible for Renewable Energy research activities as well as the development and promotion of RE. The **Forestry Department** (under the **Department of State for Forestry, Natural Resources and the Environment – DOSFNRE**) is responsible for the management of the nation's forest resources. The Forestry Act provides for the commercial trade in fuel wood and for the regulation of the movement of forest produce requiring valid licenses for production and sale of fuel wood.

The **Department of Community Development** is the technical supporter of the **Department of State for Local Government, Lands & Religious Affairs (DoSLGL&RA)** and is responsible for community mobilization. The department is engaged in promoting the efficient management of fuel wood resources through the promotion of substitutes and through improved end-use appliances for firewood such as improved cooking stoves and biogas research.

The **National Environment Agency (NEA)** is entrusted to ensure harmony between man and his environment and is tasked with the formulation, implementation, monitoring and compliance with environment standards.

3 1 EURO = 33.21 DALASI

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The National Energy Policy is consistent with the overall development policy objectives of Government as outlined in the Vision 2020 and the Poverty Reduction Strategy Paper (PRSP). The long-term aim of Gambia's Government for the energy sector is to maximize the efficient development and utilization of scarce energy resources to support economic development in an environmentally friendly way. The Government's overall objectives for the sector are to:

- Improve and expand existing energy supply systems through private sector partnership with the public sector
- Promote a domestic fuel sub-sector clearly focusing on sustainable management of forest resources
- Widen the population's access to modern forms of energy in order to stimulate development and reduce poverty
- Strengthen institutional and human resource capacity and enhance Research and Development (R&D) in energy development
- Provide adequate security of energy supply

According to the National Energy Policy document, the aim of the RE sub-sector is to ensure the promotion and considerate utilization of RE to support the sustainable development of the country. The specific objectives are to (i) promote the utilization of renewable forms of energy such as solar, wind and bio-mass (ii) promote the use and develop a domestic production capacity for RE fuels and technologies and (iii) ensure the sustainable supply of RE fuels, devices and technologies at competitive prices through private sector participation.

The Policy also encourages the use of alternative fuels and technologies as a substitute for petroleum products through the following strategies: (i) exploring the prospects of using gas, HFO, modern biomass (including bio-energy, groundnut shell and sawdust briquettes and bagasse) for energy generation, (ii) complement the Gambian Government's fiscal incentives with donor assistance to promote the use of efficient fuels and technologies, (iii) continue to provide fiscal incentives in the form of duty releases for fuel supply to the rural electrification project and (iv) encourage investment in efficient alternative technologies for energy generation.

To promote the utilization of new and RE technologies, the following strategies have been formulated: (i) popularize the use of solar PV, solar thermal and other RE systems to provide energy for various applications, particularly in rural areas, (ii) facilitate local and international donor intervention on the provision of grants, interest-free loans as well as other fiscal incentives for the acquisition of renewable energy devices including solar PV and thermal, wind and biomass systems, (iii) promote the use of solar water heaters in institutional facilities, hotels and private households, (iv) create awareness of the economic and environmental benefits of using RE technologies through public education (TV, radio and other media), (v) promote adaptive research and development of RE devices, (vi) encourage the production/assembly of RE devices in The Gambia, (vii) encourage utilization of efficient RE technologies by providing tax-free concessions on the technologies themselves and proven energy-efficient devices and (viii) encourage and support private sector participation in the promotion and development of RE fuels, devices and technologies at competitive prices.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

There is no legislation for the RE sector at the moment. It is, however, expected to be formulated under the Renewable Energy and Energy Efficiency program of the GEF-UNIDO Energy Program for West Africa. To cater for this present drawback, the Electricity Act provides the framework for regulation relating to electricity generation from renewable energies on a commercial basis, standards in terms of electricity generating or consuming devices and personnel to be licensed for any electrical works etc. For other RE fuels, provision has been made in the draft Petroleum Products Legislation. For the devices in the domestic energy sub-sector, e. g. improved cook-stoves, there are no provisions for regulation, legislation or standardization. These are produced according to regional or sub-regional specifications and track records.

For rural electrification, concessions and other incentives would be the only basis to encourage investment in rural areas, as these are otherwise unattractive for potential investors. At the moment, the national utility of NAWEC is the only provider of grid-electricity in the rural areas. The DoSPEMR, however, is encouraging the use of RE in the rural electrification program through private sector participation. A number of private parties have, however, installed stand-alone PV systems and solar water pumping systems in some of the villages.

With regards to incentives for RE and energy efficient devices, the Government of The Gambia has adopted a policy in March 2008 to encourage the use of RE and energy efficiency (EE) by granting a zero-import tax status to all solar PV panels, solar water heaters, wind energy equipment and energy efficient light bulbs (compact fluorescent lamps). In addition, there is no license fee for operators in the electricity sub-sector using RE.

As the national policy encourages the use of RE and EE, the Government welcomes and facilitates all initiatives of companies or other investors planning to invest in RE and EE devices. In most instances, additional incentives are provided by the Gambia Investment Promotion and Free Zone Agency (GIPFZA) for investments especially in energy and RE.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The use of fuel wood and residues from wood processing for electricity generation is not encouraged because of the already present constraints in the utilization of wood for domestic cooking. More than 90 % of the population rely on wood to meet their energy needs. The use of other types of biomass is quite low due to the limited availability of agricultural waste and other potential sources.

There are some limited activities in the field of biofuels mainly produced from jatropha. Several projects were initiated by the Government in the 1980s in order to search for fuel alternatives to reduce the country's dependence on fuel wood and charcoal. This included the promotion of improved cooking stoves using firewood or charcoal and groundnut shell briquettes.

Biogas was subject to research activities in the early 1980s, but its implementation was rejected due to cultural barriers. Recently, however, the DoSPEMR participated in the promotion of biogas through the Peri-Urban Project for Agriculture. Within this, 20 biogas digesters in rural and peri-urban areas were implemented. At least two of these sites are running satisfactorily.

4.2 SOLAR ENERGY

With respect to solar energy, Gambia has a substantial potential of 4.5–5.3 kW/m²/day. Therefore, solar energy is one of the most promising RE sources of the country. By the end of 2006, PV installations with a capacity of more than 700 kWp were installed in Gambia. In addition to PV applications, the implementation of solar cookers and solar water heating units helps to reduce the high demand in electricity consumption.

4.3 WIND POWER

The available wind power potential of Gambia is about 3 m/s. Presently about 20 wind power applications are in operation for water pumping purposes. Even though the available wind power potential is modest, the coastal areas of Gambia offer substantial opportunities for the future.

4.4 HYDRO POWER

Gambia has no national Hydro Power potential. The country, however, cooperates with Guinea, Senegal and Guinea Bissau in order to construct two large-scale Hydro Power electricity generation units at Sambagalo and Kaleta.

5 MARKET RISKS AND BARRIERS

The promulgation of an Electricity Act (Electricity Act 2005) and the finalization of the Petroleum Products Bill expected to be legislated this year will provide the necessary environment for private investor participation with laws protecting the interests of both the consumers and investors. The Public Utilities Regulatory Authority (PURA) regulates the sector through the Acts.

The Gambian Government has made the process for private sector participation as transparent as possible in order to minimize the issue of corruption as much as possible. The Government has ratified the international Law on Intellectual Property Rights through the National Assembly in 2006 thus acknowledging the value and inviolability of innovations and creativity.

Private sector participation is the cornerstone of Government policy, including the National Energy Policy that acknowledges and encourages investments by the private sector. Domestic and foreign private sector commitment is most welcomed especially for the production and delivery of goods and services and employment creation. The GIPFZA acts as a one-stop shop for all investors to the country. This agency provides investment certificates and incentives for qualified investors in the energy sector. There are no restrictions on transfer of margins or profit, and the banking sector is completely liberalized including foreign exchange rates and transactions and transfer of foreign currency.

Capacity for trained personnel has been recognized as inadequate. Therefore, the DoSPEMR collaborates with other partners in order to provide training seminars on basic energy technology and RE technologies.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

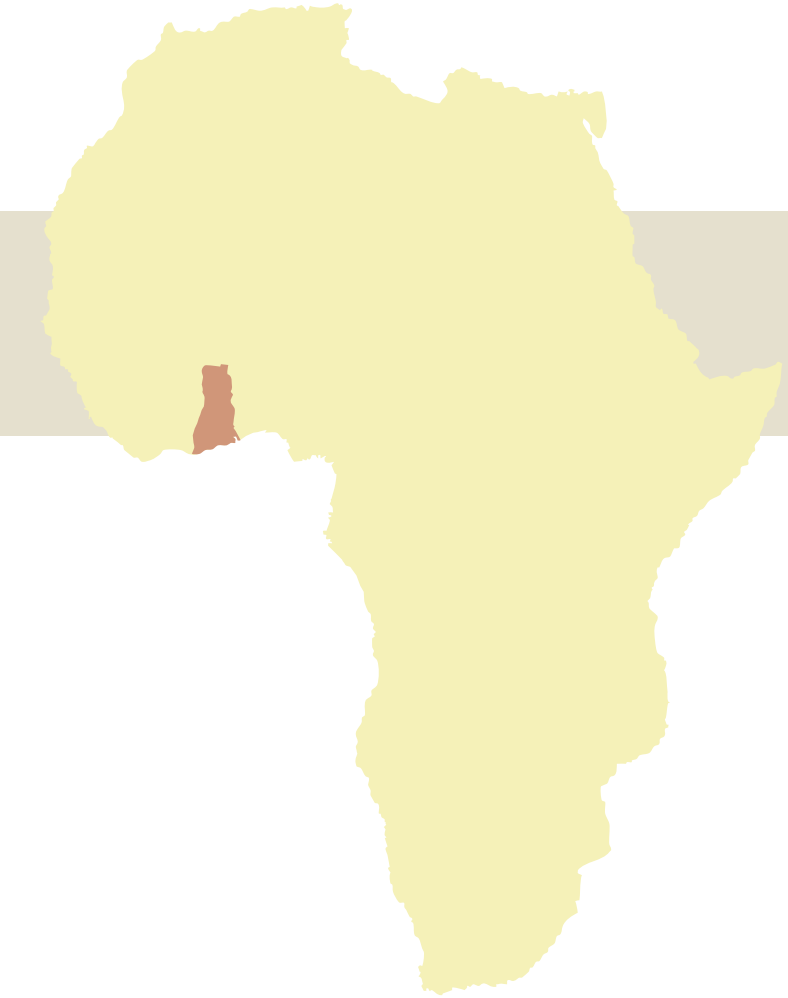
TABLE 7

Local Business Partners and Institutions

NAME	ADDRESS	PROFILE
Department of State for Petroleum, Energy & Mineral Resources	2nd Floor, Futurelec Building Bertil Harding Highway, Kotu Phone: +220 890 51 06 brusubii@yahoo.co.uk	Policy adviser to the Government in all aspects of energy responsible for policy formulation, implementation and monitoring
Gambia Renewable Energy Centre	DoSPEMR TK Motor Road, Kanifing Phone: Tel: +220 439 28 38	Technical supporter of the Department of Energy responsible for RE research, development and promotion
Department of Forestry	Phone: +220 448 48 44	Responsible for forest resource protection and management including the management of fuel wood supply
National Environment Agency (NEA)	Fitzgerald Street, Banjul Phone: +220 422 38 60 nea@nea.gm	Formulation, implementation and monitoring of environmental standards
National Water and Electricity Company (NAWEC)	53 Mamadi Manjang Highway P.O. Box 609, Banjul Phone: +220 437 62 33 Fax: +220 437 59 90 nawecmd@gamtel.gm	Electricity, water and sewage services in the urban and peri-urban areas
Public Utilities Regulatory Authority (PURA)	Bertil Harding Highway, Kololi Phone: +220 446 51 75 info@pura.gm	Regulatory body for electricity, water and telecommunication
Gambia Investment Promotion and Free Zone Agency (GIPFZA)	Phone: +220 437 73 77 info.gipfza@qanet.gm	Support and promotion of investments in Gambia
Development Management Consultant International (DMCI)	P.O Box 5342, Brikama Nyambia Phone: +220 448 45 24 sla@qanet.gm	Provides consultancy services in the energy sector and other sectors as well
RC Engineering	Phone: +220 990 94 34 reycarrol@gmail.com	Consultancy Services for solar power and water pumping systems
CES	Phone: +220 437 82 00 papasanneh@yahoo.com	PV and electrical equipment services
Sun Power	Phone: +220 422 92 83 Ibrahimdiame@yahoo.com	PV and water pumping systems
ESEIM Solar	Phone: +220 990 60 12 eseimsolarenergy@yahoo.co.uk	PV and water pumping systems
Solar Project Gambia	Phone: +220 439 90 92 mail@solarprojectgambia.com	Solar drying and cooking
Power Systems Engineering	Phone: +220 984 28 98 leroipoisson2002@yahoo.com	PV and wind energy
Gambia Electrical	Phone: +220 439 21 90 gec@qanet.gm	Electrical sales and contractor
SWE-GAM Co Ltd	Phone: +220 437 24 64 swegam@gamtel.gm	Water pumping systems and PV
JECCO	Phone: +220 446 17 09 jecco@qanet.gm	PV, pumps, borehole & well equipment
ABC Gaye's Association	Phone: +220 437 06 55 abcgaye@yahoo.com	Improved stoves
Gam Solar	Phone: +220 985 63 20 gamsolar@gmail.com	PV and water supply systems

7 BIBLIOGRAPHY

- Republic of The Gambia/European Community (2007): Country Strategy Paper And National Indicative Program. For the period 2008-2013 (http://ec.europa.eu/development/icenter/repository/scanned_gm_csp10_en.pdf)
- Development Management Consultants International – DMCI (2005): Report Household Energy Strategy for Gambia (HES)
- N. N. (without year): Review of Traditional Energy Sector (RPTES), Country Study 1st Draft, Banjul
- The Government of The Gambia (1998): Forest Bill
- de Bakker, Peerke (2003): The Gambia Country Side – European Union Energy Initiative for the Eradication of Poverty and Sustainable Development (EUI), Banjul
- N. N. (1982): Energy Survey and Master Plan Report, Draft Final Report, Banjul
- N. N. (without year): Report of the Study on The Feasibility of Producing Charcoal Briquettes in Gambia
- N. N. (2005): National Energy Policy 2005, Part I – Overview of the Situation and Part II – Policies and Strategies
- Government of The Gambia (1994): Vision 2020 Inc.
- Energy Department, Department of State for Energy (2008): National Energy Data
- N. N. (2005): Project for the Construction of a New Power Station in Gambia
- Management Development International – DMCI (2005): Final Report on a National Household Energy Consumption Survey in Gambia
- Department of State for Finance and Economic Affairs (2005/06): Gambia – The Second Strategy for Poverty Alleviation (SPAII). Poverty Reduction Strategy Paper (2003–2005)
- Lahmeyer International GmbH (2007): Final Feasibility Study – Solar Home System Program
- Lahmeyer International GmbH (2006): Final Feasibility Study – Small Scale Wind



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ACRONYMS AND ABBREVIATIONS

GHANA

AGSI	Association of Ghana Solar Industries
ATK	Aviation Turbine Kerosene
BST	Bulk Supply Tariff
CDM	Clean Development Mechanism
DANIDA	Danish International Development Agency
DSC	Distribution Service Charge
DSTC	Deng Solar Training Center
EC	Energy Commission
ECG	Electricity Company of Ghana
EPA	Environmental Protection Agency
ERP	Economic Recovery Program
EUT	End User Tariffs
GDP	Gross Domestic Product
GEDAP	Ghana Energy Development and Access Project
GEF	Global Environment Fund
GHp	Ghana Pesewas (1 GHp = 0.6313 Euro)
GHS	Ghana Cedi (currency of Ghana; 1 Ghana Cedi (GHS) = 100 Ghana Pesewas)
GIPC	Ghana Investment Promotion Center
GPRS	Growth and Poverty Reduction Strategy
GRIDCO	Grid Company Limited
GT	Ghana Telecom
GVCTF	Ghana Venture Capital Trust Fund
Hi-fi	high-fidelity (quality standard for audio technique)
IPP	Independent Power Producers
KITE	Kumasi Institute of Technology, Energy and Environment
LPG	Liquefied Petroleum Gas
M2+	key economic indicator and term used to forecast inflation
MIGA	Multilateral Investment Guarantee Agency
NED	Northern Electricity Department
NES	National Electrification Scheme
NREL	National Renewable Energy Laboratory
PURC	Public Utilities Regulatory Commission
PV	Photovoltaic
RESPRO	Renewable Energy Services Project
RFO	Residual Fuel Oil
SHS	Solar Home System
SLTV-HV	Solar Lamps and Television – high voltage
SLTV-LV	Solar Lamps and Television – low voltage
SLTV-MV	Solar Lamps and Television – medium voltage
SME	Small/Medium Enterprise
SMME	Small Micro and Medium Enterprises
SOE	State Owned Enterprises
TAPCO	Takoradi Power Company
TICO	Takoradi International Company
TSC	Transmission Service Charge
UNDP	United Nations Development Program
USD	United States Dollars
VAT	Value Added Tax
VRA	Volta River Authority

MEASUREMENTS

GWh	gigawatt hour
koe	kilograms of oil equivalent
kVA	kilovolt ampere
kWh	kilowatt hour
m^2	square meter
m^3	cubic meter
MJ	mega joule
mm	millimeter
MW	megawatt
°C	degree Celsius
t	ton
toe	tons of oil equivalent

SUMMARY

The Country Study of Ghana is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Ghana. The study is structured as follows:

Chapter one provides **Background Information on Ghana.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Ghana.

Chapter two summarizes facts and figures of **Ghana's Energy Market** including stakeholders and market actors and involved as well as related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Ghana. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions, concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Ghana.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Ghana.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Lake Volta, which runs through most of the eastern side of the country, is the world's biggest artificial lake, which resulted from the construction of the national power plant at Akosombo. Offshore hydrocarbon deposits explored at Cape Three Points have proven crude oil reserves, estimated at 1.8 billion barrels. The geographical location of the country also permits extensive fishing in the Atlantic Ocean. Ghana has tropical climatic conditions. It is warm and comparatively dry along the southeastern coast, hot and humid in the Southwest, hot and dry in the North. The country consists mostly of low plains with dissected plateaus in the southern central areas. The hottest months are March and April when the temperature reaches 31 °C. The wettest month is June when average rainfall is estimated at 178 mm, after which the main food harvest comes.

FIGURE 1

Map of Ghana

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

In 1957, Ghana became the first country in Colonial Africa to gain independence. A series of coups following independence resulted in the suspension of the constitution in 1981 and the proscription of political parties by the military government of that time. A new constitution, restoring multiparty politics, was approved in a national referendum in 1992. Flt. Lt. Jerry John Rawlings, head of state from 31 December 1981, won the presidential elections in December 1992 and December 1996. He was constitutionally barred from running for a third term in the 2000 elections, which was won by John Agyekum Kufour.

Presently, a consensus on economic paradigm is developing. Both the current and the previous Government welcome private sector participation and believe in economic and structural reforms including privatization of State Owned Enterprises (SOEs). Political stability is prevailing. Although general elections were expected to be held in December 2008, there was no real apprehension of the direction of the economy irrespective of the winner of the next elections.

Ghana's educational system is rated as one of the best in the sub-region. 68 % of the population have at least basic education. There are several universities and institutions of high learning catering for the needs of natives and foreigners. There is also a reasonably large pool of both skilled and unskilled labor, and for both wages are relatively low.

Road transport accounts for 98 % of all freight that is moved. The railway system, which has been reconstructed, consists of a triangular network connecting Accra, Kumasi and Sekondi-Takoradi. Ghana's two ports in Tema and Takoradi, however, are in a good state, and cargo handling has been increasing continuously. Whereas Tema concentrates on imports, Takoradi handles mainly exports. Ghana is well connected via international airlines including the national carrier of Ghana International Airlines.

In mid-2008, the Government sold 70 % of its 100 % share in Ghana Telecom (GT) to Vodacom from the United Kingdom. A second network operator, Western Telesystems Limited (now Zain), is also licensed to provide telephone and data services.

The main framework guiding Ghana's overall development is the Ghana Growth and Poverty Reduction Strategy (GPRS II). It aims to lift the country to middle-income status by 2015. Therefore, the Government has projected a per capita income of 1,020 USD (799.58 Euro) by 2015, a figure that many analysts see as unrealistic, looking at the pace of current economic development. Analysts and market watchers, however, agree that Ghana has experienced impressive growth rates over the last years, significantly rising from an annual growth rate of 3.7 % in 2000 to 6.4 % by the end of 2007.

Ghana's recent fiscal policy has tended to focus on creating an enabling macro-environment for private businesses and streamlining the operations of Government organizations to enable them to operate on full cost recovery basis by fixing the appropriate level of tariffs. Therefore, institutions such as the Public Utilities Regulatory Commission (PURC), the Petroleum Tender Board and the National Communications Authority were established to regulate tariffs. Petroleum and utility tariffs (water, electricity and telephone) were raised several times over the last three years in order to enable the Government to cut back on subsidies and hence reduce its high budget deficits.

The focus of the monetary policy over the years was on bringing down both interest rate and inflation or at least keeping them at manageable levels. This means the Central Bank has been averse to growth in broad money (the so-called M2+). It also pursues aggressive open market operations and complements this with deposit auctions.

2 ENERGY MARKET IN GHANA

2.1 OVERVIEW OF THE ENERGY SITUATION

The bulk of Ghana's energy consumption is covered by biomass (in the form of firewood and charcoal) accounting for about 59 % of the total energy consumption. Electricity products account for 9 % and petroleum products for 32 %. The per capita energy consumption is estimated at 360 kilograms of oil equivalent (koe). The overall energy consumption of Ghana is estimated at 6.6 million toe. The situation is worse in the rural areas where as much as 82 % still use kerosene, candles and other traditional fuels as sources of light. Their share of grid electricity accounts for only 17.1 %. Generators, dry cell and automotive batteries account for the remaining 0.9 %.

In the last few years, the predominant source of electric power and major energy source in Ghana was hydro. Biomass, including firewood and charcoal, forms the bulk of energy for cooking and water heating in the residential & commercial sector. Solar energy plays a significant role in the agricultural sector (crop production, drying etc.) and more recently in the tourist industry and educational institutions. Moderate wind speed identified in the southern part, particularly along the coastal belt, is yet to be exploited. The most recent development is the identification of crude oil in commercial quantities. Up to now, all crude oil and some petroleum products have been imported. The native natural gas deposits are too small to be commercially exploited, and there are also no nuclear or coal power plants in operation.

TABLE 1:

Electricity Generation Capacity of Ghana

SOURCE	CAPACITY (MW)	SHARE (%)
Total Hydro Power	1,180	68 %
Akosombo hydroplant	1,020	59 %
Kpong hydroplant	160	9 %
Total thermal power	550	32 %
TAPCO thermal power plant	330	19 %
TICO thermal power plant	220	13 %
Total energy capacity installed	1,730	100 %

Source: VRA, as of 2006

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

Ghana's power generation sources comprise two major installed hydroplants at Akosombo and Kpong with an overall generation capacity of 1,180 megawatts, constituting 68 % of total generation capacity. Two diesel-powered thermal generating plants in Takoradi have a total capacity of 550 megawatts, constituting the remaining 32 % of the total generation capacity. The electricity generation capacities are summarized in table 1.

Ghana's power generation trend from 2000–2007 has been erratic. The minimum reservoir elevation of the Akosombo dam, which generates about 56 % of the nation's electricity, is 238 feet. This level is required to generate hydroelectric power of 16 GWh/day. Table 4 presents the trend in electricity generation between 2000 and 2007. The main consumers of electricity are households, industry and commerce including educational institutions and health facilities. Consumption figures of these consumers are shown in table 5.

TABLE 2:

Consumption of Light Crude Oil for Thermal Electricity Generation (m^3)

SITE	LIGHT CRUDE OIL	DISTILLATE FUEL OIL
TAPCO	356,187	258
TICO	479,327	677
Total	835,514	935

Source: VRA, as of 2006

TABLE 3:

Average Thermal Generation and Energy Consumption

THERMAL GENERATION (ON AVERAGE)	ENERGY SOURCE	CONSUMPTION (T)
1 GWh of electricity by TAPCO combined cycle gas turbine	Light crude oil	221
1 GWh of electricity by TICO single cycle gas turbine	Light crude oil	332
1 GWh of electricity by diesel power generators less than 1.2 MVA	Diesel oil	300 (average)

Source: VRA, as of 2007

TABLE 4:

Trend in Electricity Generation (GWh) 2000–2007[1]

YEAR	2000	2001	2002	2003	2004	2005	2006	2007*
Hydro	6,610	6,608	5,036	3,885	5,281	5,629	5,619	3,727
Shares (%)	92	84	69	77	87	83	67	53
Thermal	613	1,251	2,260	2,015	758	1,159	2,810	3,251
Shares (%)	8	16	31	34	13	17	33	47
Total Generation	7,223	7,859	7,296	5,900	6,039	6,788	8,429	6,978

Source: VRA, Energy Commission of Ghana, as of 2007

1 NOTE: THE REDUCTION IN 2007 IS DUE TO THE DROP IN ENERGY GENERATION FROM THE AKOSOMBO PLANT CAUSED BY DROUGHT.

TABLE 5

Consumption Figures (GWh) 2000–2007

SECTOR	2000	2001	2002	2003	2004	2005	2006	2007
Household	1,584.56	1,687.71	1,795.34	1,853.91	1,970.99	1,956.62	2,079.50	2,094.87
Industrial	445.36	503.33	477.29	492.94	530.23	747.91	841.00	803.00
Commercial	4,026.38	4,336.48	3,899.75	2,206.08	2,085.28	2,542.56	3,592.00	26.85
Total	6,056.30	6,527.53	6,172.38	4,552.93	4,552.93	5,247.09	6,512.50	5,582.87

Source: Energy Commission of Ghana, as of 2007

Ghana is a net importer of electricity. In order to meet the Volta River Authority's (VRA) planned generation capacity, electricity generated in Ghana is complemented with imports from Côte d'Ivoire, a neighboring country. Ghana, however, also exports electricity to neighboring countries such as Togo and Burkina Faso. Table 6 shows the imports and exports of the product in GWh.

The Public Utilities Regulatory Commission Act 1997 (Act 538) bestows the statutory duty of setting power tariffs on the Public Utilities Regulatory Commission (PURC).[2] With effect of 1 November 2007:

1. The Volta River Authority (VRA) charges rates as defined in the First Schedule as Bulk Supply Tariff (BST).
2. The Ghana Grid Company Limited (GRIDCO) charges rates as defined in the Second Schedule as Transmission Service Charge (TSC).
3. The Electricity Company of Ghana (ECG) and Northern Electricity Department (NED) of the VRA charge the rates as defined in the Third Schedule as Distribution Service Charge (DSC).
4. The Electricity Company of Ghana (ECG) and Northern Electricity Department (NED) of the VRA charge the rates as defined in the Fourth Schedule as End-User Tariffs (EUT).

Petroleum Sector

Petroleum products constitute an important part of the overall energy mix in Ghana. Table 7 presents the various petroleum products used for the country's economic activities. Figure 2 visualizes the shares of each type of petroleum product.

With the exception of Hydro Power, no other RE source feeds into the national electricity grid. Prices of such energy sources were therefore not available at the time this report was completed. The national prices for petroleum prices are set by the National Petroleum Authority and presented in table 8.

TABLE 6

Overview of Electricity Tariffs and Prices[3]

TARIFF CATEGORY	PRICE (GHP/KWH)(1 GHANA PESEWA = 0.6313 EURO)	PRICE (EUROCENT/KWH)
BST	6.02	3.80
TSC	0.90	0.57
DSC	5.85	3.69
Residential		
0–50 (exclusive)	9.50	6.00
51–300	12.00	7.58
301–600	16.00	10.10
600 +	19.00	11.99
Service charge (GHp/month)	50.00	31.57
Non-residential		
0–300	14.00	8.84
301–600	17.00	10.73
600 +	19.00	11.99
Service charge (GHp/month)	250.00	157.83
SLTV-LV		
Maximum demand (GHp/KVA/month)	100.00	63.13
Energy charge (GHp/KWh)	16.00	10.10
Service charge (GHp/month	750.00	473.48
SLTV-MV		
Maximum demand (GHp/KVA/month)	900.00	568.17
Energy charge (GHp/KWh)	9.05	5.71
Service charge (GHp/month)	1,250.00	789.13
SLTV-HV		
Maximum demand (GHp/KVA/month)	900.00	568.17
Energy charge (GHp/KWh)	8.05.00	5.08
Service charge (GHp/month)	1,250.00	789.13

Source: Ministry of Energy of Ghana, as of 2006

TABLE 6

Electricity Imports & Exports (GWh)

Import	629
Export	755
Net import	126

Source: Ministry of Energy of Ghana, as of 2006

TABLE 7

Consumption of Petroleum Products (Tons)

Liquefied petroleum gas (LPG)	35,848	4 %
Gasoline (premium)	294,397	33 %
Kerosene	65,103	7 %
Aviation turbine kerosene (ATK)	46,247	5 %
Gas oil	294,164	33 %
Residual fuel oil (RFO)	155,521	18 %

Source: NPA, as of 2008

2 SEE ALSO SECTION 3.2.

3 NOTES:

1) THE EXCLUSIVE LIFELINE BLOCK CHARGE FOR RESIDENTIAL CONSUMERS IS SET AT GHP 9.50/KWH. THIS REDUCED CHARGE IS ONLY GRANTED TO CONSUMERS WHOSE CONSUMPTION IS WITHIN THE 0–50 KWH RANGE. CONSUMERS EXCEEDING 50 KWH PER BILLING PERIOD OF 30 DAYS CANNOT BENEFIT FROM THE LIFELINE TARIFF.

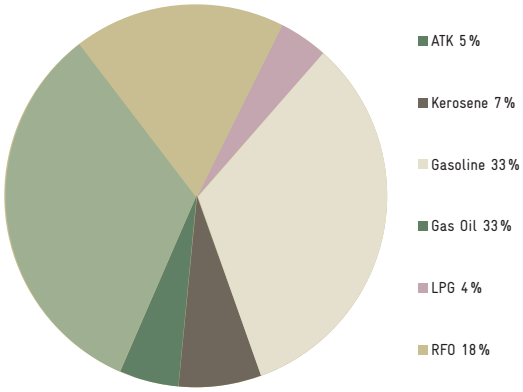
2) FOR A CONSUMPTION OF 51–300 KWH, A TARIFF OF GHP 12.00 PER UNIT APPLIES FOR RESIDENTIAL AND GHP 14.00 PER KWH FOR NON-RESIDENTIAL CONSUMERS

3) FOR A CONSUMPTION OVER 300 KWH UP TO 600 KWH, A TARIFF OF GHP 16.00 PER KWH FOR RESIDENTIAL AND GHP 17.00 PER KWH FOR NON-RESIDENTIAL CONSUMERS.

4) CONSUMPTION ABOVE 600 KWH ATTRACTS A TARIFF OF GHP 19.00 KWH APPLIES FOR RESIDENTIAL AND GHP 19.50 PER KWH FOR NON-RESIDENTIAL CONSUMERS.

5) EACH CONSUMER CLASS PAYS THE SERVICE CHARGE SPECIFIED IN THE FOURTH SCHEDULE

FIGURE 2
Shares of Petroleum Products



Source: NPA, as of 2006

TABLE 8
Retail Prices[4] of Petroleum Products (GHS/liter)[5]

PRODUCT	2000	2001	2002	2003	2004	2005	2006	2007
Gasoline	14.20	23.21	23.2	44.44	44.44	68.52	81.90	92.53
Diesel	13.25	19.56	19.56	38.89	38.89	61.33	76.61	87.31
Kerosene	13.25	24.64	24.64	38.89	38.89	50.36	64.47	77.44
LPG	20.70	22.00	22.00	38.00	38.00	53.84	68.46	82.32

Source: NPA, as of 2007

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The main actors for energy planning and regulation in Ghana are the relevant public institutions responsible for producing and enacting laws that regulate the distribution and tariffs. Recently, the private sector has been involved in the promotion of RE as an additional contributor to the national energy mix. The main actors are:

- Volta River Authority (VRA). The VRA is responsible for the generation and transmission of electricity in Ghana and supplies electricity in bulk to ECG for onward distribution to the southern part of the country. It also distributes power in northern Ghana through its subsidiary, the Northern Electricity Department (NED).
- The Energy Commission (EC) and the Public Utilities Regulatory Commission (PURC). Both function as regulatory agencies and have been established by Acts of Parliament to ensure the smooth cooperation of all players in the energy sector and to create the necessary environment for the protection of private investment in the sector.
- The EC was established in accordance with the Energy Commission Act of 1997 (Act 541). Its roles include the regulation and administration of utilization of energy resources in Ghana.
- The PURC Act of 1997 (Act 538) established the Public Utilities Regulatory Commission to regulate and oversee the provision of utility services by the public sector to consumers and related matters.

Ghana aims at achieving medium income status by the year 2015. Analysts believe that in order to achieve this goal, the Gross Domestic Product (GDP) has to triple. Energy is a critical success factor in this plan. As the economy is poised for growth, demand for energy also increases. Industries have to be supplied with adequate consumption levels to facilitate the production of goods and services. Households and educational institutions cannot be left out if all spheres of the economy will experience this considerable growth level. In this regard, modern energy is the main topic of discussion in different forums. The Minister of Energy, Felix Kwasi Owusu-Adjapong, claims that "Ghana needs to increase its power generation capacity beyond 4,000 MW within the next four years in order to attain a medium income status".

Ghana's Vision 2020 as framed within the scope of the National Electrification Scheme (NES) comprises a Government policy of achieving 100 % electrification by the year 2020 (as opposed to presently 54 %). The current generation level is inadequate for a nationwide extension of the grid, mainly due to energy shortfalls. These existing insufficiencies shift responsibility on policy makers to promote alternative energy sources such as RE for an overall growth of the energy sector.

4 ANNUAL AVERAGE PRICES
5 CONVERSION RATE: 1 GHS = 0.6313 EURO, AS OF OCTOBER 2008

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Technical advice to the Ministry of Energy is vested in the Energy Commission. The Commission has recommended the integration of RE technologies as alternative sources to the energy mix of Ghana. One of the policies being developed by the Energy Commission in collaboration with the World Bank is the Renewable Energy Law. No valid regulations for RE, e.g. for the pricing of biodiesel as an alternative to fossil diesel, are in place. Tariffs for energy generated by wind turbines are not available at present. The Commission, however, has received funds for drafting and implementing the Renewable Energy Law that will cover all technologies found in Ghana including wind, solar, waste-to-energy and biomass. The Government's objective is to create an enabling environment that will lead to the integration of RE technologies as alternatives to the main and yet unsustainable energy sources found in the country. To demonstrate its commitment to strengthen the industry, the Government currently provides certain incentives to promote specific technologies and to provide a level playing field for all competitors throughout the industry.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

For investors importing generators to invest in the RE sector, the following specific incentives are available:

1. Total exemption from import duty on RE generators including solar generators, wind turbines and municipal waste
2. Exemption from VAT in importing RE products only if the components are brought in whole (i. e. not in separate pieces) into the country
3. Exemption from the payment of customs import duties on plant, machinery, equipment and accessories imported specifically and exclusively to establish the enterprise

RE legislation in Ghana is ruled by the Energy Commission Act of 1997 (Act 541) and the Public Utilities Regulatory Commission Act (Act 538). The Renewable Energy Division of the Energy Commission is responsible for developing national policies and strategies for all RE resources, technologies, demand and supply side management and generation such as solar PV systems for both stand-alone and grid connected applications wind energy resource assessment and generation, small hydro development in Ghana covering mini and micro projects, biomass/biofuel and wood fuel resource assessment, development and generation. The objectives of the Renewable Energy Division of the EC include the following objectives:

1. To develop codes and standards for solar, wind and bioenergy systems in order to support the deployment of RE technologies (especially for rural development and environmental care) as well as to enhance energy efficiency and supply for economic growth
2. To promote RE energy projects
3. To ensure that all RE service providers are provided with licenses/permits
4. To develop regulations and codes of practice to guide operations of charcoal exporters in the charcoal industry in order to ensure the conservation of the national forests
5. To ensure that RE service providers comply with licensing terms and conditions, regulations and codes of practice through effective monitoring and supervision
6. To collaborate with other divisions in order to strategically plan national energy resources and usage

Other regulatory institutions involved in the RE industry are the Environmental Protection Agency (EPA) and the Ghana Standards Board. The Ghana Standards Board's certification of product and environmental permit issued by the EPA are required for importing and selling solar systems in Ghana. Companies buying from the Ghanaian open market, however, are allowed to operate with the permits and licenses of the wholesalers until they start their own solar system importation.

The current level of national electrification is 54 %. Electrification is mainly accessible to the regional capitals, district capitals and commercial towns leaving most of the rural areas off the national electricity grid. The National Electrification Scheme, framed within Ghana's Vision 2020, inculcates a Government policy of achieving a one hundred per cent (100 %) electrification by the year 2020. Policy makers are confronted with meeting modern energy needs of rural Ghana. In order to endow this objective with appropriate funds, the Government has sought a grant from the World Bank and implemented the Ghana Energy Development and Access Project (GEDAP). Under this program, a 6 million USD revolving fund is managed by rural banks enabling rural households to access sustainable lighting products such as solar lanterns. The rural banks are loaning between 20–25 % per annum based on the profile of clients.

It has been suggested that RE can fill the gap in the rural-urban energy sector. One of the major projects aimed at addressing rural energy needs is the UNDP/Global Environment Fund (GEF), a joint project of the National Renewable Energy Laboratory (NREL), the USA and the Government of Ghana's Renewable Energy-Based Electricity for Rural, Social and Economic Development (RESPRO) in the East Mamprusi district of the Northern Region of Ghana aiming to provide solar energy on a user for fee basis. RESPRO is already operating solar systems in over 100 communities in 13 Districts of the three northern regions as well as in the Brong Ahafo Region. For the most remote communities, i.e. as islands that are off-grid, the Government aims at subsidizing the upfront investment cost for solar PV products.

The EC is the final statutory body required to issue licenses for organizations to establish a RE business in Ghana. Specific ventures such as municipal waste-to-energy, however, also require approval from the respective regulatory bodies such as the Accra Metropolitan Authority and Kumasi Metropolitan Authority mandated to carry out waste management. For hydroprojects, the PURC is responsible of the kilowatt pricing of electricity per hour whereas the VRA has

to issue a permission for independent generators to feed into the national grid and EC has to agree to purchase the energy for distribution to consumers. Hence, depending on the RE technology, the approval has to be sought from the applicable body among all of the mentioned organizations.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

Apart from firewood and charcoal, energy derived from biomass is very unpopular. Biodiesel derived from plants such as jatropha was in the past promoted by the Government of Ghana. The lack of an adequate framework for the pricing and use of the technology as an alternative to fossil fuel, however, did not encourage the private sector to participate. Biogas from organic and municipal waste is gaining popularity in Ghana. There are a few companies that are developing biogas digesters for utilizing the methane generated for domestic use (in cooking and lighting). Biofuels have not yet gained popularity as an alternative source of fuel for automobiles and industrial engines against the e.g. conventionally used diesel. In the past, the Government was encouraging the promotion of biodiesel from the jatropha plant with the result that many farmers opted for jatropha plantation in place of cassava and maize. This, however, was strongly criticized by social authorities thus rendering the program unpopular. There are a few entrepreneurs who still believe biofuel could be profitable but lack the financial support to produce in commercial quantities.

There is no doubt that efficient use of biomass-based energy such as charcoal and biogas generated from municipal waste as well as biodiesel from appropriate organic materials saves money for users and trees for Ghana as a whole while reducing carbon dioxide emission for the world. Wood fuel accounts for 85.8 % of primary energy used in Ghanaian homes and provides income-generating activity (charcoal producers, transporters and retailers) to a substantial part of the rural community. In 2000, 16 million metric tons of wood fuel was consumed, 9 million of which was converted to charcoal. As of 2001, the rate of deforestation in Ghana was 740,000 hectares per year (equaling 1.7 % of the overall forestation).

Charcoal, which is used as a fuel source in most biomass cooking stoves, is still being produced in a crude way by the informal sector. In Ghana there is a lot of potential renewable raw material for charcoal production in the relatively large palm oil extraction factories such as found in Kade in the eastern region. These factories use part of the spines and shells to power their operation, but much is left to go waste. This process in itself presents investors with tremendous joint venture opportunities for more scientific production methods in biomass energy production. There is evidence of continued use of biomass energy (from charcoal or firewood) for cooking in most households in Ghana. One of the main reasons is the prevailing traditional method of how to cook maize and other cereal-based meals that require this source of fuel. In aiming at the reduction of deforestation, a few non-governmental organizations have introduced and promoted the use of various types of efficient biomass cook stoves on the Ghanaian market as alternatives to traditional cooking stoves. These stoves reduce charcoal consumption for household and commercial cooking. However, the efficiency in the use of charcoal as main fuel source could still be improved and thus contribute to carbon emission reductions which could then be monetized on international derivatives markets for carbon certificates under the Clean Development Mechanism (CDM).

4.2 SOLAR ENERGY

The main solar technology applications on the Ghanaian market are rural solar home systems (especially lanterns and torch lights), urban solar home systems (household appliances, lanterns), solar systems for schools, systems for lighting health centers, vaccine refrigeration, solar water heaters, solar water pumps, telecommunication, battery charging stations and solar streetlights. Solar technology spans the urban, peri-urban and rural Ghana. The dynamics of the distribution of specific products, however, differ from one place to another due to two main factors: Firstly, the generally occurring opportunity cost for deploying solar energy as an alternative energy source and secondly, the far distances of the locations from the national electricity grid in Ghana where solar energy is applied (off-grid locations).

In urban and peri-urban areas most of the towns are on the national grid making the use of solar energy unpopular in these locations. Solar energy uses in such areas are found in the form of solar water heaters in hotels and guesthouses. New hotels springing up in Accra, the capital city of Ghana, are deploying solar water heaters for various reasons. Solar energy generates long term cost savings although the initial capital outlay is high. Generally, the use of solar water heaters is still not very widespread in the country. Solar home systems are found among a few wealthy residents who use the technology to power basic electrical gadgets such as television and Hi-fi audio systems. Solar home systems have still not been able to penetrate the Ghanaian market.

Solar energy is predominant in clinics and other public places such as educational institutions that are off the national grid. Most of these projects have been deployed by the Ministry of Energy with the assistance of donor agencies such as UNDP, DANIDA and GEF. It is important to note that most of the solar activities in Ghana are carried out through public-private partnerships. In rural Ghana, solar technology is found in the form of lanterns, torch lights and cell phone battery chargers. Also, solar energy in the form of sunlight is the main energy for drying cloth and farm produce such as cocoa in the country.

Ghana is generously endowed with solar energy by virtue of its location within the tropics. Sunshine is even more pronounced in the northern regions with an annual solar radiation of 16–29 MJ/m^2. In Ghana, solar PV remains the main alternative energy (besides hydroenergy) for lighting in educational institutions, health facilities and households. The country has 54 % level of electrification. This is the percentage of communities on the national grid. The remaining 46 % use

other sources of energy. Solar streetlights are gaining popularity in rural and peri-urban communities. Solar lanterns are displacing their kerosene counterparts due to long term cost savings and a major reduction of indoor pollution.

Also available on the Ghanaian market are solar water heaters. Larger units of solar water heaters are usually deployed in the hotel industry. Single units of 130–190 liter boilers are also available with or without electric booster heater. Solar water heaters, however, are unpopular in Ghana due to the fact that most people are not used to taking hot showers or baths. Although solar water heaters are available to large-scale industries such as hotels as well as small individual households, it has been observed that majority of such facilities still use grid connected electric water heaters.

The World Bank is a strong partner in promotion of solar energy in Ghana and has demonstrated this with the introduction of the Ghana Energy Development and Access Project (GEDAP) aiming at deploying over 7,500 PV systems to schools, hospitals and off-grid communities in Ghana. Within the GEDAP, end-users of solar products receive a 50 % grant (of the purchase price) while the rest is spread over a maximum term of three years with Apex Bank, an SME focused bank in Ghana. Barclays Bank is also considering end-user finance of solar products with the traditional rotating saving and credit funds known as "Susu" schemes. The participants of these schemes are organized in associations. These associations are the vehicles through which participants are educated on the acquisition of solar lanterns. Table 9 presents available PV applications in Ghana.

TABLE 9

Solar Photovoltaic Applications in Ghana

SOLAR SYSTEMS	INSTALLED CAPACITY	GENERATION (GWH)
Rural Solar Home Systems (SHS)	450	0.70–0.90
Urban SHS	20	0.05–0.06
Systems for schools	15	0.01–0.02
Systems for lightng health centres	6	0.01–0.10
Vaccine refrigeration	42	0.08–0.09
Solar water pumps	120	0.24–0.25
Telecommunication	100	0.10–0.02
Battery charging stations	10	0.01–0.02
Grid connected systems	60	0.10–0.12
Solar Streetlights	30	0.04–0.06
Total	853	1.34–1.82

Source: Energy Commission of Ghana, as of 2004

4.3 WIND POWER

There is general perception that wind speeds in Ghana are too low to generate energy. Recently, however, the Energy Commission has identified the costal belt, particularly the Volta and Central Regions, as viable places for harvesting enough wind for energy generation. The discovery has encouraged very little private participation so far, and major wind farms have been constructed yet. A few individuals have installed wind turbines to backup the intermittent power supply in some parts of the country. Industrial use of wind farms is under 1 % of the range of RE technologies in Ghana. Studies by the Energy Commission have shown that there is enough potential to generate wind energy in Ghana. The coastal belt and the Volta and Central Regions in particular have wind speeds of 3–5 miles per second which is enough to drive turbines to generate wind energy. The technology, however, has been virtually untapped by the private and public sectors.

4.4 HYDRO POWER

Hydroenergy is the most tangible RE technology that has been deployed in Ghana. The main hydroelectric plants are the Akosombo and Kpong dams which supply electricity to most parts of Ghana. Since 2008, the Government of Ghana has, started to build yet another major hydroelectric dam at Bui in the Brong Ahafo Region for 562 million USD (440 million Euro). When completed after the scheduled two-year building time, the Bui dam will serve the northern part of Ghana which falls in line with the National Electrification Scheme of targeting 100 % electrification of the country. There are about thirteen other river sites that have been earmarked for mini hydro projects requiring public private partnerships to implement.

As of 2006, the data available showed that the VRA planned to meet Ghana's total energy demand of 9,518 GWh with the following mix: 5,862 GWh from hydroenergy 2,856 GWh from thermal energy and 800 GWh from imports from Côte d'Ivoire. The generation level from hydroenergy from 2006 to 2008 was 5,619 GWh. This shortfall of 243 GWh of hydroenergy presents opportunities for investors and local engineers to install mini hydro systems on 13 rivers earmarked for such facilities by the VRA.

The latest crisis was experienced in the year 2007 and early 2008. This energy crisis sparked off the creation of opportunities for foreigners who wish to enter joint ventures with local partners for the construction of mini hydro dams. Fiscal incentives are available for such ventures and modalities for Independent Power Producers (IPP) are under discussion.

5 MARKET RISKS AND BARRIERS

The Ghana Investment Promotion Center (GIPC) Act 478 was issued in 1994 to enable the GIPC to adopt and implement an investor-friendly set of rules and regulations to boost private sector investments. Through the GIPC, the Government is now a facilitator and promoter of investments, unlike previously when its interest was in investment regulation. Currently, private sector investors are benefiting from the macroeconomic and sectoral reforms introduced under the Economic Recovery Program (ERP) as well as from the activities of the GIPC. These benefits include the rehabilitation of economic and social infrastructure, the liberalization of imports and foreign exchange and the eased remittance of dividends, profits and fees abroad.

All this has been made possible on account of the political stability that Ghana has enjoyed over the past couple

of decades. The Government of Ghana has committed itself to establishing a new "Golden Age of Business" for the private sector. The Government therefore envisages an economy where the production and distribution of goods and services will be mainly the business of the private sector. This new production arrangement is anchored on a new robust collaborative partnership between a focused but strong public sector and a vibrant private sector. Ghana is a member of the World Bank's Multilateral Investment Guarantee Agency (MIGA). MIGA provides investment guarantees for certain non-commercial risks (i.e. a political risk insurance) to encourage foreign investors for qualified investments in developing member countries. MIGA guarantees cover the following risks: transfer restriction, expropriation, breach of contract and war and civil disturbance. The Government's pro-business orientation coupled with benefits deriving from MIGA ensures that investors obtain insurance cover against social and political business risks.

Trading across borders is very relevant to the RE sector given that most of the technology and equipment is usually imported. The Investment Climate Study looks at the procedural requirements as well as the time and cost of these procedures for both exported and imported goods transported by waterway. For importing goods, the procedures evaluated start at the vessel's arrival at the port of entry and end at the shipment's delivery at the importer's warehouse. For export, the study starts to evaluate procedures from the time the goods are packed at the factory to their departure from Tema, Ghana's port of exit. The costs of importing and exporting include import and export duties, levied by the Customs Excise and Preventive Services, as well as administrative charges. Specific incentives on imports of RE products are provided as described in Section 3.1. Specific incentives on exports are embodied in various mandates provided by Ghana Export Promotion Council, Ghana Investment Promotion Council and Africa Growth and Opportunity Act. Ghana's economic policy keeps shortening the procedural requirements in order to make the country more competitive globally and to put an end to frequent demands of bribes during import and export procedures.

Various incentives and benefits are generally offered to most investors under Ghana's new Investment Promotion Act (GIPC Act 1994, Act 478). In addition, entrepreneurs who invest in declared areas of priority (including energy and agriculture) are offered special/specific incentives. The general investment incentives are largely automatic and are granted in various forms to most investors. They incentives include the following: (i) exemption from the payment of customs import duties on specified inputs, plant, machinery and equipment required for the enterprise, (ii) increased capital allowance rates, (iii) tax reliefs for establishing enterprises at specified locations, (iv) retention of at least 35 % of exports earnings in an external account, (v) automatic immigrant quota for expatriate personnel in accordance with size of investment, (vi) guarantee against expropriation. The current corporate tax rate is 25 % of profits chargeable to tax.

Shareholders are protected by local regulations. They are also considered as the 'legal backing' of Commercial Courts as they have access to the company's internal documents. Ghana's Companies Code of 1963 defines the rights and obligations of shareholders and directors of limited liability companies. The Code covers approval procedures, requirements for immediate disclosure of transactions and availability of external reviews of transactions before they take place and disclosure in periodic filings and reports. A director liability includes the possibility for investors to hold a director or a board of directors liable of damages. Moreover, investors' interests are protected by the Ghana Investment Promotion Center.

The laws that govern intellectual property rights in Ghana are the Copyright Act 2005 (Act 690) and the Patent Law of 1992. This section of the study looks at the number of procedures required to register a property as well as the time and cost it takes. In general, a large amount of properties in Ghana are not formally registered, and the process of registering a property is often difficult. Unfortunately, non-registered properties cannot be used as a guarantee for obtaining loans thus limiting financing opportunities for businesses. It takes a minimum of 5 procedures and an average of 34 days in registering an intellectual property in Ghana. The cost of the property is usually about 1.2 % of its value.

RE technologies are growing, although at a low pace. There is, however, local expertise in all the technologies found in Ghana, although limited. The VRA boasts of one of the finest assemblies of local engineers some of whom are periodically drawn to offer technical expertise to neighboring West African countries. There are not many solar energy engineers. The few SMEs involved in solar energy, however, are very competent. Biomass technologies are mostly implemented by academics having opted to commercialize them. Biogas technologies are employed in the tourist industry and educational institutions. Bio-fuel experts are few but exist.

There are some governmental regulations related to employment. To measure the ease or difficulty of employing workers, the study establishes two indicators: a rigidity of employment index and a firing cost measure. The rigidity of employment index comprises difficulty of hiring, rigidity of hours and difficulty of firing. Ghana has relatively less rigid regulations of employment. The firing cost indicator reflects the cost of firing an employee in terms of advance notice requirements, severance payments and penalties.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 10

Local Business Partners

NAME	ADDRESS	FIELD OF ACTIVITY
GECAD Ghana Ltd	38 Independence Avenue P.O. Box C74, Cantonments, Accra, Ghana Phone: +233 21 228500 info@gecadgh.com	Power generation, supplier of parts and services for installations, operations and maintenance on gas turbines
DENG Solar Training Center Ltd (DSTC)	C12/13 Southeast Alajo P.O. Box AN 19996, Accra, Ghana Phone: +233 21 257100 Fax: +233 21 233778 info@dengltd.com	Expertise include RE (solar PV), power generation, control and transmission, water filtration and irrigation, civil engineering, industrial supplies, precision scales and balances, project management, training and education
Wise Energy	Abofu 1st Junction, Off Achimota, PMB 21, Kanda, Accra, Ghana Phone: +233 21 403135 richard.arku@wise-energy.org	**Targets areas with no access to the national electricity grid and provides high quality, thoroughly tested and approved components to build the necessary PV systems**
ecoZone	6 Vermont Plaza, Medlab Building, S.O.S. Road, Comm. 6, Tema, Ghana Phone: +233 22 214 646 info@ecozone.com.gh	Distributor of solar power systems, lighting, and water purification equipment to hospitals, schools, hotels, homeowners, contractors, Government, & non-governmental organizations & rural communities and other remote sites without electricity
Wilkins Engineering	No. 35 Dadeban Road, North Industrial Area, Kaneshie, Accra Phone: +233 21 23567 Fax: +233 21 252615 wilkins@africaonline.com.gh	Wholesales, retails, installs and maintains PV solar home systems (SHS) to households, public and private commercial institutions in Ghana
Toyola Energy Limited	H/No.011 Opa Road Sarpeiman, P.O. Box OF 266, Ofankor, Accra Phone:+233 245 482842 toyolaenergy@yahoo.com	Manufactures, distributes and sells biomass efficient cooking stoves (Gyapa stoves, www.enterpriseworks.org), to rural and peri-urban households and institutional customers in selected regions in Ghana
Biogas Technologies West Africa Limited	14/2 Guava crescent, community 19, Lashibi, Tema, Ghana Phone: +233 22 410638 jaidan@biogasonline.com	Biogas digester construction company in West Africa; provision of organic waste for useful energy and nitrogen-rich plant fertilizer as well as manufacturing of biogas stoves and biogas manometers
EnterpriseWorks Ghana	Crn. Josiah Tongogara/North Labone Ave P.O. Box CT 4808, Accra Tel: (021) 765454/781090 ewghana@africaonline.com.gh www.enterpriseworks.org	Active in the domestic energy sub-sector, providing financial and technical assistance to the USAID-funded Kenya Ceramic-Lined Stove Project including the Household Energy Program in Ghana, funded by USAID and Shell Foundation funding (focusing on manufacturing and commercialization of consumer-oriented stoves)
Raford Technologies	P.O. Box AN 7172, Accra-North, Ghana, Phone: +233 21 231207 raphenyoafor@yahoo.co.uk	Wind powered electrical plants

TABLE 11

Local Business Related Institutions

NAME	ADDRESS	FIELD OF ACTIVITY
Association of Ghana Solar Industries (AGSI)	P.O. Box 19996, Accra, Ghana Phone: +233 21 233779 Fax: +233 21 233778 info@ghanasolarindustries.com	Aims at raising the profile of the solar industry, improving the quality of design/installation, administering a membership accreditation programs, promoting the development of standards within the industry. Makes presentations for the Government in order to abolish taxes on solar components and to negotiate training agreement with Deng Solar Training Center (DSTC)
Ghana Venture Capital Trust Fund (GVCTF)	Premier Towers, 12th Floor, Ministries, Accra, Private Mail Bag, CT 449, Cantonments, Accra Phone: +233 21 671459 nanabonsu@venturecapitalghana.com	Governmental body responsible for providing investment capital to local SME's through existing venture capitalists; oversees the promotion of venture capital/private equity investments in Ghana
Kumasi Institute of Technology, Energy and Environment (KITE)	72 Old Achimota Road, Dzorwulu, P.O. Box AT 720, Achimota, Accra Phone: +233 21 256800-1 Fax: +233 21 256800 info@kiteonline.net	Non-governmental organization specialized in environmentally sound technical solutions and related policy interventions for sustainable development
Ghana Investment Promotion Center (GIPCI)	P.O. Box M193, Accra, Ghana Tel: +233 21 665125-9 gipc@ghana.com	Encourages, promotes and facilitates investments in all sectors of the economy except mining, petroleum, free zones activities, privatization of Government enterprises and portfolio investments

TABLE 12

List of Companies and Related Business Organizations

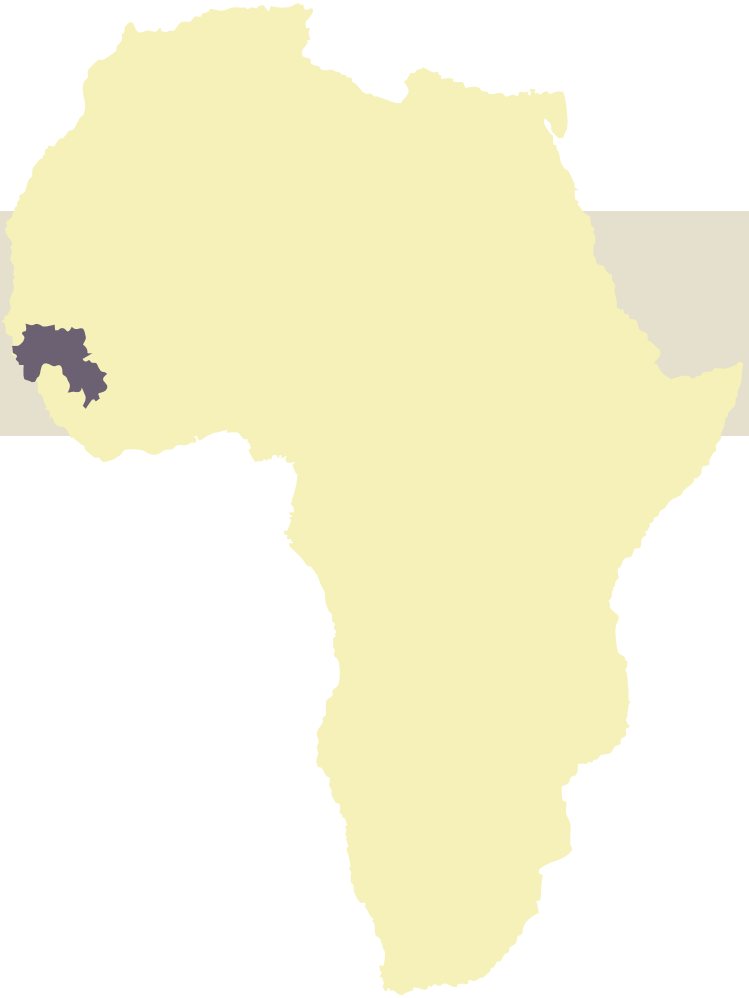
NAME	ADDRESS	FIELD OF ACTIVITY
Energy Commission (EC)	FREMA House, Plot 40, Spintex Rd. P.M. B. Ministries, Accra – Ghana Phone: +233 21 813756 info@energycom.gov.gh	RE technologies advisor to Ghana's Government
Ministry of Energy	P.O. Box SD 310, Stadium, Accra Phone: +233 21 667156 cabavana@energymin.gov.gh www.energymin.gov.gh	Responsible for implementing all energy issues in Ghana
United Nations Development Program (UNDP)/Global Environment Facility (GEF)	P.O. Box 1423, Accra Phone: +233 21 227323 george0@unops.org	Global partnership to address global environmental issues while supporting national sustainable development initiatives
IFC Lighting Africa Program	No. 1 Central Link Street, South Legon, P.O. Box CT 2638, Accra, Ghana Phone: +233 21 513153 ckattah@ifc.org	Aims to recognize the success and vitality of the Africa small, micro and medium enterprises (SMME) sector; annual awards program specifically to acknowledge, encourage and celebrate excellence amongst African SMMEs
Environmental Protection Agency (EPA)	P.O. Box M326, Accra, Ghana Phone: +233 21 664697 Fax: +233 21 662690 cdm@epaghana.org	Ensures all social practices and businesses (including but not limited to renewable energy practices) are not detrimental to the Ghanaian environment
Electricity Company of Ghana (ECG)	Electro-Volta House, 28 th February Road, Accra Postal Address Post Office Box GP 521 Telephone+233-21-676727/676747 Fax +233-21-666262 ecgho@ghana.com www.ecgonline.info/ecgweb	State-owned entity responsible for the distribution of electricity to consumers in southern Ghana, namely Ashanti, Central, Greater Accra, Eastern and Volta Regions of Ghana
Energy Foundation Ghana (EF)	P.O. Box CT 1671 Accra, Ghana Tel: (+233 21) 515610/515611/515612 Fax: (+233 21) 515613 Mail: info@ghanaef.org www.ghanaef.org	Non-profit, public-private partnership institution (founded in collaboration of the Government of Ghana), devoted to the promotion of energy efficiency and renewable energy

7 BIBLIOGRAPHY

- Agyemang-Bonsu W. K. (2008): The DNA's CDM Approval Process and Preparedness for CDM Activities in Ghana, Austria JI/CDM Workshop
- Africa Growth and Opportunities Act – AGOA (without year): (www.agoa.gov)
- Government of Ghana (1963): Companies Code
- The World Bank Group/International Finance Corporation – IFC (2009): Doing Business, Measuring Business Regulations, (www.doingbusiness.org/ExploreEconomies/?economyid=76)
- ECOWAS (without year): Energy Protocol A/P4/1/03, (www.ecowapp.org/member_utilities.html)
- Energy Commission of Ghana (2006): Energy Supply to the Economy, Woodfuels and Renewables
- Energy Commission Act (1997): Act 541 (www.lexadin.nl/wlg/legis/nofr/oeur/lxwegha.htm)
- Food and Agriculture Organization – FAO (2003): The State of the World's Forests
- Ghana Association of Bankers (without year): (http://ghanaassociationofbankers.com)
- Ghana News Agency – GNA (2008): Section Economics/Business/Finance
- KITE (2000): Implementation of Renewable Energy Technologies – Opportunities and Barriers: Ghana Country Study
- Ministry of Energy (2003): Household Energy in Ghana
- N. N. (2002): Energy News
- Public Utilities and Regulatory Commission (2007): Publication of Electricity Tariffs
- Public Utilities and Regulatory Commission - PURC (1997): Act 538 (www.purc.com.gh/legislation.php)
- Statistical Service (2000): Population and Household Census
- Statistical Service (without year): Ghana Living Standards Survey-4

Websites

- Ghanaweb: (www.ghanaweb.com)
- Global Environment Facility: (www.gefweb.org)



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ACRONYMS AND ABBREVIATIONS

GUINEA

ADB	African Development Bank
ADB	Asian Development Bank
BERD	Bureau Électrification Rural Décentralisé (Rural Electrification Decentralized Office)
CEDEAO	Communauté Économique Des États de l ‚Afrique de l'Ouest (Economic Community of West African States – ECOWAS)
DNEF	Direction National des Eaux et Forêts (National Division of Water and Forestry)
DNHE	Direction Nationale de l'Hydraulique et de l'Energie
ECOWAS	Economic Community of West African States
EDG	Electricité de Guinée (Guinea Electricity)
EU	European Union
GDP	Gross Domestic Product
GNF	Guinea Francs
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation Agency)
HDI	Human Development Index
HIPC	Heavily Indebted Poor Country
HV	high voltage
IEPF	Institut de l'Énergie et de l'Environnement de la Francophonie (Institute for Energy and the Environment in French Speaking Countries)
IFAD	International Fund for Agricultural Development
LPG	Liquefied Petroleum Gas
LPDSE	Lettre de Politique de Développement du Secteur de l'Énergie (Policy Letter for the Development of the Energy Sector)
LV	low voltage
MDG	Millennium Development Goals
MSF	Médecins Sans Frontières
MV	medium voltage
NDE	National Division of Energy
NGO	Non-governmental Organization
NMG	National Multisectoral Group
OPEC	Organization of Petroleum Exporting Countries
PDE	Direction Préfectorales de l'Éducation (Prefectoral Directorate for Education)
PREP	Poverty Reduction Program
PRSP	Poverty Reduction Strategic Paper
PV	Photovoltaic
SGP	Société Guinéenne de Pétrole (Guinean Oil Company)
SOGUIP	Société Guinéenne des Pétroles (Guinean Oil Society)
TSPP	Taxe Spéciale sur les Produits de Pétrole (Special Taxes on Petroleum Products)
UNDP	United Nations Development Program
USAID	United States Agency for Internal Development
USD	United States Dollar
WB	World Bank

MEASUREMENTS

€	Euro (1 EUR = 7,291 GNF; 1000 GNF = 0.13715 €).
GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
km²	square kilometer
kWh	kilowatt hour
kWp	kilowatt peak
m/s	meters per second
m³	cubic meter
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
Wp	Watt-peak
°	degree

SUMMARY

The Country Study of Guinea is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Guinea. The study is structured as follows:

Chapter one provides **Background Information on Guinea**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Guinea.

Chapter two summarizes facts and figures of **Guinea's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Guinea. This includes an overview of support mechanisms for photovoltaic (PV) as well as existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Guinea.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Guinea.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

The Republic of Guinea[1] is located in West Africa between latitudes 7°05‘ and 12°51‘ South and longitudes 7°30 and 15°10‘ West. Its geographic size equals 245,857 km². It is bordered in the East by Mali and the Ivory Coast, in the West by the Atlantic Ocean (with 300 km of coastline) and Guinea-Bissau, in the North by Mali and Senegal and in the South by Sierra Leone and Liberia. Guinea comprises four physiographic provinces characterized by different climates, soils, vegetations and landscapes.

FIGURE 1

Map of Guinea

Guinea has a humid tropical climate with two alternating seasons, the dry season and the rainy season. The rainy season lasts an average of eight months in Forested Guinea and five months in High Guinea. Thus, Guinea is one of the few West African countries with high rainfalls, varying between 1,200 and 4,000 mm per annum. Most rivers of the West African region (Gambia, Senegal, Niger) spring from the Fouta Djallon Massif; that is why Guinea is called the “Water Tower” of Western Africa.

Maritime Guinea or Flat Guinea covers 18% of the country’s territory and is characterized by mangrove swamps. The coastal area has a huge water supply potential and offers opportunities for farming and fishing. The maritime region of guinea produces rice, fruit, vegetables, tubers, salt and palm oil but also bauxite and various manufacturing products.

The Middle Guinea or Fouta-Djalon covers 22% of the territory and is characterized by tree and bush savanna. Farming and livestock breeding are the predominant activities of its economy with 39% of all country’s livestock breeders being based in Middle Guinea. The region’s main products are fruit, vegetables, grain (fonio[2], corn and rice) and tubers (cassava, sweet potato and potato). Another important source of income is the crafts industry. Besides that, there is also a significant potential for the development of a tourism industry in this region.

High Guinea is characterized by tree and bush as well as grassy savanna covering 40% of the territory. Being an auriferous region “par excellence”, both industrial gold production and traditional gold washing are being performed. Livestock breeding (with 27% of identified livestock breeders ranking on position 2 behind Middle Guinea), farming and continental fishing in the Niger River basin further contribute to the region’s economy. People are also active in subsistence farming and commercial farming. These sectors, however, suffered from major production difficulties in the last few years. As a consequence, the industrial fruit and cotton processing units have ceased to operate for the time being. In the craft industry sector, traditional pottery is well developed.

The Forested Guinea is dominated by tropical rainforest and stretches over 20% of the territory. It is characterized by mining, agro-pastoral activities and forestry as well as craft industry activities. In addition to growing crops for their own livelihood, people are active in the production of products for export purposes, namely coffee, cocoa, tobacco, tea and rubber. Forestry resources are being exploited with both traditional and industrial methods.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Republic of Guinea is one of the very first French speaking countries in West Africa gaining independence in 1958. The following separation had a very positive effect on the political development and economic growth. In fact, Guinea clearly opted for stopping exchange and cooperation with former colonizers through its choice of a total and immediate independence. As a result of this, France decided the immediate withdrawal of the colonial administration. As an independent country, Guinea faced several difficulties and decided to enter a partnership with the Soviet Union. The country experienced a particularly active stage of political and social evolution during the liberation wars in Guinea-Bissau and Cape-Verde. The so-called “First Republic” (1958 to 1984) was characterized by a socialist and centralized type of state controlled economy. The state was intervening in all economic sectors including the productive sector, the commercial sector and even the banking system. The Second Republic (1985 up till now) is characterized by an open market economy with substantial economic and financial reforms.

The total population of Guinea is estimated at 9.4 million as of 2008 when the last general population census took place. Its gender distribution comes to 48.7% of men and 51.3% of women. The Guinean population lives mainly in rural areas (71.2%) with less than a third (28.8%) of its people living in urban areas. Conakry, the capital city of the country,

1 THE NATION IS SOMETIMES CALLED GUINEA-CONAKRY TO DISTINGUISH IT FROM ITS NEIGHBOUR GUINEA-BISSAU.

2 WHITE FONIO (D. EXILIS) IS THE MOST IMPORTANT OF A DIVERSE GROUP OF WILD AND DOMESTICATED DIGITARIA SPECIES THAT ARE HARVESTED IN THE SAVANNAS OF WEST AFRICA.

concentrates more than one half of the total urban population. This is why it grows faster than most of the big cities in the sub-region. Guinea is one of the less developed HIPC (Heavily Indebted Poor Country) countries. The country ranks at 156th out of 177 countries with a per capita GDP of 375 USD and a Human Development Index (HDI) of 0.466 (as of 2003). High Guinea and Middle Guinea remain the poorest regions of the country. Table 1 presents a summary of the country specific HDI figures.

TABLE 1

Human Development Indicators (HDI) of Guinea

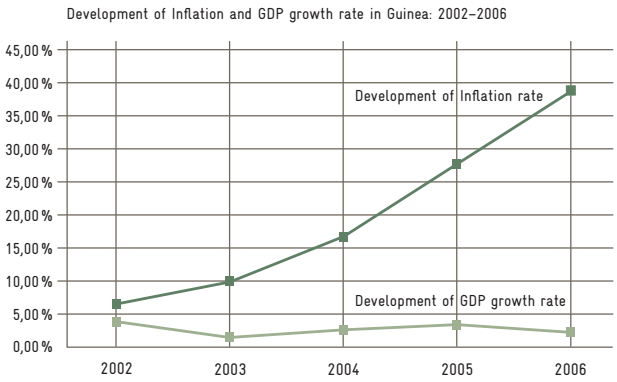
ISSUE	RATING IN GUINEA	RATING IN AFRICA
Life expectance at birth	49	53
Infant mortality rate	11,4 %	7,8 %
Access rate to health facilities	58 %	60 %
Access rate to potable water	48 %	60 %
Gross primary school enrolment	63 %	81 %
Gross secondary school enrolment	13 %	29 %

Source: UNDP, as of 2003, and UNDP/Human Development Report, as of 2009

The Guinean social situation still remains unstable, mainly because of consumer prices rocketing with a nearly 40 % rise in basic goods' prices, namely for rice, sugar, milk and cooking fuels. More than half of the Guinean population (approx. 53.6 %) lives on less than half a USD a day. A large group of the population (about 19 %) lives under extreme poverty, i.e. on less than USD 0.32 per day. Figure 2 illustrates the GDP growth compared to the development of the country's inflation rate.

FIGURE 1

GDP Growth Rate and Inflation Rate (2002–2006)



Source: IMF/Guinean Ministry of the Economy, Finances and Planning: PRSP, as of August 2007

The rapid inflation, shifting from 6 % in 2002 to nearly 40 % in 2006, made some donor partners (WB, ADB, IFAD, OPEC etc.) suspend ongoing projects and programs in Guinea.

2 ENERGY MARKET IN GUINEA

2.1 OVERVIEW OF THE ENERGY SITUATION

Guinea has a significantly low rate of access to electricity, with less than an estimated 17 % for the entire population. As a result of the insufficient production capacity, there are serious malfunctions and blackouts in the electric power sector of Guinea. As to hydrocarbons, Guinea does not have proven reserves despite of ongoing researches at various sites. Therefore, the bulk of the country's demand is covered by imports.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The installed electricity production capacity equals approximately 239 MW and is provided by 9 hydroplants and 18 thermal power plants. The production capacity of the 9 hydroplants is 127 MW. Table 2 presents an overview of existing electricity production facilities. Table 3 provides information on the cost structure of thermal electricity production.

The major performance indicators of the electricity sector are: (i) the low rate of access to electricity (less than 17 %, i.e. 1.5 out of 9 million inhabitants), (ii) the very low billing rate (53 %), (iii) the low rate of recovery/collection (an estimated 80 %). As a result of this particularly dilapidated state of the electric power industry, Guinea is suffering from a severe drop of its electrification rate.

In Guinea, electric power tariffs are fixed by joint order of the Ministry of Energy and Hydraulic (MEH) and the Ministry of Economy and Finance. The electricity tariffs of Guinea are presented in Table 4.

TABLE 2

Existing Electric Power Production Facilities

TYPE	PRODUCTION CAPACITY (MW)
Thermal Production (interconnected)	99,5
Hydroelectricity	127,16
Other Thermal Production Units (not interconnected)	12,26
TOTAL	238,92

Source: IDEACONSULT: LPDSE, as of 2006

TABLE 3

Thermal Production Cost Structure (per kWh)

DESIGNATION (2006 SITUATION)	COST PER kWh (EURO)	% OF TOTAL COSTS
Procurement of fuel	0,0302 €	33 %
Operation and maintenance	0,0064 €	7 %
Personnel costs	0,0093 €	10 %
Financial charges	0,0032 €	3 %
Depreciation expenses	0,0125 €	13 %
Provision	0,0306 €	33 %
Taxes	0,0006 €	1 %
Total costs	0,0928 €	100

Source: IDEACONSULT: LPDSE, as of 2006

TABLE 4

Electricity Tariffs of Guinea

TYPE OF USAGE	POWER RANGE KWH	KWH COST IN EURO	OBSERVATIONS
Domestic LV	1 to 60	0,014 €	Fixed premium = 0,739 Euro
	61 to 330	0,035 €	
	330	0,040 €	Three-phase fixed premium = 2,218 Euro
Professional, commercial and industries LV	1 – 330	0,122 €	fixed premium = 0,798 Euro
	330	0,197 €	Three-phase fixed premium = 2,396 Euro
Private and industrial MV/HV- Contracted load in kVA: 6312	Unique	0,197 €	
International institutions, NGO, embassies MV/LV Single-phase connection: 0,798 € Three-phase connection: 2,396 € Contracted load in kVA: 0,962 €	Unique	0,224 €	
Administration LV, MV, HV	Unique	0,271 €	

Source: EDG, as of 2008

Petroleum Sector

Up to now, Guinea does not have any confirmed hydrocarbon reserves. However, there are some ongoing research activities at various sites of the country. The bulk of the country's demand is covered by imports of hydrocarbons, estimated at 800,000 tons of petroleum, oils and lubricants in 2008 (excluding mining companies' consumption). As a result of the political disengagement of the Government in the productive and commercial sectors, there are four international petroleum companies: TOTALFINAELF, SHELL, MOBIL-OIL and Guinean company PETROGUI share the distribution market. The Guinean Petroleum Company (SGP) manages the deposits. All petroleum products consumed in Guinea are imported. In 2005, imports reached a total of 692,286 metric tons, as opposed to 727,820 metric tons in 2004 and 721,727 metric tons in 2003. Guinea also imports small quantities of Liquefied Petroleum Gas (LPG) equaling 316 tons in 2005; its relatively high price can only be afforded by the wealthiest of buyers. All the petroleum products consumed in Guinea are imported. Table 5 summarizes the imports from 1989 to 2003.

The transportation sector is the major consumer of petroleum products, with 52.2 % of total consumption. The products being consumed are divided into 54 % of gasoline, 36 % of diesel and 10 % of kerosene. The mining sector holds the second position with a consumption of more than 80 % of fuel oil. Petroleum products are distributed via the deposits owned by the Guinean Petroleum Company (SGP) and through a gas station network of various companies and privates distributors. Mining companies have their own storage capacities (company CBG: 50,000 m³, Friguia: 57,000 m³) and network of gas stations.

The prices of the different petroleum products are set for the whole country by decision of the Ministry of Commerce. The structure of prices is revised through the Economic and Financial Coordination Committee in its monthly technical support unit meeting. The selling price at the individual fuel pumps changes periodically according to the price fluctuation on the international market. The price increase in 2005 has been the last adjustment of retail prices since 1992. At present, the official retail prices are fixed at 0.60 €/liter of gasoline, 0.53 €/liter of diesel and 0.53 €/liter of kerosene. The stability of the retail price does, however, not prevent some of its determinants from varying from one month to another as the retail prices are subject to the fluctuations of the supply prices. The operating charges and different taxes, except for the Special Taxes on Petroleum Products (TSPP), are determined as a function of the price. The TSPP has been adjusted to the decrease and is presently fixed at 0.54 €/liter for gasoline, 0.037 €/liter for diesel and 0.024 €/liter for kerosene. Table 7 provides an overview of the current fuel prices.

TABLE 5

Imports of Petroleum Products (Metric Tons)

YEAR	GASOLINE	KEROSENE	DIESEL	FUEL OIL	TOTAL
1989	58,345	11,142	100,490	317,715	487,692
1990	75,948	8,565	91,772	334,551	510,836
1991	66,659	17,724	85,113	306,338	475,834
1992	57,321	37,940	97,016	286,360	478,637
1993	77,178	55,717	151,524	295,512	579,931
1994	78,700	45,784	126,041	315,477	567,002
1995	98,567	50,778	113,045	311,817	574,207
1996	101,519	45,497	132,025	323,767	602,808
1997	108,432	31,426	160,798	342,551	743,307
1998	96,732	26,941	154,982	344,299	622,954
1999	108,500	25,802	182,215	324,125	640,642
2000	74,181	24,122	139,242	362,183	599,728
2001	81,481	20,606	174,517	405,110	691,714
2002	74,579	21,890	201,723	420,705	718,897
2003	99,891	28,875	234,944	462,776	827,486

Source: UNDP, 2004

TABLE 6

Current Fuel Prices

YEAR	GASOLINE (€/LITER)	DIESEL (€/LITER)	KEROSENE (€/LITER)
2008	1.07	1.07	1.07
2009	0.74	0.74	0.74

Source: Ministry of Commerce, as of 2009

Biomass Sector

As it is the case in most West African countries, the energy balance of Guinea is highly dominated by the use of fuel woods (wood, charcoal). This is why biomass resources are ranking at the top of the country's energy resources. Despite of the high predominance of fuel woods in the energy balance of the country, its potential remains unknown. No comprehensive studies covering the entire national territory were conducted to assess the available potential. Due to several estimates[3], the accessible volume is about 8.5 million to 14 million m³. Table 8 presents the current status of disposable woodland areas. Table 9 summarizes the accessible volume of wood energy for production.

TABLE 7

Current Status of Disposable Woodland Areas in Guinea

TYPE OF FORMATION	SURFACE (1,000 HA)	%
Mangrove swamps	250	1.02
Moist forests	700	2.85
Open woodland forest and tropical forest	1,600	6.51
Savanna woodland	10,636	43.25
Sub-total wood formations	**13,186**	**53.63**
Fallow lands and tree and bush savanna	7,500	30.51
Total forest wood formations	20,686	84.14
Agricultural utilization	1,700	6.10
Others	2,200	9.76
Total	**24,586**	**100**

Source: World Bank/RPTES – Final Report Guinea, as of 1998

TABLE 8

Accessible Volume of Wood Energy

TYPE	SURFACE (1,000 ha)	GROSS PRODUCTION m³	ACCESS AND USE m³
Mangrove swamps	260	1,690.0	338.0
Tropical rainforest	800	3,200.0	640.0
Open woodland forest	2,700	4,250.0	1,700.0
Savanna woodland and tree and bush savanna	12,000	18,000.0	9.000.0
Bush and fallow land	6,150	412.5	2,063.0

Source: World Bank/RPTES – Final Report Guinea, as of 1998

As to the distribution of the forestry resources, the data show a highly imbalanced distribution from one region to the other. The very low national coverage ratio (4.8 %) testifies a significant discrepancy as compared to the ecologically recommended standard (30 %). Due to this situation, there are various considerations how to create stronger awareness and policies for sustainable wood energy management.

3 WORLD BANK/RPTES REPORT AND OTHERS

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The **Ministry of Energy and Hydraulics (MEH)** is the governmental authority responsible for the energy sector. The sector management, however, is shared with other ministerial departments involved in the various segments related to the energy sector:

- The **Ministry of Environment** is in charge of water and forestry issues, thus playing an important role in the constituent dealing with traditional domestic wood fuel (biomass).
- The **Ministry of Mines and Geology** is in charge of oil prospection, thus managing the upstream segment of the hydrocarbon sector.
- The **Ministry of Commerce and Competitiveness** manages the downstream segment of the hydrocarbon sector.
- The **Ministry of Economy and Finance** plays a transversal role and is related to all governmental actions and segments in the energy sector.

The **National Division of Energy (NDE – Direction Nationale de l'Énergie – DNE)** is responsible for defining and conducting the country's energy related policy, except policy concerning hydrocarbons. The NDE comprises two divisions: the **Energy Planning and Regulation Division and the Renewable Energies Division**. A third division **(Division of Electricity)** was being planned when the study team visited the country in November 2008. The Energy Planning and Regulation Division comprises three sections: i) the Planning and Energetic Infrastructures Section, ii) the Regulation Section and iii) the Project Preparation Section. The Renewable Energies Division consists of four sections as depicted in the organizational chart presented below. Biofuels will be assigned to the bioenergy section in the course of the planned internal restructuring.

Biomass Sector

One of the characteristics of the traditional energies sector in Guinea is the fact that there have been but few stately interventions. Two departments are directly involved in this sector, namely the **MEH** for energy demand side aspects and the **Ministry of Agriculture, Waters and Forests (MAWF)** for offer aspects:

- As for the **MEH**, the strategy adopted for the Program of Economic and Financial Development includes a restructuring of the conventional, carbon-based energies sector through the improvement of management and operation structures and the development of a favorable environment for private investments. Up to now, however, traditional energies have not been taken into account.
- In the forestry domain, most of the programs aiming at the protection of the environment failed to integrate the energy dimension of the wood. The programs' priority was to fight soil erosion, forest fires and deforestation. What indeed has been constituted as a priority is the protection of inshore water bodies of the Fouta Djallon region[4], as well as essential activities for the preservation of the country's agricultural potential and ecological equilibrium.

4 MOUNTAINOUS REGION OF WEST-CENTRAL GUINEA, WHICH ALSO SERVES AS WATERSHED FOR SOME OF WESTERN AFRICA'S GREATEST RIVERS

- The National Division of Water and Forestry (DNEF) under the ministry in charge of forestry (MAWF) is responsible for the fuel woods production sub-sector (energy woods) without having any real organic relation with the DNE under the MHE. All offer-related energy wood issues – as mentioned already above – are handled by this division namely the development of strategies and the realization of forestry projects and programs.

Electricity Sector

The legal base for the electricity sector has been established by the laws of 1993 and by Law L/98/012[5] of June 1st 1998 relating to the foundation, construction, operation, maintenance and transfer of production infrastructures. The first section of this law defines institutions in charge of the management of the sector as well as their respective roles. These are:

- The MEH is in charge of the supervision, control and regulation of the sector. It defines and implements the energy policy and the structure of the tariffs.
- The National Council for Electricity acts as consultative organ. It consists of representatives of several ministerial departments, delegates of the dealers, the representatives of consumers and independent experts. The council is the instrument of mediation between the various actors of the electricity sector.
- The Electricité de Guinée (EDG) Company is in charge of the electricity sector.
- The Electricity Sector Regulatory Body was created in September 2005. It still lacks a clear definition of its mission.

Between 1994 and 2001, the electric power sector was managed by two companies: ENELGUI, the state owned company in charge of managing the electric power production and infrastructure, and the operating company SOGEL in charge of electric power transport and distribution. This organizational sub-division resulting from various reforms did, however, not meet the Government's expectations and ended with the termination of SOGEL's lease in October 2001. Since then, EDG, a business corporation established by the Government with the State as a majority shareholder, has been managing the sector. EDG is managing the capital and operation related rights and obligations and is responsible for the maintenance, restoration and development of electric power production, transportation and distribution facilities and equipment in order to guarantee public electric power service.

Petroleum Sector

In the petroleum sector of Guinea, the energy reform was implemented in 1992 thus permitting a thorough restructuring on the institutional level and allowing the transfer of storage, transport and distribution of petroleum products to private operator. Along this process,, an upstream regulation of the petroleum sector was implemented to ensure the technical control of the petroleum companies operating in Guinea. A regulatory framework body has been adopted and established by the Government for controlling and supervising compliance with these regulations. This implementation was done in cooperation with the World Bank[6].

In 2005, these structures have slightly been changed by an alteration of the responsibilities of the Ministries of reference and the National Directions that depend on this sector. For example, research is currently in the hands of the National Direction of Oil Research (belonging to the Ministry of Mine and Geology). The technical control of oil setups is performed by the National Direction of Hydrocarbons (belonging to the Ministry of Energy and Hydraulics). This direction is also responsible for addressing the country's need for oil products and is in charge of issuing the certificates of conformity and validation for the establishment of gas stations and fuel storage tanks. The National Direction of Energy (belonging to the Ministry of Energy and Hydraulics) is responsible for the oil product sector. This includes the compilation of consumption figures, import statistics and overall information on sector-related policies.

The oil imports are managed by the Importing Committee consisting of representatives of oil companies, the ministries in charge of commerce and finance, the Central Bank and the Government. The role of the committee is to define the quantities to be imported and to process calls to tender in order to acquire oil products.

The storage of oil products is in the hands of the Guinean Oil Company (SGP). The company is responsible for handling, storage and wholesale shipping of oil products. Transportation and distribution are performed by oil companies (Totalfinal, Shell and Petrogui) and by private Guinean companies. The Ministry of Economy and Finance is responsible for the collection of various taxes and is heading the Importing Committee. The official retail prices are fixed by order of the Ministry of Commerce and Competitiveness. The Ministry of Mines and Geology promotes the exploration of potential oil resources. Activities in this direction started in 1974 with the establishment of the Société Guinéenne des Pétroles (SOGUIP – Guinea Oil Society). Up to now, these activities have brought no tangible results despite promising findings in bordering countries. At present, there are no proven oil reserves in Guinea.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Up to now, there is no institutional framework for Renewable Energies (RE). In general, however, the RE sector is subject to the same regulations as the other energy sectors. Thus, the energy sector policy document of 1992 (LPDSE 92) can be considered as the so far appropriate RE development policy framework in force in Guinea, also referring to RE related

5 SEE ALSO WEBSITE OF DROIT AFRIQUE WWW.DROIT-AFRIQUE.COM/INDEX.PHP/CONTENT/VIEW/104/220, AS OF 2009

6 SEE WEBSITE WORLD BANK: › COUNTRIES › AFRICA › GUINEA › PROJECTS & PROGRAMS › ALL PROJECTS (HTTP://WEB.WORLDBANK.ORG/EXTERNAL/DEFAULT/MAIN?MENUPK=351830&PAGEPK=141143&PIPK=399272&THESITEPK=351795), AS OF 2009

institutional aspects. A new policy document for the energy sector is being prepared (as of 2008[7]). It will be based on the new Electrification Master Plan that is under validation.

Since 2008, an energy sector development policy document is under preparation and validation. It is based on the achievements of the past few years resulting from major reforms in the energy sector and on the data compiled in the Electrification Master Plan. The DNEF is implementing several forestry programs and projects operating with wood energy components. It promotes natural vegetation development actions (moist forest and mangrove swamps), state controlled reforestation as well as community-based and private reforestation in order to enhance the production. On the political and statutory scale, the DNEF established a forestry policy document (in 1988) along with a six year Action Plan and Forestry Code[8] (in 1989), which are currently the major forestry resources' management tools (that need to be updated).

The Poverty Reduction Strategy Paper (PRSP)[9], passed in 2002, only considers the electric power sector in terms of basic infrastructures and accelerated economic growth. The proceeded PRSP revision is also an opportunity for the better consideration and integration of all energy sub-sectors (not only the electricity sector) within the PRSP in order to cope with the urgent demand for energy services and access in Guinea.

The ECOWAS Energy Services Access Program is part of the active membership of Guinea within the ECOWAS (Economic Community of West African States). With support of UNDP (through its Poverty Reduction Program (PREP), based in Dakar, Senegal) multisectoral consultations on the implementation of the objectives defined in the ECOWAS White Book in Guinea have been set up. At 20 September 2005, Order No 4545/MHE/SGG/2005[10] established the National Multisectoral Group (NMG) by defining its composition, its objectives and its attributes. The objectives of the NMG are defined as follows:

- Review the existing institutional and strategic framework for energy services and poverty reduction
- Analyze the national energy status in order to define an energy service access vision for Guinea
- Define the long-term objectives for energy services access at the national level
- Assess necessary investments

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

All regulations, incentives and legislative framework conditions are defined by the MEH and the **Decentralized Rural Electrification Office** (Bureau Electrification Rural Décentralisé – BERD). While the Ministry coordinates all energy sector specific regulations, the BERD executes a program designed to enhance the access to modern energy services in rural areas of Guinea. The project started in 2003 and was finished in December 2008.

Currently the emphasis of the Decentralized Rural Electrification Office is on training activities for private players operating energy services at decentralized sites. The training units consist of promotional activities, onsite technical capacity building and the provision of adequate calculation and management tools. So far, ten consulting companies and around twenty electrification operators were trained on RE projects' implementation. The overall incentives included the electrification of ten sites through "pico-diesel networks"[11] and the electrification of three sites via installation of PV solar kits. The PV incentive includes three service levels. The first level includes two solar lights (30 Wp), the second two lights plus one alternating current socket (60 Wp) and the third three lights plus one alternating current socket (90 Wp). Table 9 summarizes the RE achievements of Guinea.

TABLE 9

RE Achievements in Guinea

SYSTEM	IMPLEMENTED NUMBER	IMPLEMENTATION PERIOD	COST IN 1,000 USD	DONOR	OPERATING STATUS
Solar/photovoltaic	800 kWp	1984–2008	10,000	EU, WB GTZ , GTZ, R.W, USAID, RW	80 %
Biogas	92	1977–2004	59	China, EU, IEPF, Etat	30 %
Micro Hydro Power plant	2	1983–2004	2,500	North Korea, Canada	80 %
Wind pump	2	1990–2004	5	EU, MSF, China	60 %
Biomass (wood saving) – fuel saving oven		1992–2004	2,000	EU	85 %

Source: LPDSE, as of 2008

7 IDEACONSULT, AS OF 2008

8 DROIT AFRIQUE, AS OF 2009

9 IMF/GUINEAN GOVERNMENT, 2002; SEE ALSO LATEST PRSP VERSION: IMF/ GUINEAN MINISTRY OF THE ECONOMY, FINANCES AND PLANNING, AS OF 2007

10 DROIT AFRIQUE, AS OF 2009

11 THE TERM 'PICO' CHARACTERIZES A VERY SMALL DIESEL-BASED ELECTRICITY NETWORKS OR GRIDS.

Between 2004 and 2008, further incentives contributed significantly to the increase of RE utilization. This includes the implementation of 800 kWp at health care centers, solar pumping facilities, street lighting and some private households.

In the field of hydroelectricity, governmental incentives started feasibility studies at 13 target sites with a total capacity of 23.6 MW. The so called "hydraulic ram program" aimed at installing ten hydraulic rams to supply 5 m³ of water per day for the supply of villages with 500 inhabitants in Middle Guinea. This program was very promising in the beginning, but was finally shut down due to lack of sustainability.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

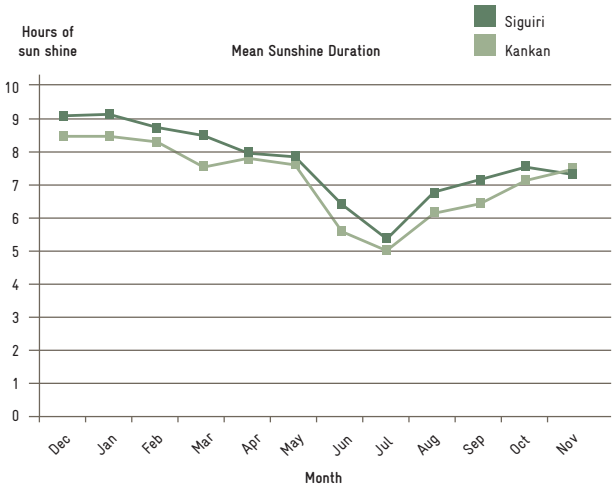
The biomass potential in Guinea is essentially based on wood energy. Despite the high predominance of fuel woods (wood and charcoal) in the energy balance of the country, its actual potential remains unknown. No comprehensive studies covering the whole national territory were conducted to assess the available potential. According to various estimations[12], the accessible volume is about 8.5 million to 14 million m³.

4.2 SOLAR ENERGY

The assessment of the Guinean solar power potential lacks a systematic and concise approach and structure. The information available indicates an average annual insolation at the rate of 4.8 kWh/m² per day and a mean sunshine duration of 2,700 hours per year (as almost encountered at the location of Kankan in High Guinea). The figures clearly demonstrate that the solar potential is considerable throughout the territory. Figure 10 provides information on the specific sunshine duration of Guinea.

FIGURE 10

Sunshine Duration in Guinea



Source: DNE/Bah, as of 2007

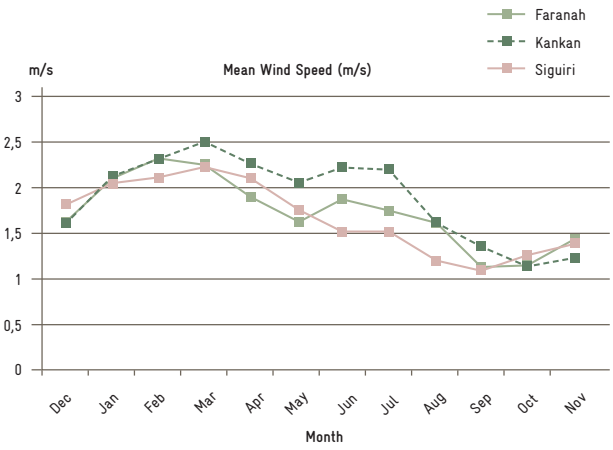
12 WORLD BANK/RPTES REPORT AND OTHERS

4.3 WIND POWER

The assessment of the Guinean wind power potential likewise lacks a systematic and concise approach. The data indicating the average annual wind velocity range from 2 to 4 m/s in Maritime Guinea and Middle Guinea. Such poor potential does not allow for overall exploitation. It is, however, possible to use wind energy for pumping systems using mechanic windmills. Figure 11 indicates the mean wind speed at different sites.

FIGURE 11

Mean Wind Speed (m/s)



Source: DNE/Bah, as of 2007

4.4 HYDRO POWER

Guinea has a considerable Hydro Power potential of about 6,000 MW that corresponds to an annual ensured production capacity of 19.300 GWh. Up to now, only 2 % of the available potential is being exploited. The regional distribution of the national Hydro Power potential is presented in Table 10. Table 11 presents the distribution of actual Hydro Power production sites. Figure 12 indicates the location of Hydro Power production sites.

TABLE 10

Regional Distribution of the Hydro Power Potential

REGION	CAPACITY (MW)	%
Maritime Guinea	2,800	47 %
Middle Guinea	2,600	43 %
High Guinea	500	8 %
Forested Guinea	100	2 %
Total	6,000	100 %

Source: LPDSE, as of 2008

The Hydro Power potential is high throughout the whole of Guinea. Potential sites are classified below according to their related expected productive power:

- Four sites with a potential productive power exceeding 200 MW: Amaria (665 MW), Souapiti (515 MW), Koukoutamba (281 MW), Kaleta (240 MW)
- Three sites with a potential power of 150 MW to 200 MW
- Ten sites with a potential power of 100 to 150 MW

- Sixteen sites with a potential power of 50 to 100 MW
- Forty-eight sites with a potential power of 10 and to MW
- Thirty-seven sites with a potential power under 10 MW

TABLE 11
Distribution of Hydro Power Production Sites

REGION	NUMBER OF SITES	TOTAL CAPACITY (kW)
Middle Guinea	53	18,510
Forested Guinea	33	19,150
Maritime Guinea	28	15,610
High Guinea	16	4,220
Total	130	54,490

Source: LPDSE, as of 2008

5 MARKET RISKS AND BARRIERS

The lack of appropriate institutional framework is one of the major risks constraining the development of the RE market. At present, the sector's development remains highly dependent on the establishment of an intervention framework promoting private operators' involvement. Consequently, approval of a new LPDSE taking into account the whole of the current reference frameworks (PSRP, MDGs, PDE, ECOWAS, etc.) is a must to secure the sector's future. In addition, the political stability of the country also represents a risk constraining the country's economic growth in general and the energy sector's growth in particular. The development of the RE market is constrained by several factors:

- Institutional constraints: The energy sector's institutional frame does not authoritatively take RE into account. It is, however, expected that its current development will overcome this constraint.
- Financial constraints: Due to the lack of appropriate financing mechanisms, access costs for RE, namely solar equipment (initial investment), remain very high.
- Fiscal constraints: Currently, there are no fiscal incentives supporting RE.
- Socioeconomic constraints: The overall income level is rather poor.

In order to promote and encourage investments in the major development objectives, Guinea has established an investment code (Law L/95/029/CTRN of 6/30/1995). This law stipulates that anybody is allowed to take up commercial, industrial, mining, farming and service provision activities in the territory of the Republic of Guinea as long as the activities comply with the laws and regulations of the Republic. With regard to exchange regulations, the code guarantees investors the possibility to transfer their profits in convertible currency to any destination of their choice. The investment code also protects private investments against any expropriation attempts for nationalization purposes. In addition to those guarantees offered to private investors, the code provides major fiscal benefits (e.g. exemption in the first year of investment, reduction of tax base etc.) for investments in priority fields and areas targeted by the code. Table 12 presents Guinea's position within the Ease of Doing Business ranking.

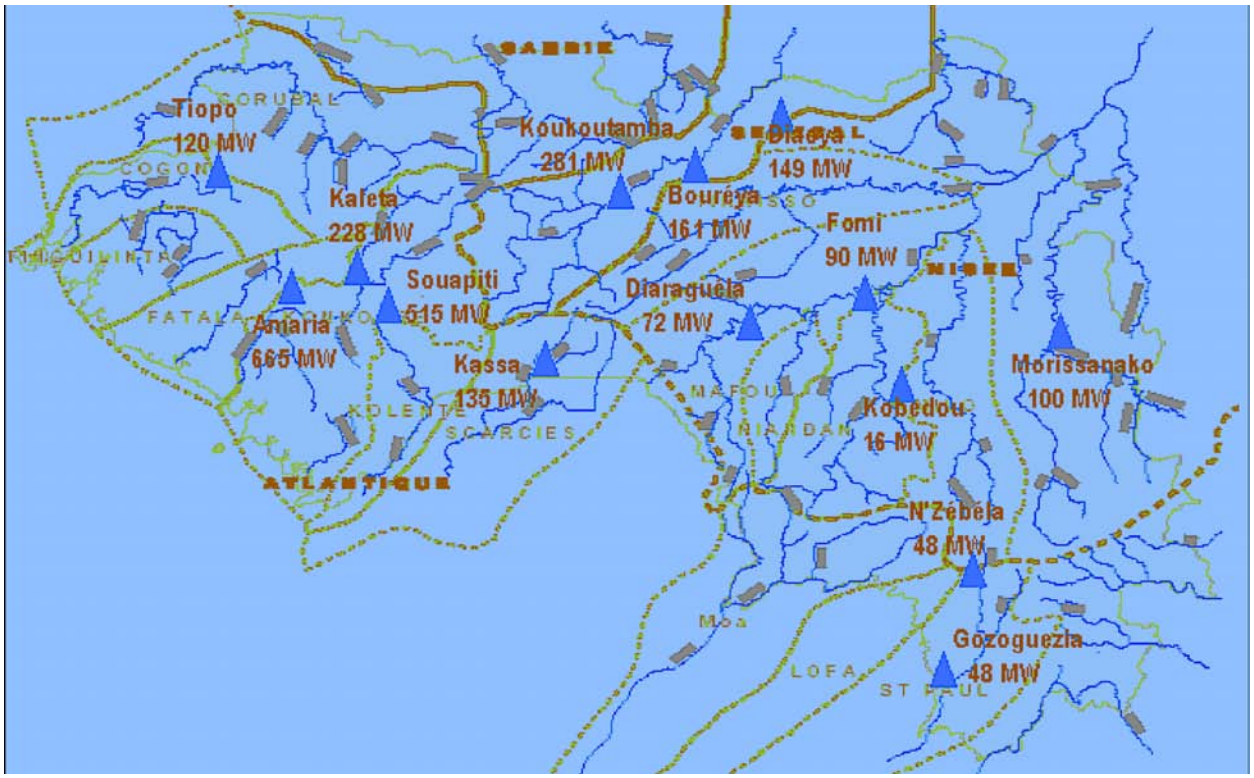
TABLE 12
Ease of Doing Business Ranking

SELECTED INDICATOR	RANKING
Doing business	171
Starting a business	177
Dealing with construction permits	162
Employing workers	114
Registering property	157
Getting credit	163
Protecting investors	170
Paying taxes	168
Trading across borders	110
Enforcing contracts	131
Closing a business	109

Source: World Bank Group/International Finance Corporation – IFC, as of 2009

FIGURE 12

Location of Hydro Power Production Sites



Source: LPDSE, Cartographies Potential Hydro Power Dams in Guinea, as of 2008

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

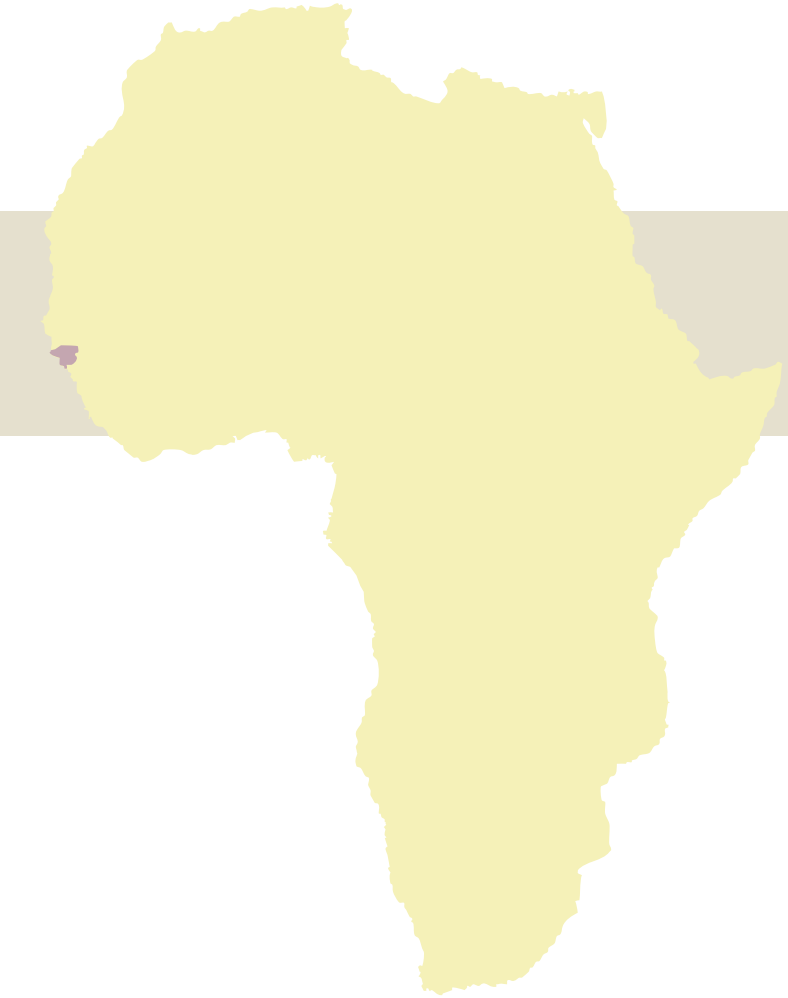
TABLE 13

Key Actors in the Field of Energy in Guinea

INSTITUTION	ADDRESS	PROFILE
Ministry of Hydraulics and Energy – MEH	BP 1217 Conakry, Guinea Phone: +224 30 45 10 65 Fax: +224 30 45 10 71	Administrative authority responsible for the institutional management of the entire energy sector
The Rural Electrification Decentralized Office – BERD	Villa 30 Cité des Nations BP 3186 Conakry, Guinea Phone: +224 30 43 14 98 Fax: +224 30 43 15 08 nava.toure@berd.org.gn	A project funded by the World Bank, the GEF and the Guinean Government designed to implement decentralized rural electrification strategies
Electricité de Guinée – EDG	B.P : 1463 Conakry, République de Guinée Tel : +224 – 60-59-88-28 ou 30-45-43-09 ou 60-25-75-23 ou 60-25-27-57 ou 60-25-31-20	Public corporation in charge of public electric power service throughout Guinea
SES	BP 2952, Conakry, Guinea Phone: +224 60 22 18 76 sesplus.guinee@yahoo.fr	Private company involved in solar equipment sale
Guinea Solar	n.a.	Private company involved in solar equipment sale
AGUIPER	n.a.	Guinean Association for the promotion of RE
TOPERGUI	n.a.	Rural electrification lease holder

7 BIBLIOGRAPHY

- CEDEAO (2005): Monographie Pays/Etude CEDEAO: Cas de la République de Guinée – Rapport Final, by Ousmane Bah (Conseiller à la DNE)
- Central Intelligence Agency – CIA (2009): World Fact Book. Guinea (www.cia.gov/library/publications/the-world-factbook)
- Direction Nationale de l'Energie – DNE(2007): Thème 4 – Les Énergies Renouvelables dans le Développement du Secteur Énergétique de la Guinée – Stage de Formation sur l'Utilisation des Énergies Renouvelables pour le Développement Durable, Conakry
- Direction Nationale de l'Energie – DNE (2006): Projet de Déclaration de Politique Générale de Développement du Secteur de l'Énergie de la République de Guinée
- Direction Nationale de l'Énergie – DNE (2005): Memorandum à l'Attention de Madame le Ministre de l'Hydraulique et de l'Énergie sur les Études du Plan Directeur d'Électrification et du Projet d'Électrification Rurale, by Fodé Moussa Soumah
- Direction Nationale de l'Énergie – DNE (2004): Evaluation Interne du Programme d'Appui National pour l'Économie du Bois Énergie – Avril 2004 – DP N°3 – Rapport Final, by Ousmane Bah
- Droit Afrique (2009): Guinée (www.droit-afrique.com/index.php/content/view/104/220)
- Électricité de Guinée – EDG (2005): Annual Report
- Government of Guinea (1995): Law L/95/029/CTRN of 6/30/1995
- IDEACONSULT (2008): LPDSE - Lettre de Politique de Développement du Secteur de l'Énergie
- International Monetary Fund – IMF/Guinean Government (2002): Poverty Reduction Strategy Paper: Republic of Guinea, January 2002 (www.imf.org/External/NP/prsp/2002/gin/01/013102.pdf)
- International Monetary Fund – IMF/Guinean Ministry of Economy, Finance and Planning – Permanent Secretariat on Poverty Reduction Strategy – SP-SRP (2007): Poverty Reduction Strategic Paper DSRP2 (2007–2010)
- Mody Amadou Oury Barry (2007): Évaluation des Besoins pour l'Atteinte des OMD en Guinée – Secteur Ciblé: ENERGIE – Rapport évaluation des Coûts
- United Nations Development Programm – UNDP (2003) Human Development Report 2003. Africa (www.africaaction.org/docs03/hdr0307.htm and www.undp.org/hdr2003)
- United Nations Development Programm - UNDP (2009): Human Development Report 2009. Guinea HDI Rank – 170 (http://hdrstats.undp.org/en/countries/data_sheets/cty_ds_GIN.html)
- United Nations Development Programm – UNDP (2004): Rapport National sur le Développement Humain (RNDH). Guinée.
- World Bank Regional Program on Traditional Energy Sector – RPTES (1998): Final Report Guinea
- THIAM (2006): Monographie – Pays (Guinée Conakry) – Draft Version.
- World Bank (2009): Guinea. All Projects (go: > Countries > Africa > Guinea > Projects & Programs > All Projects; or: http:// web.worldbank.org/external/default/main?menuPK=351830&pagePK=141143&piPK=399272&theSitePK=351795)
- World Bank Group/International Finance Corporation – IFC (2009): Doing Business. Measuring Business Regulations (www.doingbusiness.org)



COUNTRY CHAPTER: GUINEA-BISSAU

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ACRONYMS AND ABBREVIATIONS

GUINEA-BISSAU

AD	Action for Development
AUDCG	Acte Uniforme Relatif au Droit Commercial General (Uniform Act on General Commercial Law)
BCEAO	Banque Centrale des États de l'Afrique de l'Ouest (Central Bank of West African States)
CFAF	CFA Franc (1 Euro = 655,957 CFAF)
DGE	Direction Générale de l'Énergie (General Direction of Energy)
EAGB	Electricidade e Águas de Guinea-Bissau (Electricity and Water Company of Guinea-Bissau)
GDP	Gross Domestic Product
INEC	Instituto Nacional de Estatística e Censos (National Institute of Statistics and Census)
LPG	Liquefied Petroleum Gas
OHADA	Organisation Pour l'Harmonisation en Afrique du Droit des Affaires (Organization for the Harmonization of Business Law in Africa)
PRS	Poverty Reduction Strategy
PV	Photovoltaic
RE	Renewable Energy
SIE	Système d'Information Énergetique (Energy Information System)
TEC	Common External Tariff
UEMOA	Union Économique et Monétaire Ouest Africaine (West African Economic and Monetary Union)

MEASUREMENTS

°C	degree Celsius
€	Euro (1 Euro = 655.957 Francs CFA)
GWh	gigawatt hour (1 GWh = 1,000,000 Kilowatt hours (kWh))
h	hours
km²	Square kilometer
ktoe	kilotons of oil equivalent (= 1,000 toe)
kVAh	kilovolt ampere hour
kWh	kilowatt hour
kWp	kilowatt peak
m/s	meters per second
m^2	square meter
m^3	cubic meter
mm	millimeters
MW	megawatt (1 MW = 1,000 kW)
toe	tons of oil equivalent

SUMMARY

The Country Study of Guinea-Bissau is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Guinea-Bissau. The study is structured as follows:

Chapter one provides **Background Information on Guinea-Bissau.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Guinea Bissau.

Chapter two summarizes facts and figures of **Guinea-Bissau's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Guinea-Bissau. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Guinea-Bissau.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

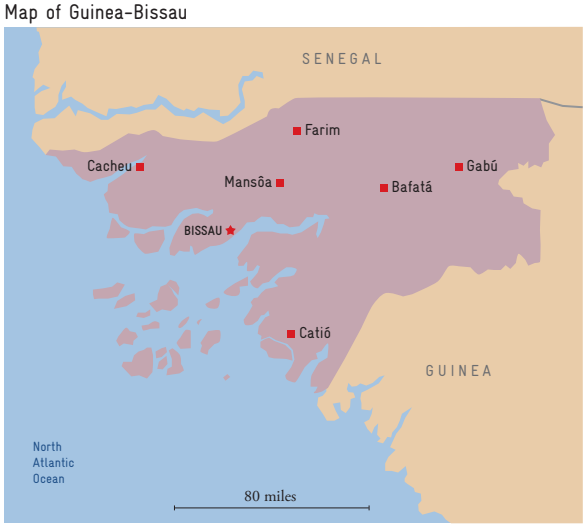
Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Guinea-Bissau.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Guinea-Bissau is located in West Africa and limited by the Atlantic Ocean, Senegal and the Republic of Guinea. The total area is 36,125 km² with approximately 28,000 km² constituting the continental part. Offshore, there are about sixty small islands of which the archipelago of Bissagos is the most important one.

FIGURE 1:
Map of Guinea-Bissau



With the exception of the islands, Guinea-Bissau is dominated by a marshy coastal plain. The relief rises gradually towards the East and forms a shelf culminating in 360 meters of altitude in the South East. Numerous rivers flow from West to South and form vast estuaries at their mouth. Many of them are navigable and constitute the principal means of transport. The country is subject to a hot and wet tropical climate, with annual average temperatures of around 25 °C. From one season to another, the variation of temperature is not very significant.

The rainy season lasts from June to November with wind blowing from South West; the annual average precipitation is around 1,200 mm. The dry season extends from December to May with Harmattan blowing from the North East.

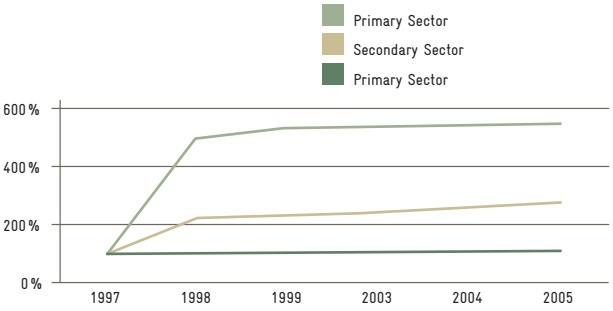
1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The former Portuguese colony of Guinea-Bissau gained its independence in 1974. Since then, several political changes have occurred in the country. In order to comply with human rights, the National Assembly approved of a package of constitutional amendments in line with the guarantee of fundamental rights in February 1993. But respect for these rights by the elements in power is not always the case. In August 1991, the Guinean League of Human Rights was established.

According to the National Institute of Statistics and Census (INEC), the population of Guinea-Bissau is estimated at 1,366,412 inhabitants with a population density of 34 inhabitants per km². The country counts approximately 1,500 villages, mainly with dispersed habitat. Guinea-Bissau consists of five major ethnic groups. The Balantes represent approximately 30 % of the population, the Fula 20 %, the Mandjac 15 %, the Mandingo 13 % and the Pepels 8 %. The language mostly used in Guinea-Bissau is Portuguese Creole, however the official language is Portuguese.

The economy of Guinea-Bissau mainly depends on the primary sector. The agricultural potential of the country is enormous and accounts for almost 62 % of Gross Domestic Product (GDP). More than 90 % of the exports and the employment of 550,000 people are related to this important sector. Agriculture is dominated by the production of rice and cashews. Another important source of income is the fishing sector exporting about 500 million tons per year thus accounting for 7,500,000 Euro. Figure 2 illustrates the GDP development within the last few years.

FIGURE 2
GDP by Sector (in Mio €)



Source: National Institute of Statistics and BCEAO Guinea-Bissau, as of 2005

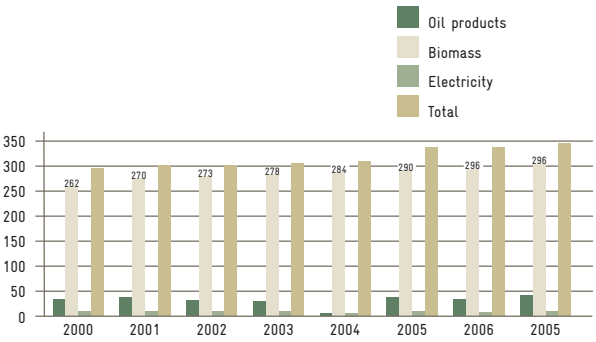
2 ENERGY MARKET IN GUINEA-BISSAU

2.1 OVERVIEW OF THE ENERGY SITUATION

The energy sector in Guinea-Bissau is divided in three parts, i. e. the electricity sub-sector, the petroleum sub-sector and the biomass sub-sector. In 2007, according to the Guinea-Bissau energy balance, the final total consumption of the country was 345,000 toe with biomass consumption as the dominant factor. Figure 3 presents the final energy consumption and the related energy sources.

FIGURE 3

Final Energy Consumption by Type of Energy (1,000 toe)



Source: SIE, Guinea-Bissau, as of 2008

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

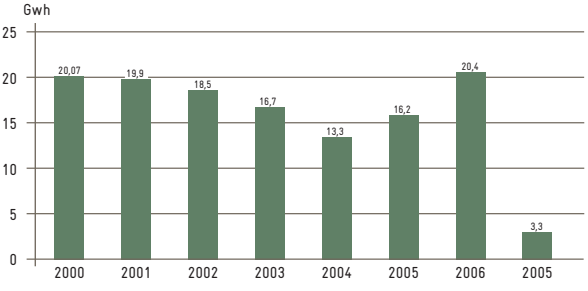
Guinea-Bissau's infrastructures of electricity production are in a bad state and the capacity is very insufficient. There is a considerable lack and malfunction of infrastructures for electricity production. The electricity production of Guinea-Bissau is thermal-based (diesel) and is based on a major thermal power plant in Bissau (with a capacity of 17.5 MW) as well as on secondary production centers (with a capacity of about 7 MW) operating in the center of the country. The peak capacity is estimated at 20 MW (figure 4). In 2006, the availability of the power station of Bissau did not exceed 3.9 MW. Today, the available capacity is 5.5 MW.

During 2002–2007, the electricity access rate decreased due to insufficient and disordered production and distribution infrastructures. Figure 5 presents the evolution of the electricity access rate.

As to electricity prices, Guinea-Bissau has the most expensive tariffs in the region. Current prices are indicated in Table 1.

FIGURE 4

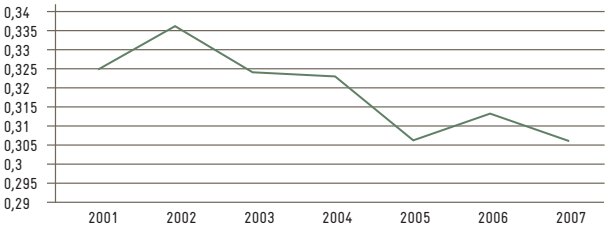
Electricity Production



Source: EAGB, as of 2007

FIGURE 5

Evolution of the Electricity Access Rate



Source: EAGB, as of 2007

TABLE 1

Electricity Tariffs

TARIFFS FOR HOUSEHOLDS				
Level	kWh	Price/kWh in CFAF (1 Euro = 655.957 CFAF)	Price/KVAH in CFAF	Power Tax CFAF
1	0–50	78		1,000
2	51–200	161		2,000
3	>200	322		2,100
TARIFFS FOR GOVERNMENTAL OFFICES, SHOPS, ETC.				
With meter	>0	255	48	6,400
Without meter	>0	320	48	6,400
TARIFFS FOR INDUSTRY				
Single	>0	165	50	50,000

Source: EAGB, as of 2008

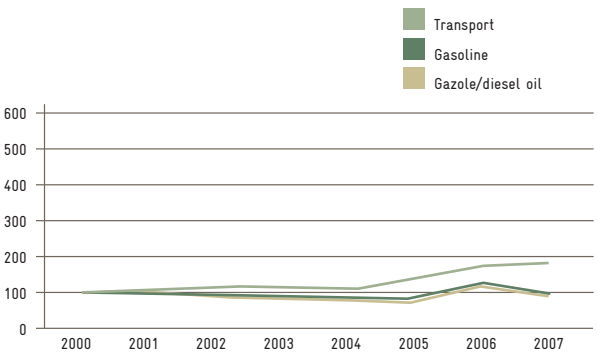
Petroleum Sector

Guinea-Bissau has not proven oil reserves. Therefore, all petroleum products are imported thus charging the country's economy with high expenses. According to the energy balance of 2007, the consumption of petroleum products is mainly dominated by the transport sector (40,614 ktoe), followed by electricity production (0.946 ktoe) and the residential sector (0.240 ktoe). The evolution of consumed petroleum products in the transport sector is presented in Figure 6.

Prices of petroleum products are determined by the Ministry of Energy and Industry and are to be revised on a monthly basis. Table 2 presents the prices of petroleum products.

FIGURE 6

Evolution of Petroleum Product Consumption in the Transport Sector



Source: SIE, Guinea-Bissau, as of 2008

TABLE 2

Prices of Petroleum Products (March 2008–February 2009)

As of:	PRODUCT (PRICES IN CFAF) (1 EURO = 655.957 CFAF)					
	Diesel	Diesel Electricity Generation	Gasoline	Kerosene	Gasoline	LPG
20/03/08	569	452	670	455	524	776
20/06/08	729	575	801	606	600	776
10/08/08	696	540	777	577	580	776
14/11/08	570	433	609	475	480	776
19/12/08	542	410	609	401	472	776
12/02/09	500	375	545	348	440	776

Source: Ad Hoc Committee for Oil Products Prices of the Ministry of Energy and Natural Resources,as of 2009

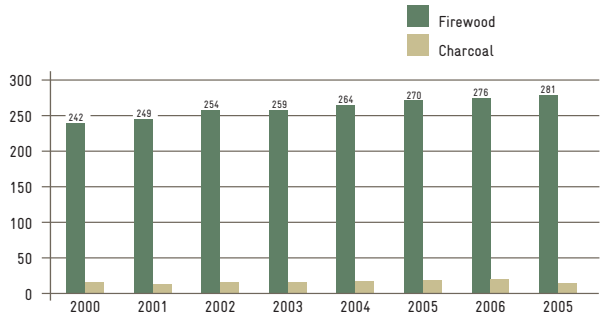
Biomass Sector

The biomass represents over 95 % of the total energy consumed by households in Guinea-Bissau. Wood is the dominant fuel with a demand that exceeds 500,000 tons per year, followed by charcoal being the most-used fuel in the capital. The quantity of the biomass used is around 738,000 tons.

The price of wood varies according to the demand and requested amount. Charcoal is sold by bag or measure for about 0.10 Euro.

FIGURE 7

Biomass Consumption (1,000 tons)



Source: SIE, Guinea-Bissau, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

In Guinea-Bissau, the energy sector is under the supervision of the Ministry for Trade, Energy, Industry and Environment also in charge of the definition of any policies in the overall sector and the promotion of RE.

A General Direction of Energy (DGE) is in charge of the execution of this policy. Its tasks are the elaboration of the legal and regulatory orders in the energy field and the control of their application. It is also entrusted with the realization of prospective studies, the promotion of new technologies and the follow-up of the studies of installation. Within the DGE, the service of RE is the executive body in charge of all activities related to these energy resources.

The electric system of Guinea-Bissau is managed by the Electricity and Water Company of Guinea-Bissau (Electricidade e Águas de Guinea-Bissau – EAGB). Within the existing market structure, there are several private energy producers in Guinea-Bissau. Self-sufficient producers of electricity are also feeding part of their production into the distribution network of EAGB.

As to forest resources and domestic fuels, the overall sector is controlled by the Directorate General of the Forests supervised by the Ministry for Rural Development and Agriculture.

The development of local energy resources is controlled by the National Institute on Research and Applied Technologies under the supervision of the Ministry for Natural Resources. At the regulatory level, the Ministry of Energy delivers import and export licenses for all types of energy products and technologies.

For the overall regulation aspects, a multisector regulation unit is currently being planned. This authority will control the telecommunication sector, harbor activities and the overall transport sector. In a next step, the integration of the electricity sector in this very unit is planned.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Up to now, Guinea-Bissau does not have any explicit Renewable Energies (RE) policies. Even though a draft was developed by the Government as early as 2004, the document has not been adopted yet. Furthermore, a strategic plan for RE was elaborated during 2004–2008. Due to a lack of funds, it has not been implemented yet.

At the regional level, the Common External Tariff (TEC) of the West African Economic and Monetary Union (UEMOA) was established in 2000. Within this union, there is no promising tax incentive for RE yet. Recently, UEMOA started to review the situation and is now moving towards the implementation of tax incentives that are more favorable to the development of RE. UEMOA is committed to encouraging and developing the use of RE in all member states. Therefore, it is expected that UEMOA will establish various incentives to support the sustainable development of energy supply.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Up to now, there are no regulations, incentives and legislative framework conditions that support the implementation of RE in Guinea-Bissau. As to rural electrification, it is planned to create ambitious regulations that allow private operators to conduct business in this sector thus offering promising opportunities for the utilization of RE.

The Governmental body in charge is the Directorate General for Energy. Up to now, however, all projects and incentives in the field of RE were realized by the investors without any involvement of the Ministry of Energy or the Directorate General for Energy. No permissions are currently required to develop RE projects. In terms of feed-in tariffs and other necessary regulations, there are no laws or regulations at all.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The forest areas of Guinea-Bissau are estimated at about two million hectares. The available amount of biomass is about 48.3 million m³. The annual consumption of wood for energy purposes is estimated at 625,000 m³ and leads to a significant reduction of existing forest areas. The available biomass potential from agricultural products, wood processing residues and livestock manure is about 67,000 m³ per year. In terms of bio fuel production, there is a potential of about 10,000 m³ from cashew and about 20 hectares of jatropha plantations.

4.2 SOLAR ENERGY

Guinea-Bissau has an important solar radiation: 4.5 to 5.5 kWh/m²/day over an average of 8 hours per day (3,000 h of insulation per year). In spite of this promising potential, up to now merely 450 kWp of PV installations are being used for communication networks, water pumping stations and house lighting. The Government plans to significantly increase the utilization of PV in order to cover up to 2% of the overall energy consumption by 2015. Table 3 presents an overview of existing PV installations.

TABLE 3

Existing PV Installations in Guinea-Bissau

SITE	FUNDER	UTILIZATION
Bafata and Gabu	PRS	Pumping and lighting
Bafata and Gabu	PRSII	Pumping and lighting
Bissau Bissau/Hop.Raoul	PRSII	Lighting
Rural Area	PRSII	Lighting
Rural Area	PRSII	Pumping
Rural Area	PRSII	Pumping
Bissau	Guinean Telecom	Communication

Source: compiled by Julio Antonio and the author, as of 2008

4.3 WIND POWER

The average wind speed is estimated at 2.5 to 7 m/s along the coast and on some of the islands. Even though there is a very promising potential, there is no mentionable utilization of wind power in Guinea-Bissau so far.

4.4 HYDRO POWER

The available Hydro Power potential of Guinea-Bissau is estimated at about 184 MW from the rivers Corubal and Geba. Even though there is a very promising potential available, up to now there is no mentionable utilization of Hydro Power in Guinea-Bissau.

5 MARKET RISKS AND BARRIERS

The lack of consistent policies in the field of RE is the most critical of all existing market risks and barriers. Furthermore, the weakness of industrial and private sectors, together with a lack of clear direction and leadership from Governmental institutions is blocking the development of RE in Guinea-Bissau. Therefore, it is important to create a favorable environment for the private and industrial sector in order to enable them to operate effectively and encourage them to expand their investments in RE projects. The most critical technical barrier is the lack of accurate data on available RE resources.

As to necessary investments, Guinea-Bissau has no incentives or benefits in order to attract potential investors. The political instability after the civil war is still discouraging national and international investments. Other substantial risks and barriers include corruption, high costs, insufficient human resources and the absence of a coherent institutional and regulatory framework.

The foundation of a company in Guinea-Bissau is not very difficult. The OHADA Uniform Act on general commercial law (Acte Uniforme Relatif au Droit Commercial General – AUDCG) regulates the exploitation and trade of natural resources as well as intermediate operations. In the specific activities related to RE sub-sector, the exercise of commercial activities requires a license or a permit issued by the Government. This license is granted for a period of 10 years and it is automatically renewed as long as prerequisites are met. The granted period for the permit is 5 years following the same renewal conditions.

Concerning foreign investment, the Investment Code of Guinea-Bissau was created in 1991 and amended in 1996. Due to the Investment Code, individuals and legal entities from all nations around the world are invited to make investments in the country. The Investment Code of Guinea-Bissau guarantees that there are no restrictions for foreign investment and no obligation to employ local staff. Moreover, the equal treatment of companies, the freedom of commercial management and easy capital transfer procedures are guaranteed.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

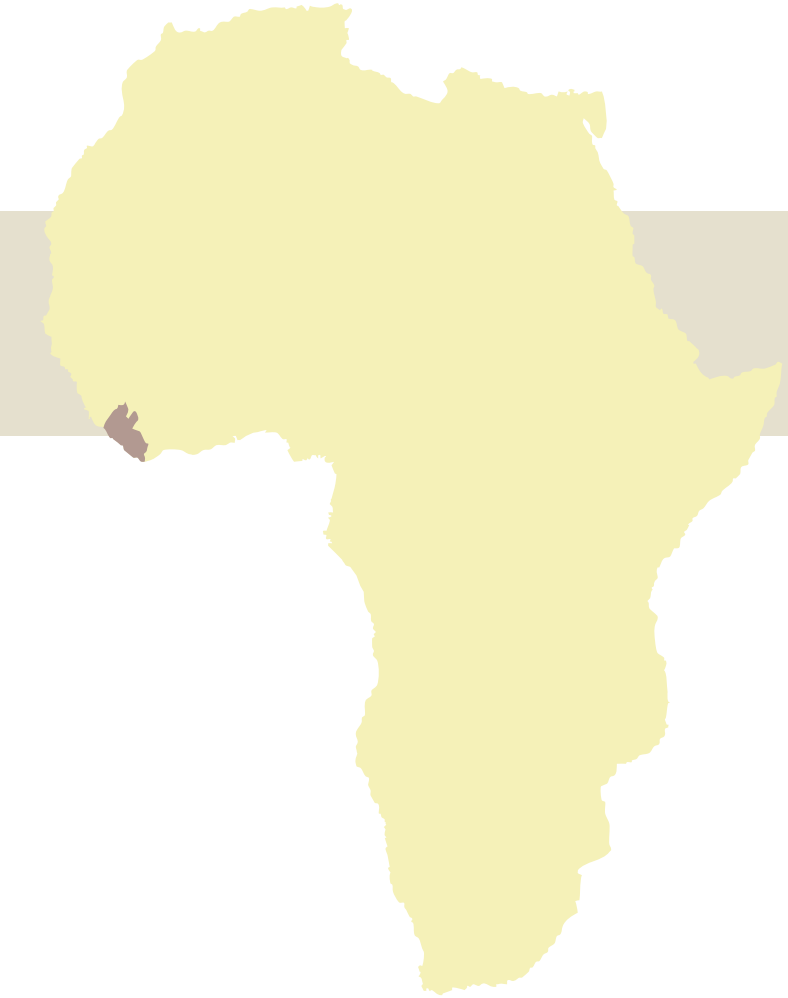
TABLE 4

Local Business and Trade Partners

NAME	ADDRESS	FIELD OF ACTIVITY
Associação Comercial, Industrial e Agrícola a Guiné-Bissau (Commercial Association of the Industrial and Agricultural Sector)	B. P. 88, Bissau Phone: +245 22 30 84	Commercialization of the industrial and agricultural sector
Action for Development (AD)	Phone: +245 251 365 ad@sol.gtelecom.gw	Promotion activities for solar energy
Direcção General dos Geologia e dos Minas (General Direction for Geology and Mines)	B. P. 399, Santa Luzia Phone: +245 222 329	Regulation of the mining sector
Direction Général de l Énergie (DGE)	Phone: +245 664 43 47 Bissau	Energy policy
Electricidade e Águas de Guinea-Bissau (Electricity and Water Company of Guinea-Bissau – EAGB)	Rua Eduardo Mondlane Bissau Phone: +245 20 11 84	Production and distribution of electricity
Empresa Distribuidora de Combustivos e Lubrificantes	B. P. 3, Bissau Phone: +245 201 262	Distribution of fuels and lubricants
Institut National de la Recherche et Technologie Appliquée (National Institute on Research and Applied Technologies)	Rua da Guinea-Bissau Bissau Phone: +245 22 20 80	Research
Ministry of Agriculture and Rural Development	B. P. 71, Bissau Phone: +245 221 200	Domestic energy policy management
Ministry of Energy and Industry	B. P. 311, Bissau Phone: +245 21 5659 245	Regulation of the energy and industry sector
Secretaria de Estado da Energia, dos Recursos Naturais e do Ambiente (State Secretary for Energy, Natural Resources and Environment)	B. P. 399, Bissau Phone: +245 22 19 25	Energy, environment and natural resources

7 BIBLIOGRAPHY

- BCEAO, Guinea-Bissau (2005): Various publications
- International Monetary Fund – IMF/Ministry of Economy, Republic of Guinea Bissau (2007): Guinea-Bissau: Poverty Reduction Strategy Paper (PRSP)
- C. Boccaletti, G. Fabbri, J. Marco, E. Santini (2008): An Overview on Renewable Energy Technologies for Developing Countries: The Case of Guinea-Bissau (www.icrepq.com/icrepq-08/295-boccaletti.pdf)
- DGI/Guinea-Bissau (2004–2008): Strategic Plan on Energy Sector
- Direction General of Energy of Guinea-Bissau (years unknown): Various documents of projects and programs, rapports and texts
- ECOWAS (2005): White Paper on Access to Energy Services
- Encyclopédie Microsoft Encarta (2004): Guinée-Bissau, Pour la Partie Historique
- ENDA (2005): Country monograph
- ENDERS, Armelle (1994): Histoire de l'Afrique Lusophone, Paris, Éditions Chandeigne
- Energy Information Administration (2006): West Africa (ECOWAS)
- Issa Mare DIAW (2004): Situation et Évolution du Secteur de l'Énergie en Afrique de l'Ouest/Régulation dans le Contexte du Système d'Échanges d'Énergie Électrique Ouest Africain", 2nd Global Regulatory Network Conference Bamako, Mali, 26–27 July 2004
- Ministry of Environment (1999): Initial National Communication on Climatic Changes
- Ministerio das Finança, Gabinete do Ministro (2007): Despacho No. 48/07
- M. Boubacar Issa Abdourhamane (without year): Politique Institutionnelle en Guinée-Bissau, CEAN, IEP Université Montesquieu-Bordeaux IV (last viewed in August 2009 (www.etat.sciencespobordeaux.fr/institutionnel/gbissau.html)
- National Institute of Statistics (2005): Various publications
- Ogunalde Davidson (2008): Scaling Up Market for Renewable Energy in Africa, Thematic Background Paper for International Conference on Renewable Energy in Africa, Dakar, Senegal
- Orlando MENDES (2007): Agro Climatologie de la Production de l'Anacardier en Guinée-Bissau, Agrhymet
- Performance Management Consulting (2008): Rapport Définitif sur l'Étude pour l'Élaboration d'une Stratégie Durable de la Résolution de la Crise Électrique au Sein des États Membres de l'UEMOA
- PREDAS (2004): Stratégie Energie Domestique de Guinée-Bissau, Bissau
- Rapport National d'Investissement Guinée-Bissau (2008): Conférence de Haut Niveau sur l'Eau pour l'Agriculture et l'Énergie en Afrique: Les Défis du Changement Climatique, Syrte, Jamahiriya Arabe Libyenne, 15–17 Décembre 2008
- RECIPES: Developing Renewables (2006): Country Energy Information, Guinea-Bissau
- Réunion Annuelle ICA (2008): Point sur la Production de l'Énergie Électrique en Afrique
- Tabucci, Antonio (2000): Suspecte Lusophonie, Le Monde, Paris
- Bernard Krief Consultants (2006): Country Profile Guinea-Bisseau. Investment Conference in Construction & Civil Engineering Central & West Africa (www.africonstruct.org/.../studies/Sector_Profile_Guinea_Bissau.pd)



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ACRONYMS AND ABBREVIATIONS

LIBERIA

CBL	Central Bank of Liberia
CPA	Comprehensive Peace Agreement
EC	European Commission
EE	Energy Efficiency
EPA	Environmental Protection Agency
EPP	Emergency Power Program
FDA	Forestry Development Authority
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoL	Government of Liberia
IMC	Inter-Ministerial Committee
IMPTC	Inter-Ministerial Petroleum Technical Committee
IPRS	Interim Poverty Reduction Strategy
LACC	Liberia Anticorruption Commission
LCC	Liberia Chamber of Commerce
LEAP	Liberia Energy Assistance Program
LEC	Liberia Electricity Corporation
LIBA	Liberia Business Association
LPG	Liquefied Petroleum Gas
LPRC	Liberia Petroleum Refining Company
MIC	Ministry of Industry & Commerce
MLME	Ministry of Lands, Mines and Energy
NEP	National Energy Policy
NIC	National Investment Commission
NTGL	National Transitional Government of Liberia
PPP	Public-Private Partnership
PRS	Poverty Reduction Strategy
PST	Petroleum Storage Terminal
PV	photovoltaic
RE	Renewable Energy
RESCos	Rural Energy Service Companies
RFTF	Results Focused Transitional Framework
RREA	Rural and Renewable Energy Agency
SME	Small and Medium Enterprise
UN	United Nations
UNDP	United Nations Development Program
USD	United States Dollars
WAPP	West African Power Pool

MEASUREMENTS

°C	degree Celsius
dam^3	cubic decameter (1 dam^3 = 1000 m^3)
GWh	gigawatt hour
Kg	kilogramm
km	kilometer
km^2	square kilometer
kVA	kilovolt ampere
kW	kilowatt
kWh	kilowatt hour
kWp	kilowatt peak
m^2	square meter
m^3	cubic meter
mm	millimeter
MW	megawatt
yr	year

SUMMARY

The Country Study of Liberia is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Liberia. The study is structured as follows:

Chapter one provides **Background Information on Liberia**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Liberia.

Chapter two summarizes facts and figures of **Liberia's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Liberia. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions for other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Liberia.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Liberia.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Liberia is situated on the southwestern corner of the West Coast of Africa between longitudes 7°30' and 11°30' West and latitudes 4°18' and 8°30' North. The country is bounded by the Atlantic Ocean in the South, by Côte d'Ivoire in the East, by the Republic of Guinea in the North and by the Republic of Sierra Leone in the West. Liberia covers an area of 111,370 km^2 split into 15,050 km^2 of water and 96,320 km^2 of land. The total land boundaries extend to 1,585 km (Guinea 563 km, Côte d'Ivoire 716 km and Sierra Leone 306 km).

There are four tropical regions each with its own distinct physical features and height above sea level. The Coastal Plain stretches along the seacoast for 563 km. It consists of an almost unbroken sand strip rising up to 30 meters above sea level. The Coastal Plain flanked by a belt of flooded plateaus followed by a belt of high lands and rolling hills in the North and Northwest. The maximum elevation of Liberia is Mount Wutivi in the Northern highlands with a height of 1,350 meters. The average annual rainfall along the coastal belt is over 4,000 mm and declines to 1,300 mm at the forest/savanna boundary in the North. The relative humidity is generally high throughout the country.

FIGURE 1

Map of Liberia

There are four tropical regions each with its own distinct physical features and height above sea level. The Coastal Plain stretches along the seacoast for 563 km. It consists of an almost unbroken sand strip rising up to 30 meters above sea level. The Coastal Plain flanked by a belt of flooded plateaus followed by a belt of high lands and rolling hills in the North and Northwest. The maximum elevation of Liberia is Mount Wutivi in the Northern highlands with a height of 1,350 meters. The average annual rainfall along the coastal belt is over 4,000 mm and declines to 1,300 mm at the forest/savanna boundary in the North. The relative humidity is generally high throughout the country.

1 PRS, AS OF 2008

2 LISGIS, CWIQ, AS OF 2007

3 SEE ALSO UNITED NATIONS/WORLD BANK, AS OF 2005

4 IMF, AS OF 2007

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

After winning the 1997 presidential elections following an eight-year civil war, former President Charles Taylor did not manage to keep rebel groups from trying to oust him by force. Rebel attacks in Monrovia, coupled with two years of sanctions imposed by the UN crippled the Taylor-led Government, thus prompting Taylor's handing over power to his successor in August 2003. A transitional Government – composed of rebel factions, government, political parties and civil society groups – took control in October 2003 after the signing of the Accra Comprehensive Peace Agreement (CPA). Gyude Bryant, who had a two-year mandate to coordinate efforts to restore peace and rebuild Liberia, headed the transitional Government as its Chairman. Since then, Liberia has steadily been making progress towards political stability in conditions of peace and security. Successful multiparty presidential and legislative elections, held in October and November 2005, culminated in the formal inauguration of President Ellen Johnson Sirleaf and a new 94 member legislative body constituted by 14 political parties and 8 independent candidates in January 2006. Thanks to uninterrupted political and civil stability, the Government of Liberia (GoL) has been able to vigorously pursue an agenda of reconstructing post-war Liberia since 2006.

Liberia has a population of 3.5 million people. With a GDP of about 190 USD[1] per capita, Liberia is one of the poorest countries in the world. Poverty is pervasive, and is particularly acute in rural and remote areas of the country. 63.8 % of the country's population live below the poverty line[2]. Poverty has many dimensions, including low levels of income and consumption, poor nutrition and food security, low health and education indicators as well as inadequate infrastructure. It is reinforced by inequities, especially in access to juridical and economic opportunities.

The Government of Liberia has embarked on a number of national development initiatives with external assistance. These development initiatives have been structured around the Results Focused Transitional Framework (RFTF)[3] of February 2004–January 2006, the 150 Day Deliverables or Action Plan of February–June 2006 and the Interim Poverty Reduction Strategy (IPRS) of July 2006–June 2008[4], offering guidance to donor interventions as an addition to continuing programs and activities previously initiated on an emergency relief scope employing short-term recovery strategies.

In April 2008, the Government of Liberia finalized the Poverty Reduction Strategy (PRS) as a macro-economic policy framework document to guide socio-economic development activities and national reconstruction between 1 July 2008 and 30 June 2011. The PRS was designed around four major objectives: (i) consolidating peace and security, (ii) revitalizing the economy, (iii) strengthening governance and the validity of law and (iv) rehabilitating infrastructure and delivering basic services.

The Liberian economy is characterized by a structural imbalance between a modern enclave and the traditional sector. The modern sector basically depends on foreign investment and technological skill and is geared towards mining, rubber and forest products. Before the war, this sector accounted for 70 % of export earnings and almost 50 % of the Gross Domestic Product (GDP). The traditional sector, on the other hand, is rural based and relies in general on indigenous capital and rudimentary technology for subsistence agriculture supports and comprises nearly 70 % of the population. There is no connection between the two sectors whatsoever. The modern sector's link to the rest of the economy is generally weak and exists mainly in the form of profit sharing with the Government, the payment of royalties, income tax levied on employers and duties on imported materials in some instances.

2 ENERGY MARKET IN LIBERIA

2.1 OVERVIEW OF THE ENERGY SITUATION

The current energy market in Liberia is dominated by petroleum products imported in refined forms and traditional wood biomass consumed primarily for cooking and heating as in most Sub-Sahara African countries. The market for petroleum products is considered as formally institutionalized, while that of wood biomass is rather informal. Currently, there are no sufficient disaggregated data on the overall energy mix of Liberia in view of production and consumption.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

Before the civil war, the total installed electricity generation capacity – including the private sector – was about 412 MW. The Liberia Electricity Corporation (LEC) provided approximately 191 MW, while the concessionaires delivered 212 MW. The installed capacity of the rural electrification program totaled 13 MW and consisted of small isolated rural systems powered by plants ranging from 300 to 1,300 kW. All facilities were completely damaged during the 14-year civil war. Figure 2 presents the available electricity generation capacities before and after the civil war.

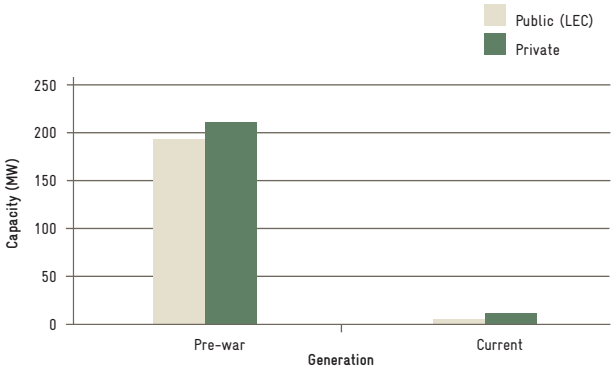
The LEC small scale operations started in late November 2003 after the inauguration of the National Transitional Government (NTGL) with the financial and fuel supply support of the European Commission (EC). They ended by the first week of April 2004 as a result of the LEC's inability to finance the fuel oil supply component of its operation. The high electricity theft rate in the LEC distribution network was the main reason for the utility's inability to sustain its operations. 22.6 % of the energy production could not be accounted for during the period January 1 to 31 March 2004[5].

Launched in 2006, the Emergency Power Program (EPP) was designed to re-establish public power supply in Monrovia and its immediate environs. The EPP initially installed a total power of 2.5 MW, which has now been increased to 9.6 MW. There is no generation capacity outside Monrovia besides privately owned generators and scattered donor-funded solar power pilot projects. A very large number of diesel generating units (ranging from 15–250 kVA) are in everyday use throughout the country. All institutions, agencies, commercial entities and a large number of private households generate their own electrical power. A combined capacity of small diesel units is conservatively estimated to be over 15 MW. There are no reliable data on the overall electrical energy consumption in Liberia as there are numerous privately owned generators of various capacities scattered across the country. Recently obtained production and consumption data from the LEC are presented in Table 1.

The current electricity tariff is fixed irrespective of consumer type (residential, commercial or industrial). Although only laid out to cover operational and maintenance costs, the current electricity prices are relatively high. Due to dependence on fossil fuel and fuel price instability, electricity tariffs have been ranging between 0.34 USD and 0.60 USD per kWh (based on fuel adjustment costs) since the inception of the EPP. Current tariffs stand at 0.43 USD per kWh. This price, however, is lower than the cost of self-generation, which is estimated at a minimum of 0.75 USD per kWh. Currently, there are no tariffs for RE implemented as RE projects still are in a rudimentary and non-commercial stage.

FIGURE 2

Pre-War vs. Post-War Electricity Generation (MW)



Source: Liberia Electricity Corporation (LEC), as of 2004-2008

TABLE 1

Annual Electrical Energy Production and Consumption (GWh)

Year	Energy Production	Energy Consumption
2004	1.95	1.51
2005	0.00	0.00
2006	2.05	1.64
2007	8.23	6.70
2008	11.25	9.16

Source: Liberia Electricity Corporation, as of 2004–2008

5 LEC ANNUAL REPORT, AS OF 2004

Petroleum Sector

Yearly volumetric imports of approximately 35.2 million US gallons consist mainly of gasoline, diesel fuel and to a lesser extent jet fuel and kerosene. Presently, a number of large and small vendors hold licenses to import and distribute petroleum products. Although the Liberia Petroleum Refining Company (LPRC) is the major player in the downstream petroleum sector, the wholesale and retail business is dominated by the private sector, namely West Oil Investment, Monrovia Oil Trading Company, Aminata & Sons, SRIMEX Enterprise, Origin Oil & Gas, TOTAL International, Gulf Trading Company and LIB-AFRIC. West Oil is the leading importer with a market share of about 34 % . Table 2 presents an overview of imports in the petroleum sector.

Local pricing of petroleum products in Liberia is subject to external fluctuations in the price of oil on the world market. Import tariffs, port handling charges and storage fees also affect the price of petroleum products. The current pump prices of gasoline, diesel and kerosene are 2.50 USD, 3.00 USD and 2.90 USD per US gallon respectively. Table 3 provides wholesale, distributor and pump prices of petroleum products between 1997 and 2005.

The use of kerosene and Liquefied Petroleum Gas (LPG) for heating and cooking is limited to a very small number of expatriate workers and wealthy Liberians who reside in Monrovia. The price per kg of LPG is about 2.5 USD.

TABLE 2

Annual Petroleum Imports in US Gallons

YEAR	GASOLINE	DIESEL	KEROSENE	JET-A1
2000	11,528,818	15,089,206	456,408	1,472,509
2001	9,961,590	15,299,071	260,011	1,119,020
2002	8,837,731	12,290,039	328,047	1,535,958
2003	7,209,339	10,797,827	435,446	2,025,402
2004	13,170,250	21,595,384	640,862	6,381,150
2005	17,107,913	24,657,097	644,046	6,115,622
2006	20,487,703	30,678,151	1,054,258	5,156,645

Source: Liberia Petroleum Refining Company (LPRC), as of 2006

TABLE 3

Comparative Petroleum Product Prices per US Gallon, 1997–2005

YEAR	GASOLINE			DIESEL			KEROSENE		
	Whole-sale	Distributor Price	Pump Price	Whole-sale	Distributor Price	Pump Price	Whol-sale	Distributor Price	Pump Price
2005	3.02	3.07	3.25	3.12	3.17	3.25	2.49	2.55	2.70
2004	2.39	2.45	2.60	2.44	2.50	2.65	2.49	2.55	2.70
2003	No data available								
2002	No data available								
2001	2.79	2.85	3.00	2.69	2.75	2.90	2.49	2.55	2.70
2000	2.12	2.18	2.30	2.12	2.18	2.30	2.12	2.18	2.30
1999	1.89	1.88	2.00	1.82	1.88	2.00	1.82	1.80	2.00
1998	1.58	1.64	1.75	1.58	1.64	1.75	1.58	1.64	1.75
1997	1.33	1.39	1.50	1.33	1.39	1.50	1.33	1.39	1.50

Source: LPRC Petroleum Storage Terminal (PST) Status Report, as of 2007

Biomass Sector

Traditional wood biomass (firewood and charcoal) is the primary energy source for cooking and heating. In 2004, it was estimated that over 95 % of the population relied on firewood, charcoal and palm oil for their energy needs[7]. According to the Central Bank of Liberia (CBL), the charcoal production amounted to 255,600 kilograms in 1999. Data obtained from the National Charcoal Union of Liberia (NACUL) in 2005 revealed that 36,500,000 kg (36,500 tons) of charcoal were produced per annum. Though there are no reliable data on firewood consumption in Liberia, forecasts for the country estimate an annual increase in demand of about 0.6 m^3 per household[8].

6 LPRC ANNUAL REPORT, 2006
7 CSET, AS OF 2004
8 CSET, AS OF 2004

2.3 MARKET ACTORS AND REGULATION STRUCTURES

Electricity Sector

Under the current legislation, the Liberia Electricity Corporation is the only institution responsible for the generation, transmission, distribution and sale of electricity under policy guidance of the Ministry of Lands, Mines and Energy (MLME). LEC used to supply the major cities and towns connected to the grid or with stand-alone diesel plants. Additional power was produced within the various mining and agricultural concessions. Due to the LEC monopoly, private investments have not been attracted to the electricity sub-sector. The draft National Energy Policy (NEP), however, has stressed the need for the liberalization of the electricity market.

Petroleum Sector

The Government's institutional framework for the petroleum sector comprises an office responsible for hydrocarbons in the MLME and two state-owned enterprises dedicated to upstream and downstream operations. NOCAL and LPRC are the two Government institutions established by law to administer and regulate the petroleum sector of Liberia under the policy guidance and supervision of the MLME. NOCAL is responsible for the upstream petroleum sector, while the downstream petroleum is under the jurisdiction of the LPRC. In the upstream sub-sector, petroleum exploration and development is one of the Liberia's top priorities. Although the current law does not provide for separation of policy-setting, monitoring and operation roles, in practice the MLME is involved in policy-setting in the upstream sector as it chairs the Inter-Ministerial Petroleum Technical Committee (IMPTC) in charge of analyzing applications for licenses and negotiating concession agreements. The IMPTC is the executive body of the Inter-Ministerial Committee (IMC) chaired by the Minister. In accordance with regulations and procedures, it decides on the granting of licenses and concessions. NOCAL receives applications from interested investors, submits them to the IMPTC (to which it provides technical advice) and then supervises the implementation of the resultant concession agreements. In the downstream sub-sector, the LPRC is responsible for the importation, refining, storage and distribution of petroleum products. At present, there is no operational refinery in the country. All of the country's refined products are imported by companies licensed by the LPRC and through LPRC's offloading and storage facilities. Even though there is no detailed study currently available indicating whether the refinery can be retrofitted or not, it is obvious that the requisite financial resources for any restorations are not available, even if it made sense from an economic point of view.

Biomass Sector

Although there is no public entity established by law to plan and regulate the biomass sector where charcoal and firewood predominate, the Forestry Development Authority (FDA), a Government entity created by law in 1976, is responsible for the regulation and management of the forestry sector. One of the FDA's objectives is to stop waste and destruction of forests and the associated natural resources by bringing about the profitable harvesting of all forest products while assuring that supplies of these products are perpetuated. However, FDA's mandate does not include any explicit policy and regulatory oversight for the biomass energy sector. The already mentioned National Charcoal Union of Liberia (NACUL), a holding group of commercial charcoal producers established in 2005, is working closely with the FDA in order to coordinate the production and sale of charcoal in the sector.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The formulation of Liberia's first NEP started in early 2006 with provisions in the 150 Day Plan deliverables, followed by a National Energy Stakeholders Forum in October 2006, the publication of the National Energy Sector White Paper, the interim Poverty Reduction Strategy Process and the final Poverty Reduction Strategy. NEP contains Liberia's national vision for the energy sector from the emergency phase, which is nearing completion, to the capacity building and development phases. As part of its policy and strategy, the Government is considering various international models based on best practices in order to develop and ensure that its poverty reduction policy is fully supported by the provision of sustainable energy services to all consumers. The Government believes that the private sector and Public-Private Partnership (PPP) arrangements will play a key role in the medium to long-term development of the energy sector. The Government began to transform the National Energy Sector White Paper into a National Energy Policy in mid 2007. The Renewable Energy (RE) and Energy Efficiency (EE) Policy and Action Plan for Liberia is to:

- Establish a legal/regulatory framework for the development of RE & EE sub-sector in Liberia
- Attract private investment to the RE sub-sector through fiscal and tax incentives
- Develop and expand the RE market in Liberia through PPP
- Transfer technology and build local capacity in the RE & EE sub-sector through training

Following the drafting of the RE and EE Policy and Action Plan of Liberia, the Government embarked on the formulation of the broader National Energy Policy, which comprehensively addresses key policy issues needed to reform the overall energy sector of Liberia. NEP addresses access, quality, cost and institutional framework as the major strategic issues implied in the principal policy objective for energy supply. These issues refer to the overall necessity for energy products and services to be available, acceptable, affordable and adequate.

NEP reaffirms the Government's conviction that economic development is impossible without access to reliable, accessible, affordable and environmentally friendly energy. Increased commercial energy access and use will contribute to the growth of Liberia's economy. According to the NEP, the Government shall establish by legislation the appropriate institutional framework and special incentives and financing mechanisms to facilitate the availability of affordable electricity supplies in remote and low-income rural communities. The development and growth of private and community-owned rural energy service companies (RESCOs) shall be supported. The Government also recognizes the need to provide efficient non-electric energy resources or off-grid electricity for those communities that cannot be connected to the grid in the near future due to affordability and resource constraints. Examples of potential non-electric energy resources include high-efficiency charcoal or biomass stoves for cooking. Low-cost but highly efficient solar lights will be promoted. To generate employment and help to raise incomes for such communities, the Government – according to NEP – will prioritize the use of modern energy services for productive activities. With increased incomes, the demand for modern energy services ensuring a better quality of life will also grow.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

There has been no explicit regulation/legislation for facilitating the development of RE in Liberia. Legislative framework for rural electrification is restricted to the Government-owned LEC, which has never been able to provide sufficient capital to develop RE technologies.

To facilitate RE development and rural electrification, the NEP proposes to establish a Rural and Renewable Energy Agency (RREA) by law to facilitate the economic transformation of rural Liberia through the development of RE technologies. The RREA will be complemented by a Rural Energy Fund designed to support all economically sensible, socially acceptable and environmentally friendly rural energy projects and programs regardless of financial viability. The focus on RE is due to the fact that off-grid and RE technologies offer the best solution for remote communities and will complement the targeted subsidies that will address the issue of affordability.

In this regard, a Bill to Adopt Liberia's Energy Law has been drafted for submission to the National Legislature for enactment. The Draft Energy Law highlights the regulation promotion and development of the RE sub-sector and to establish the RREA and the Rural Energy Fund. Given that RE development is still generally in its basic stage as most of its resources have not been recently assessed on the scale needed for national development, the NEP highlights the need to conduct resource assessments and a National Energy Strategy and Master Plan. This will direct the future course for RE development in Liberia as highlighted in Table 4.

TABLE 4

Phases of Renewable Energy Development in Liberia

PHASE	PERIOD	COMMENT
Emergency/pilot	2006–2008	Launched in 2006 and ended in 2008 with the finalization of the NEP
Capacity building	2009–2015	Building of local capacity for implementation of the National Energy Policy
Development	Beyond 2015	Developing the achievements of the capacity building phase to scale up RE development on a sustainable basis

Source: National Energy Policy of Liberia, as of 2008

Major developments for the use of RE are expected in the areas of hydro- and biomass power systems. In the case of the former, the long-term program involves Hydro Power for domestic consumption and interconnection with WAPP for export. The most promising site is the St. Paul River Basin, which has the potential to produce 824 MW. The planned rehabilitation of the Mount Coffee plant, which is part of the St. Paul River Basin, aims to produce 100 MW within 7–10 years. Moreover, the GoL has signed a concession agreement with Buchanan Renewable Energies for the construction of a 35 MW rubber wood-fired power plant (biomass power plant) to supply Monrovia and other nearby communities. Additionally, solar power systems for health, education and Small and Medium Enterprise (SME) development also form part of the medium term program.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

Generally, the development of RE is still at a low level in Liberia. There has been no previously defined long-term target for RE in the overall energy supply mix. The NEP, however, declares that by 2015, the share of RE in the overall energy consumption shall account for 30 % of the electricity production, 10 % of the overall energy consumption, and 5 % of the biofuels used for transport. There is no topical inventory of RE resources and no specific technology targets have been set. In addition, no evaluation of the RE utilization rate has been conducted. Regulatory and market/economic incentives for RE are non-existent.

4.1 BIOMASS/BIOGAS

Liberia is endowed with abundant biomass resources – rich forest, rubber plantations, oil palm, cassava, sugarcane, rice, and other crop residues. Wood biomass is the primary energy source used for domestic cooking and heating. More than 95 % of the population (most of whom are rural inhabitants) rely on firewood, charcoal and palm oil for their energy needs. Recently, the Liberia Energy Assistance Program (LEAP), funded by the United States Agency for International Development (USAID), initiated a biomass resource assessment in July 2008. The only biogas digester in Liberia, which was destroyed during the civil conflict, was located in Galai (Suakoko District, Bong County), just a few miles from the Cuttington University campus.

The recent USAID funded biomass resource assessment revealed that a variety of biomass resources exist in the country in large quantities and with opportunities for expansion. It states that these resources are more than enough to cover the country's annual electricity consumption of 297 GWh and oil consumption of 206 dam^3. The study further estimates that of the total cropland in Liberia, only 6 % is currently cultivated and that the remaining cropland amounts to some 3 million hectares. While the contribution of food crop residues, animal manure and municipal solid waste is small in comparison to other resources within the country, they could still play a valuable role in stand-alone electricity applications and be particularly effective for households in remote rural areas. On the other hand, cash crop and forest residues, resulting mainly from medium and large enterprises, provide opportunities for large-scale centralized power generation. Table 5 provides an overview of existing and potential biomass resources.

TABLE 5

Biopower and Bio Fuels from Existing and Potential Biomass Resources

EXISTING RESOURCES	BIOPOWER (GWH/YR)	BIODIESEL (DAM^3/YR)	ETHANOL (DAM^3/YR)
Food crop residues	188	–	–
Cash crop residues	5,889	–	–
Biogas from animal manure	219	–	–
Forest residues	15,248	–	–
MSW (biogenic material only)	52	–	–
Total	21,596	–	–
POTENTIAL RESOURCES			
Vegetable oils*	4,946	2,473	–
Sugarcane**	–	–	1,527
Crop residues***	21,923	–	5,385

Sources: Assessment of Biomass Resources in Liberia, as of 2008

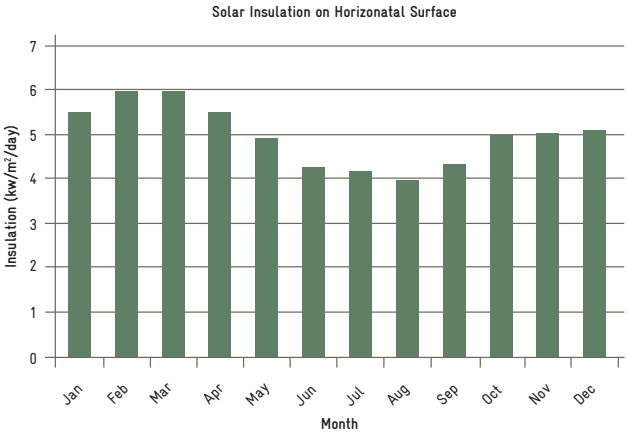
4.2 SOLAR ENERGY

Liberia is endowed with solar resources that could be used for the benefit of the entire population. Due to the country's equatorial position, Liberia receives vertical radiation at noon throughout the year giving rise to intensive insulation in all parts of the country with little monthly variations. Although Liberia has high rainfall, the annual solar insulation shows good prospects for the application of solar technologies. The global solar insulation map shows that the average solar radiation on horizontal surfaces in Liberia is between 4.0 and 6.0 kWh/m^2/day. Figure 3 visualizes the available solar insulation throughout the year.

The current solar energy applications in Liberia are limited to donor-funded pilot projects with small-scale solar power systems for schools, health centers and small businesses. Table 6 presents an overview of the current use of PV installations.

FIGURE 3

Solar Insulation per Month



Source: Solar Technology, Inc., Monrovia, as of 2007

TABLE 6

Current Use of PV Installations

CAPACITY	INSTALLATIONS	APPLICATION
29.22 kWp	50	Electricity for health clinics, schools, community centers, local Government offices, street lighting, small businesses, homes and entertainment
59.04 kWp	246	Refrigeration
0.96 kWp	3	Water pumping

Source: Center for Sustainable Energy Technology, as of 2008

4.3 WIND POWER

There is little or no data available on wind speeds in Liberia as no formal assessment has been performed to date. Liberia, however, is situated in a low wind region, and except for mountainous and coastal areas, wind resources are expected to be relatively insignificant in most rural areas. Observations along the coastal regions have indicated good prospects for the development of wind power. Unlike in the case of solar energy, no wind energy pilot project has been conducted in the country so far.

4.4 HYDRO POWER

Liberia has six major rivers running 66 % of the country's water, namely the Mano, St. Paul, Lofa, St. John, Cestos and Cavalla Rivers. Before the Liberian civil war, there were three operational hydroelectric power plants in the country: Mount Coffee Hydro Power plant on the St. Paul River 27 km North East of Monrovia (64 MW); Firestone Rubber Plantation in Harbel (4 MW) and Yandahun, a community microhydro in Lofa County (30 kW). Apart from the privately owned 4 MW plant in Harbel, there is currently no working Hydro Power plant in the country. The United States Government funded a Feasibility Study for the rehabilitation of the Mount Coffee Hydro Power Plant. The long-term plan is to generate electricity for domestic consumption and export through the West African Power Pool (WAPP). Moreover, the United Nations Development Program (UNDP) and the GoL have signed a Memorandum of Understanding to conduct a feasibility study for the development of small Hydro Power plants in rural Li-

beria. In addition, within the framework of the Global Environment Facility (GEF) and its new "Regional Programmatic Approach to Climate Change in Focal Areas of West Africa", support is expected for small Hydro Power development in rural Liberia. Several pre-feasibility studies were conducted before the war identifying a number of potential Hydro Power sites as shown in Table 7.

TABLE 7

Potential Hydro Power Sites

RIVER BASIN	REGION	SITE NAME AND CODE	DESIGN FLOW m³/SEC	HEAD (m)	POTENTIAL kW
Mano	Grand Cape Mount, Gbarpolu and Lofa	Mano River 1	10.4	30.0	2,474
		Mano River 2	9.47	30.1	2,252
		Mano River 3	8.09	25.0	1,603
		Mano River 4	3.61	20.0	572
		Mano River 5	2.43	12.0	231
Lofa	Lofa, Gbarpolu and Grand Cape Mount	Lofa River 1	55.7	17.0	7,508
		Lofa River 2	37.10	20.0	5,884
		Lofa River 3	3.48	55.0	1,517
		Lofa River 4	3.42	10.0	271
		Lofa River 5	3.35	7.0	186
		Lofa River 6	3.25	6.0	153
Farmington	Margibi	Farmington River 1	16.90	15.0	20,100
St. John	Bassa, Bong and Nimba	St. John River 1	60.40	33.0	15,806
		St. John River 2	57.50	28.0	12,767
		St. John River 3	37.70	28.0	8,370
		St. John River 4	2.32	25.0	460
Timbo	Rivercess	Timbo River 1	6.51	12.0	619
Cestos	Grand Gedeh and Nimba	Cestos River 1	8.30	12.0	789
		Cestos River 2	7.35	10.0	582
		Cestos River 3	6.51	15.0	774
Senkweh	Grand Kru	Senkwen River 1	5.78	12.0	550
		Senkwen River 2	3.47	12.0	330
Buto	Grand Kru	Buto River 1	0.26	20.0	44
Cavalla	River Gee	Cavalla River 1	0.66	25.0	130

Source: GEOSCIENCE srl., as of 1998

5 MARKET RISKS AND BARRIERS

The stagnation of the Liberian economy due to the prolonged internal conflict has created numerous impediments to investment and market development. The lack of energy policy and infrastructure (especially electricity), roads and good transport systems are major barriers for investment and trade. Moreover, the current monopoly of the National Power Utility continues to be an obstacle to private investment in the power sector. And last, but not least, endemic corruption on all levels of the society continues to be a major risk for the national market. The establishment of the Liberia Anti-Corruption Commission (LACC) by law designed to fight corruption within both the public and private sector demonstrates the government's commitment to fight corruption within the society.

The National Investment Commission (NIC) is the Government's institution holding the mandate to promote and coordinate all investment-related activities in all sectors of Liberia's economy. The Investment Code of Liberia defines all economic activities the Government wishes to encourage as well as the types of incentives it will offer to investors engaged in the defined industrial activities. According to the Code, the Government of Liberia encourages industrial enterprises which:

- Utilize Liberian manpower at all levels and contribute to advancing their skills through training schemes (on-the-job) and other incentives to the highest possible extent
- Utilize raw materials and products of Liberian origin to the highest possible extent
- Utilize ancillary activities available in the productive and service sectors of the Liberian economy to the highest possible extent
- Contribute to make Liberia independent of imports of basic goods to the extent of being economically feasible, thus saving foreign exchange
- Contribute to the extension and diversification of Liberia's exports
- Contribute to increased employment all over the country

Both domestic and foreign investors may invest and participate in any business enterprise in Liberia unless explicitly prohibited. Foreign investors may buy the shares of any Liberian business. Any individuals or companies desiring to engage in commercial and/or industrial activities in Liberia should be registered with the Ministry of Commerce and Industry before taking up business operations.

Liberia's Investment Laws are globally competitive. The country offers 100 % repatriation of funds and no currency exchange restrictions e. g. profits and dividends (net of taxes), remittance of money (net of taxes) in the event of the sale or liquidation of the business, repayments of loans acquired from foreign banks etc. There is an overwhelming local acceptance of RE technologies. The major limitation is the low level of awareness and the limited number of trained local experts. The two main local universities (University of Liberia and Cuttington University) along with the Stella Maris Polytechnic plan to cooperate with local and international re-

search institutes and other private institutions to promote and develop RE technologies.

Liberian business law does not restrict business establishment but provides the basis for a range of businesses managed by both local and international investors. Business organizations include partnerships and sole proprietorships, joint stock and limited liability corporations as well as holding companies. A new business may be incorporated locally or abroad, its ownership can be a combination of foreign and local ownership or foreign-owned.

Liberia has signed several international conventions on the protection of intellectual and industrial property rights. The act adopting the New Copyright Law of Liberia, approved on 23 July 1997, provides the legal and administrative framework for the effective implementation of programs intended to protect intellectual and industrial property rights in Liberia. Depending on the amount of capital, the sector and the location of the investment, investors may be eligible for investment incentives offered by the NIC.

The Customs and Revenue Code of Liberia provides the regulatory regime for custom duties and standards. Duties on imported goods range from 2.5 to 25 %. Import duties on RE equipment are about 2.5 to 10 %. In order to minimize the time it takes to clear goods from various ports of entries, businesses are requested to acquire a pre-shipment inspection certificate.

In the 2009 "Doing Business" assessment of the World Bank and the International Finance Corporation, Liberia ranks 157 out of 181 in the respect of "ease of doing business". This is a positive indicator as Liberia was ranked 167 out of 181 in the previous year. All countries are assessed based on local regulations that govern different stages of setting up a business. Table 8 presents Liberia's ranking and its corresponding shift for 2008 and 2009.

TABLE 8

Ease of Doing Business in Liberia

INDICATOR	RANK		CHANGE IN RANK
	2009	2008	
Doing business (overall)	157	167	+10
Starting a business	88	145	+57
Dealing with construction permit	177	179	+2
Employing workers	105	105	0
Registering property	172	170	–2
Getting credit	131	141	+10
Protecting investors	142	141	–1
Paying taxes	59	51	–8
Trading across borders	115	108	–7
Enforcing contracts	165	166	+1
Closing a business	146	147	+1

Source: World Bank/IFC, Doing Business, as of 2009

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 9

Local Business Related Institutions

NAME	CONTACT INFO	PROFILE
Ministry of Commerce & Industry (MCI)	Ashmun Street, P.O. Box 9041 Monrovia, Liberia	A GoL ministry responsible for issuing policies and regulating the commerce and industry sector
Ministry of Lands, Mines and Energy (MLME)	Capitol Hill, P. Box 9024 Monrovia, Liberia	A GoL ministry responsible for issuing policies and regulating the land, mineral and energy sector of Liberia
National Investment Commission (NIC)	Sinkor 12th Street Tubman Boulevard, P.O. Box 9043 Monrovia, Liberia info@nic.gov.lr	A GoL institution promoting and coordinating investment-related activities in all sectors of the Liberian economy
Liberia Business Association (LIBA)	C/o Corina Hotel 24th Street Sinkor Tubman Boulevard Monrovia, Liberia	A consortium of small and medium Liberian businesses
Liberia Chamber of Commerce (LCC)	Capitol Hill, P.O. Box 9 Monrovia, Liberia Phone: +231-77857-805 www.liberiachamber.com	An institution seeking to promote trade and investment in Liberia and ensure that businesses get fair treatment in their dealings with the government
Liberia Petroleum Refining Company (LPRC)	Bushrod Island Monrovia, Liberia	A Government owned company with the mandate to import and refine crude oil for distribution of the products on the Liberian market
Liberia Electricity Corporation (LEC)	Francis Cooper Chairman, LEC P.O. Box 10-165 Waterside-1000 Monrovia 10 Monrovia-Liberia Telephone: .+231-6971934 e-mail: fbcoopersr@gmail.com	A Government owned company with the mandate to generate, transmit, distribute and sell electrical energy
National Oil Company of Liberia (NOCAL)	Episcopal Plaza Randall Street Monrovia, Liberia www.nocal-lr.com/	A Government owned company with the mandate to administer petroleum exploration program in Liberia
Environmental Protection Agency (EPA)	4th Street Sinkor Tubman Boulevard Monrovia, Liberia www.epa.gov.lr/	A Government agency with the mandate to manage and regulate the environment

Source: Center for Sustainable Energy Technology, as of 2008

TABLE 10

Government Projects and Programs

PROGRAM/PROJECT	CONTACT	COLLABORATING INSTITUTION	ROLE
Emergency Power Project (EPP)	MLME/LEC	Governments of Liberia, Ghana, USA, and Norway, the European Union, and the World Bank	A multilateral project restoring grid electricity to Monrovia and its environs
Liberia Energy Assistance Program (LEAP)	MLME/LEC	Governments of Liberia and the US Government	A bilateral program aiming to facilitate access to energy services and support to transparent energy sector reform and regulatory regimes

Source: data compiled by the author

TABLE 11

Contact Information of Businesses Involved in the Renewable Energy Sector

NAME OF BUSINESS	CONTACT INFO	CONTACT PERSON
Solar Technology Inc.	Old Peugeot Garage Phone: +231 653 959 1 reggiegardiner@yahoo.com	Reginald Gardiner
Alternative Energy, Inc.	Randall Street Monrovia, Liberia Phone: +231 652 650 9 aeliberia@yahoo.com	Thomas Kpoto
Center For Sustainable Energy Technology	8th Street Sinkor Tubman Boulevard Monrovia, Liberia Phone: +231 655 926 6 gusgoanue@yahoo.com	Augustus Goanue
Premier Solar	9th Street Sinkor Opposite LISGIS Monrovia, Liberia Phone: +231 651 994 3 natereeves1234@yahoo.com	Nathan Reeves
Quantum Logistics	Adj. 101 Gas Station Pynesville City, Liberia Phone: +231 621 338 6 info@quantumgroup-lib.com	Ronald Mitchell
Solar Electricity for Health clinic	Randall Street Monrovia, Liberia www.energyforopportunity.org/ projects/health-electricity-for- rural-health-centres/	Momo S. Kpoto
Equatorial Palm Oil	UN Drive Monrovia Phone:+231 561 221 6 ebfliberia@qahoo.com	David Parker
Buchanan Renewable Energy	Buchanan House Congo Town Tubman Boulevard Monrovia Phone: +217 779 841 7 joelstrickland@ buchananrenewables.com	Joel Strickland

Source: Center for Sustainable Energy Technology, as of 2008

7 BIBLIOGRAPHY

- Bongers, F., Poorter, L., Van Rompaey, R. S. A. R and Parren, M. P. E. (1999): Distribution of Twelve Moist Forest Canopy Trees Species in Liberia and La Cote d'Ivoire: Response Curves to a Climatic Gradients, IAVS; Opolus Press, Sweden
- Center for Sustainable Energy Technology (2004): Bridging the Energy Gap in Post-war Liberia: The Need for Alternative Energy Services
- Center for Sustainable Energy Technology (2008): Renewable Energy and Energy Efficiency Policy and Action Plan of Liberia
- DECON – Dutch Energy Consultant (1983): Pre-feasibility Study on the Development of Power in the Liberian Rural Areas
- Department of Energy, Ministry of Lands, Mines & Energy, Republic of Liberia (2002): Unpublished Energy Sector Report
- GEOSCIENCE srl. (1998): Electricity Supply in Liberia; Project LBR/7ACP/21–16. European Commission Aid Coordination Office in Liberia
- Liberia Electricity Corporation (2004–2007): Annual Reports
- Liberia Institute of Statistics and Geo-information Services (2007): Core Welfare Indicator Questionnaire
- Liberia Institute for Statistics and Geo-information Services (2008): Preliminary Results of 2008 National Population and Housing Census
- Liberia Petroleum Refining Company (2003–2006): Annual Reports
- Mattick, R. E. (1982): Assessment of the Petroleum, Coal and Geothermal Resources of the Economic Community of West African states (ECOWAS) Region. U.S. Geological Survey
- Milbrandt, Anelia (2008): Assessment of Biomass Resources in Liberia. US National Renewable Energy Laboratory
- Ministry of Lands, Mines and Energy (2008): Proceedings of the National Energy Policy Validation Workshops
- Ministry of Lands, Mines and Energy (2006 & 2007): Annual Reports
- National Investment Commission (2008): Investor's Guide to Liberia (www.nic.gov.lr)
- Republic of Liberia (2001): Customs Revenue Code and Harmonized Description and Coding System of the Customs Tariff Schedules of Liberia Act of 2000
- Republic of Liberia (2004): National Biodiversity Strategy and Action Plan
- Republic of Liberia (2007): Draft Action Plan and Rationale for Renewable Energy and Rural Development
- Republic of Liberia (2008): Draft Final National Energy Policy: An Agenda for Action and Economic and Social Development
- Government of Liberia (2006): 150 Day Action Plan. A Working Document for a New Liberia (www.allafrica.com/peaceafrica/resources/view/00010785.pdf)
- Republic of Liberia (2008): Poverty Reduction Strategy
- International Monetary Fund/Republic of Liberia (2007): Liberia. Interim Poverty Reduction Strategy Paper. Breaking with the Past – From Conflict to Development; IMF Country Report No. 07/60 (www.imf.org/external/pubs/ft/scr/2007/cr0760.pdf)
- National Renewable Energy Laboratory (1998): International Programs Brochure: Global Solar Resource Map, (www.nrel.gov).
- United Nations/World Bank (2005): Liberia. National Transitional Government of Liberia. Results Focused Transitional Framework Revision (www.reliefweb.int/library/documents/2005/ntgl-lib-30apr.pdf)
- World Bank/IFC (2009): Doing Business 2009 (www.doingbusiness.org)

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ACRONYMS AND ABBREVIATIONS

MALI

AMADER	Agence Malienne pour le Développement de l'Énergie (Malian Agency for the Development of Domestic Energy and Rural Electrification)
AMARAP	Agence Malienne de Radioprotection (Malian Agency for Radioprotection)
AUREP	Autorité pour la Promotion de la Recherche Pétrolière au Mali (Authority for Oil Exploration)
CdR-ER	frame of reference for the development of rural electrification
CEWR	Commission of Electricity and Water Regulation
CFAF	CFA Franc (1 Euro = 655,957 CFAF)
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Interstate Committee for Fight against the Drought in the Sahel)
CNESOLER	Centre National de l'Énergie Solaire et des Énergies Renouvelables (National Center of Solar Energy and Renewable Energies)
CREE	Commission de Régulation de l'Electricité et de l'Eau (Commission of Electricity and Water Regulation)
DGD	Direction Générale des Douanes (Directorate General of Customs)
DNCC	Direction Nationale du Commerce et de la Concurrence (National Directorate of Trade and Competition)
DNT	Direction Nationale du Transport (National Directorate of Transport)
DNGM	Direction Nationale de la Géologie et des Mines de la République du Mali (National Direction of Geology and Mines)
DSF	Decentralized Services Firms
ECOWAS	Economic Community of West African States
EDM – SA	Énergie du Mali (Malian utility)
GDP	Gross Domestic Product
GPP	Groupement Professionnel des Pétroliers du Mali (Oil Industry Professionals Group)
IN	Interconnected Network
KfW	Kreditanstalt für Wiederaufbau (German Banking Group including KfW Entwicklungsbank/German Development Bank)
LEP	Local Electrification Plan
LV	low voltage
MEA	Ministre de l'Environnement et de l'Assainissement (Ministry of Environment and Sanitation)
MEIT	Ministry of Economy, Industry and Trade
MEMW	Ministry of Energy, Mines and Water
MF	Ministry of Finance
MV	medium voltage
NGO	Non-governmental Organization
OMVS	Organisation pour la Mise en Valeur du Fleuve Sénégal (Organization for the Valorization of the Senegal River)
ONAP	L'Office National des Produits Pétroliers (National Office of Petroleum Products)
PCASER	Projets de Candidatures Spontanées d'Electrification Rurale (Projects of Spontaneous Candidacy for Rural Electrification)
PPER	Programme Prioritaire du Electrification Rural (Rural Electrification Priority Programs)
PRODER	Programme Decennial du Electrification Rural (Decennial Program of Rural Electrification)
PV	Photovoltaic
RE	Renewable Energy
REF	Rural Electrification Fund
SHS	Solar Home Systems
SOGEM	Société de Gestion de l'Énergie de Manantali (Manantali Energy Management Company)
SSD	Societe de Services Decentralises (Decentralized Service Companies)
USD	United States Dollar
VAT	Value Added Tax

MEASUREMENTS

GWh	gigawatt hours
ha	hectare
kg	kilogram
km²	square kilometer
kWp	kilowatt peak
mm	millimeter
m³	cubic meter
MW	megawatt
MWh	megawatt hours
TOE	tons of oil equivalent
°C	degree Celsius

SUMMARY

The Country Study of Mali is to provide an overview of the country's energy market and to support decision-making for private investments for the renewable energy (RE) sector in Mali. The study is structured as follows:

Chapter one provides **Background Information on Mali**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Mali.

Chapter two summarizes facts and figures of **Mali's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Mali. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Mali.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Mali.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Mali, a vast landlocked country in the heart of West Africa, is situated between latitudes 10° and 25° North and between longitudes 4° East and 12° West. It covers a total area of 1,241,238 km² and has 7,000 km of frontiers bordering seven countries, i.e. Senegal, Mauritania, Algeria, Niger, Burkina Faso, Côte d'Ivoire and Guinea.

The climate is tropical dry and is divided in four different zones: a Saharan climate (desert) in the North (annual rainfall less than 200 mm), Sahel in the middle (annual rainfall between 200 mm and 600 mm), Sudanian (annual rainfall between 600 mm and 1,000 mm) and Sudano-Guinean in the South (rainfall > 1,000 mm). The temperatures are high and the average rainfall is low. The average maximum temperature varies between 34 and 37 °C, the average minimum between 21 and 23 °C. The maximum relative humidity oscillates between 31 and 75 %, the minimum between 11 and 38 %. Mali has two alternating seasons:

- A dry season varying from a nine month period in the North (October to June) to a six month period in the South (November to April)
- A rainy season lasting from May to October in the South and from July to September in the North adjourned by more or less intense inter-seasons with "neither rainy, nor dry" periods.

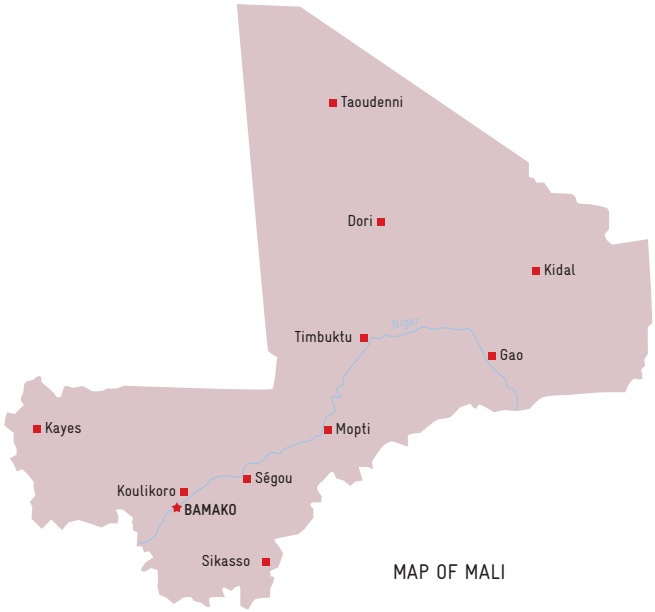
Mali's geography is the reason why the country's economy is largely rural based and explains the central role of hydrology in the energy sector.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Mali gained its independence in September 1960. The route to democracy, however, has been a long and difficult quest occasionally marked by violent outbreaks. Political pluralism was introduced in March 1991 under challenging circumstances. The Constitution provides the creation of eight Republican institutions and guarantees their independence through a predefined balance of power and the respective means of control. The Government, reigned by the Prime Minister, sets out and conducts the nation's policies and directs the armed forces. The Parliament, comprising of a single chamber, is called the National Assembly.

In 2007, Mali's population was estimated at 13.9 million inhabitants. The northern region of the country (Tombouctou, Gao and Kidal), which covers more than 60 % of the territory, houses only 10 % of the total population. The overall population growth rate is about 3 %, whereas the urban population is increasing at a rate of 5.2 % due to rural exodus. The majority of Malians, however, are still living in rural areas (70 %).

According to the 2007/2008 Human Development Report, Mali ranks at 173 out of 177 (South Africa: 121, Guinea: 160, Chad: 170 and Central African Republic: 171).



MAP OF MALI

The Gross Domestic Product (GDP) per capita increased from USD 260 in 2000 to 500 in 2007. The Gross National Income per capita based on purchasing power per capita rose from USD 750 in 2000 to USD 1,040 in 2007.

Mali's potential wealth lies in mining and the production of agricultural products, livestock and fish. In 2006, cotton, gold and livestock made up 80–90 % of Mali's total export earnings. Small-scale traditional farming dominates the agricultural sector. About 90 % of the 1.4 million hectares (3.4 million acres) are under cultivation mainly for the subsistence farming of cereals, primarily sorghum, millet, and corn. Mali's economy is largely dominated by agriculture (employing 83.4 % of the active population) followed by industry and service sectors (employing 4.1 % respectively 12.5 %).

The real growth rate of the GDP has experienced an uneven evolution reflecting amongst other determinants the climate factor and the difficulty to access maritime ports of neighboring countries. Table 1 presents the evolution of the GDP and the growth rate.

TABLE 1

Evolution of the GDP and the Growth Rate

	2002	2003	2004	2005	2006	2007
GDP (billions of CFAF)	2,223	2,454	2,632	2,893	3,125	3,356.5
Real growth rate in %	4.3	7.6	2.3	6.1	5.0	5.4

Source: Commission de l'UEMOA, Comité de Convergence et BCEAO, as of April 2007

2 ENERGY MARKET IN MALI

2.1 OVERVIEW OF THE ENERGY SITUATION

The total energy consumption of Mali was 3,212,560 toe in 2002, mainly based on consumption of wood and charcoal (81 %), followed by oil products (16 %) and electricity (3 %). The sector-based use of energy is separated in descending order of their significance as follows: households (approx. 86 %), transportation (nearly 10 %), industry (approx. 3 %, half of which is being used for mining) and agriculture (less than 1 %). This energy shares based on source and sector vary but little from one year to another. RE (solar, wind, Hydro Power etc.) is currently used at a rate insignificant to the energy balance. There is no liquid or gaseous biomass energy as part of the official supply in Mali (only solid biomass such as wood).

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity industry was state owned up to the year 2000 when reforms in the sector transferred 60 % of the property to the so called "strategic partners" consisting of SAUR International and IPS West Africa. After five years of private operation, SAUR International gave up its ownership of properties by selling shares to the Government of Mali (by October 2005). IPS West Africa is now holding 34 % of the Malian utility "Énergie du Mali" (EDM–SA). The majority of shares, however, are in the hand of the State of Mali. The reforms mentioned above lead to the foundation of the Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER). Its major objective is to handle rural electrification by dealing with private operators. According to the National Directorate of Energy (DNE), the rate of access to electricity in 2007 was estimated at 17 % on the national scale and 5 % in rural areas (as compared to merely 1 % in 2000 before reforms).

The total installed capacity of power supply of the Interconnected Network (IN), consisting of three hydroelectric power stations and two thermal power stations, was 130.49 MW in 2007 (not including the Manantali site, which jointly belongs to Mali, Mauritania and Senegal). In addition to the IN facilities, EDM–SA operates nineteen insulated centers equipped with diesel generators and two centers supplied by a network from Côte d'Ivoire. The total installed capacity of power supply of the insulated centers rose from 31.5 MW in 2005 to 38.3 MW in 2006 following the strengthening of the output in various centers including Mopti and Sikasso. Table 2 presents the evolution of power generation. Figure 2 illustrates the energy mix in the electricity sector of Mali.

EDM–SA's gross electricity production increased by 8.9 % from 865.8 GWh in 2006 to 942.5 GWh in 2007. The purchase of energy originating from the hydroelectric power station of Manantali contributed with more than one third of the production on the IN equaling 294.4 GWh (35.4 %). The evolution of the thermal component in the total production of the system was subject to fluctuations during the last five years. It decreased from 26.7 % in 2002 (with the start up of Manantali) to 16.6 % in 2003 before increasing again to 19.2 % in 2004, 20.1 % in 2005, 22.8 % in 2006 and 40.7 % in 2007 (see Figure 3).

TABLE 2

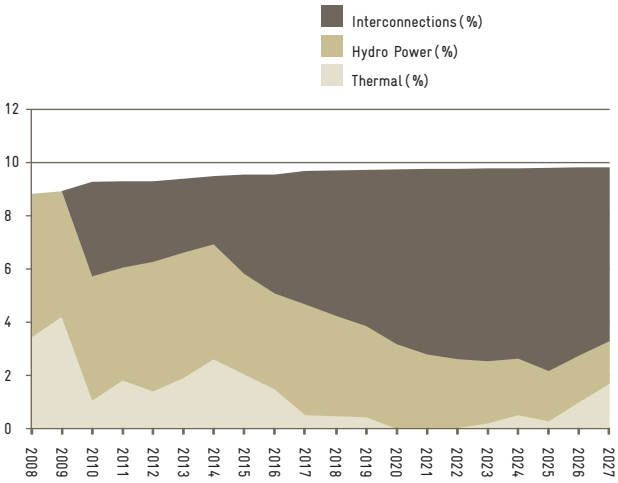
Evolution of Power Generation Capacity

		2001	2002	2003	2004	2005	2006	Growth rate
Total installed capacity including:	MW	146	249	248	251	245	255	4.3 %
Interconnected Network (IN)	MW	115	117	109	109	109	113	3.4 %
Manantali	MW		104	104	104	104	104	
Insulated centers	MW	31	29	35	38	32	38	21,6 %
Peak capacity of the IN	MW	82	87	98	111	123	133	7.5 %

Source: Énergie du Mali, 2005, 2006 and 2007 reports

FIGURE 2

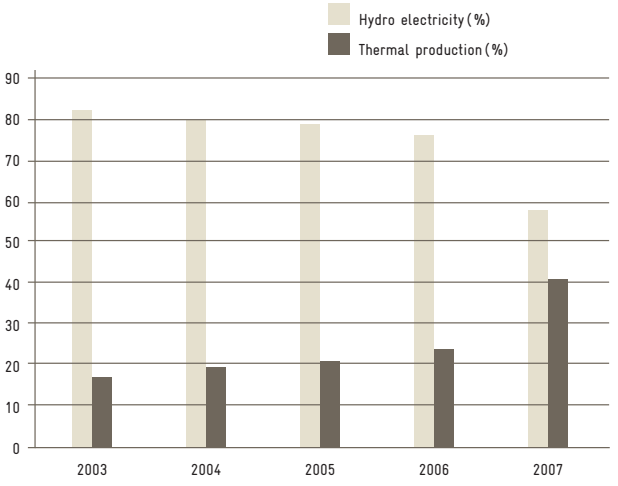
Energy Mix of the Electricity Sector



Source: graph compiled by the author with data from EDM–SA, as of 2008

FIGURE 3

Share of Hydro Power and Thermal Power for the Electricity Production



Source: Energie du Mali, 2005, 2006 and 2007 reports

The total energy consumption between January and December 2007 was 730.7 GWh, as opposed to 666.4 GWh in 2006. This corresponds to an increase of 9.7 %. Low voltage sales for the whole EDM–SA were 424.7 GWh 2007 as opposed to 373.5 GWh in 2006, equalling an increase of 13.7 %. Table 3 summarizes the overall electricity consumption of Mali.

The Interconnected Network had 151,324 consumers (LV + MV) in 2007 as opposed to 140,968 in 2006 equaling an increase of 7.3 %. IN & Insulated Centers together supplied 151,377 LV and 1,003 MV consumers in 2007, as opposed to 140,043 LV and 925 MV consumers in 2006. Table 4 presents the numeral evolution of individual electricity clients.

In spite of existing investment-related difficulties, a high growth rate can be observed in the sector of electricity and the distribution network in particular. The consumption of energy is growing at the same rate as the country's economical growth. The power supply in particular is constantly challenged to meet a faster growing demand. To avoid critical situations for the economy caused by energy shortage, a Watching Commission has been set up. Between 2006 and 2007, the total installed capacity of the interconnected network increased by 16 %, but still could not fully meet to the actual needs. Electricity production on the whole increases by 8.9 % per year, while EDM–SA's sales of LV and MV have increased by 13.7 % and 4.5 % thus leaving a considerable demand unsatisfied. In fact, the average coverage rate of the major electrified city is only about 50 %. This situation is due to the difficulties of investing in the distribution networks for an environment characterized both by the low density of consumer locations and the weak income level throughout the population.

The electricity company EDM–SA is strongly supported by the Government in the respect of tariffs for oil products and the existing tax and customs system. In order to limit the increase in the effective EDM–SA tariffs (by reducing the expenses of the company), the Government has been granting exemptions on the purchases of fuels intended for the production of electricity since 2002. The current procedure is to refund the related customs duties and taxes as discharged by EDM–SA. Since June 2002, however, EDM–SA has been benefiting from the mode of the Mining Code[1] granting exemptions of taxation at source for purchase of fuels; thus saving the company a considerable amount of money. Moreover, within the framework of a rehabilitating program, EDM–SA is benefiting from an indistinct tax system with regard to its investment plan 1995–2005 implying both external financial resources and self-financing. The tax considers both big projects and spare parts intended for the reconditioning of generators, networks materials and means of operation. In 2001 and 2002, the prices were increased. The increase of 2001 was partially cushioned by the Government through a compensation of more than 10 billion CFAF. In 2003, there was a first tariff decrease, and the missing revenues resulting from the tariff decrease were entirely compensated by the Government (up to 7.2 billion CFAF). In 2004, the Regulation Commission decided on a price reduction. Tariffs remained steady up to 2008. The evolution of electricity tariffs between 2001 and 2007 is presented in Table 5.

TABLE 3

Electricity Consumption

		2001	2002	2003	2004	2005	2006	Growth rate
Total consumption of electricity	MWh	377,682	432,326	484,198	541,102	616,230	662,510	7,5 %
of that								
Medium voltage	MWh	177,041	199,333	206,867	242,420	272,545	289,017	6,0 %
Low voltage	MWh	200,641	232,993	257,329	298,682	343,685	373,494	8,7 %

Source: Énergie du Mali, 2005, 2006 and 2007 reports

TABLE 4

Number of Electricity Clients

RATE OF USING ELECTRICITY		2001	2002	2003	2004	2005	2006	Growth rate
Total number of users		90,953	112,703	131,029	145,479	160,201	174,152	8,7 %
of that								
Medium voltage		712	771	884	951	1,019	1,109	8,8 %
Low voltage		90,241	111,932	130,145	144,528	159,182	173,043	8,7 %

Source: Énergie du Mali, 2005, 2006 and 2007 reports

TABLE 5

Evolution of Electricity Tariffs[2]

	2001	2002	2003	2004	2005	2006	2007
CFAF	96.49	103.98	95.7	85.16	84.67	84.16	85.42
Eurocent	14.73	15.87	14.62	13.00	12.93	12.85	13.04

Source: Énergie du Mali, 2005, 2006 and 2007 reports

1 LE PRÉSIDENT DE LA RÉPUBLIQUE MALI, 1999)

2 CURRENT CONVERSION RATE: 1 EURO = 655,95F CFAF, DEC. 2009

In 2004, the Commission of Electricity and Water Regulation (CREE) decided on a price reduction without compensation by the client. Since then, prices have remained steady in spite of the huge rise in international market prices for oil products and the continuous increase in the share of thermal production. The principles determining the prices in the field of rural electrification are (i) freedom of tariffs for entities being subject to various authorizations and declarations and (ii) regulated prices for licenses in compliance with the contracts signed with clients.

AMADER ensures that prices for entities being subject to various authorizations and declarations remain compatible and that incentive measures are taken to avoid that operators under a monopoly situation achieve unjustified profits.

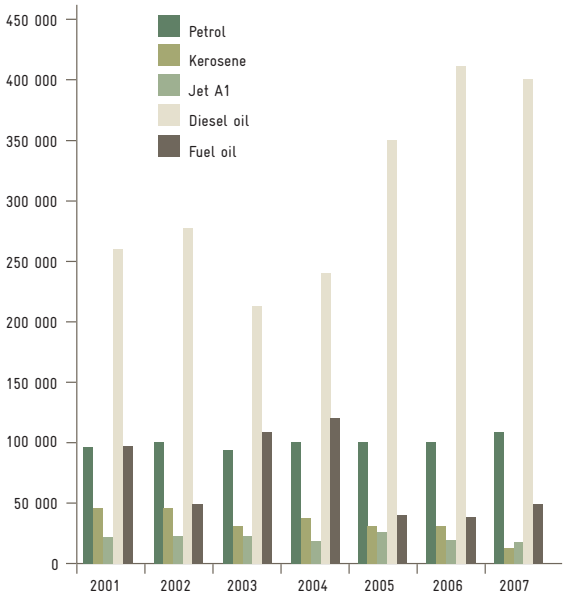
The sales within concession systems benefiting from a situation of exclusiveness or natural monopoly are subject to a price regulation by directive of CREE. Taking into account the variations of costs according to the demand, the regulated prices are defined per tariff period and are revised according to the directives of the Regulation Commission CREE. Within the conceded perimeter there is equalization of tariffs.

Petroleum Sector

Mali does not produce petroleum and has no refinery. Therefore, all petroleum products are imported trough principal trunk roads leading to the West African ports, i.e. Abidjan (Côte d'Ivoire), Cotonou (Benin), Dakar (Senegal), Lome (Togo), and Tema (Ghana). The consumption is dominated by diesel oil. Table 8 shows the volume of petroleum imported between 2001 and 2007. Some of the oil imports in the far North of the country may have been obtained informally from Algeria. Figure 4 indicates the evolution of imported petroleum products.

FIGURE 4

Evolution of Petroleum Imports (2001–2007)



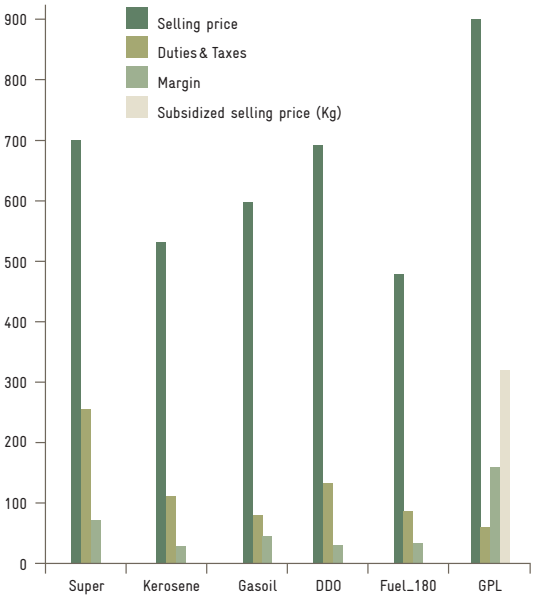
Source: graph compiled by the author with data from ONAP, as of 2008

The consumption of petroleum products is mainly divides into the following sectors: transport (70 %), industry (20 %), household: (8 %) and agriculture (2 %). Diesel oil is by far the most used fuel (see graph above). The storage capacities are mainly located in the capital city of Bamako, but some private operators are running tanks in the western region about 90 km from the Senegal border. Many mining companies are directly served from these storage capacities in the city of Kayes.

Petroleum products are strategic goods because of the dependencies that occur in a landlocked country to import them. The share in the energy mix and their respective contribution to the customs revenues increased from 31.6 % in 2000 to 37,6 % in 2004. The oil bill, however, rose to 242 billion CFAF in 2006 without any chance to raise the fiscal receipts at the same rate. The current price fixing system of oil products was established in July 2001 and entails a monthly change of the prices at pump stations. The tariffs follow the development of the international market prices and based on the average off these prices. The price structure in Mali is determined according to the mentioned import of petroleum products via principal trunk roads connected to West African ports (see above). Butane in cylinders of 2.75 kg and 6 kg is being subsidized by the Government of Mali in order to promote the substitution of fuel wood and charcoal. The pricing structure of petroleum products is presented in Figure 5.

FIGURE 5

Pricing Structure of Petroleum Products



Source: graph compiled by the author with ONAP data, as of 2008

The taxation of the oil sector is based on the Principle of Taxing Oil Products proposed by the Economic and Monetary Union of West Africa – UEMOA/ECOWAS. The overall taxing includes customs duties, the statistical royalty, ECOWAS Community Tax, the inland duty on oil products and VAT. Current price information (updates available at www.onapmali.com) on the most prominent fuels is presented in Table 6.

TABLE 6

Current Price Information of Fuels[3]

PRODUCT	CFAF PER LITER/KG (LPG ONLY)
Petrol	635
Kerosene	450
Gasoil/diesel oil	545
Fuel oil	352
Jet A1	Free
LPG (with subsidy; bottles 2.7 kg & 6 kg)	320
LPG (without subsidy)	739

Source: table compiled by the author with ONAP data, as of 2009

Biomass Sector

As in most developing countries, especially in Sub-Saharan Africa, wood energy remains the most common fuel used in Malian households. The yearly consumption is approximately 6 million metrictons. Considering the relative prices of alternative sources of energy, the existing practices and the traditions of the population using wood energy, this situation is likely to remain unchanged. The wood energy consumed primarily comes from natural forests. The organized rural market meets an increasing share in the supply of urban centers as does the uncontrolled/informal operating system. A slow but sure transition from crude wood to charcoal as well as an increase in the requirements for primary energy sources can be registered.

2.3 MARKET ACTORS AND REGULATION STRUCTURES

Responsibilities of the multiple energy issues are shared among four ministries, one Regulation body and eight public or paragovernmental technical arms in Mali.

The **Ministry of Energy, Mines and Water (MEMW)** is in charge of defining the energy policy and general energy planning (demand and supply), as well as of the control and monitoring of the electricity (thermal and hydro) and renewable energies sectors, and only partly petroleum products. The MEMW also supervises several institutions:

The **National Direction of Energy** – it's role is to evaluate the potential of energy resources and ensure their valorisation; to study, control and supervise the energy production and to ensure compliance with technical specifications and safety requirements; to take part in co-operation projects in the fields of energy, to process the issuance of licenses for the realization of energy infrastructures by self producers, paragovernmental and private operators, decentralized communities and others.

The **National Center of Solar Energy and Renewable Energies (CNESOLER)**: As a division of the National Direction of Energy, the CNESOLER is in charge of the research and promotion of RE equipments, i.e. in the fields of biomass, micro-Hydro Power, solar and wind energies (aero generators and wind mills for water pumping systems).

The **Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER)** that is funded by the World Bank. The role of AMADER is to reduce the household energy consumption through energy efficiency and substitution programmes. Furthermore, it is in charge of the development of access to modern energy services in rural and peri-urban areas.

The **Malian Agency for Radioprotection (AMARAP)** is in charge of pacific use of nuclear energy and protection against harmful ionizing radiations.

The **National Direction of Geology and Mines (DNGM)** in charge of oil geology, geophysics and exploration through the **Authority for Oil Exploration (AUREP)**. DNGM also hosts the laboratories aiming to control the quality of all petroleum consumed in the country (all imported for now).

The **Ministry of Environment and Sanitation (MEA)** handles the biomass energy supply (particularly fuel wood and charcoal) through the forestry department. This department has one specialist working at AMADER in order to harmonize views, policies and practices.

The **Ministry of Finance (MF)** is the key body in the import and storage of petroleum products through the **National Office of Petroleum Products (ONAP)**.

The **Ministry of Economy, Industry and Trade (MEIT)** is in charge of setting prices and regulating concurrence for petroleum products through the ONAP. Trade and Economy used to be in the same department than the Finance. ONAP is therefore in between the two ministries MF and MEIT.

The **Commission of Electricity and Water Regulation (CEWR)** is independent from government operators and has juridical personality and financial autonomy. CEWR is in charge of the regulation of the sector of electricity and potable water. More specifically, CEWR ensures the application of tariff policies and regulates public services of electricity in urban areas. Furthermore, it is in charge of the development of public services, consumer protection, quality management and the approval and controlling of tariffs.

Electricity Sector

As already indicated the MEMW supervises the entire electricity policy and planning activities. A deep reform of the sector undertaken from 1998 to 2000 primarily resulted in:

- The privatization of the utility "Energie du Mali (EDM - SA)" on December 21, 2000.
- The creation of the **Commission of Electricity and Water Regulation (CREE)**, on March, 2000.
- The establishment of a legislative and regulatory scope for the organization of the electricity sector on March 2000.
- The streamlining of the role of the Government concerning policy, regulation, planning and coordination of the electricity sector.
- The disengagement of the Government from operational activities of electricity industry, in particular production, transmission, and distribution.
- The opening of the electricity sector to private operators of any origin.

3 CURRENT CONVERSION RATE: 1 EURO = 655,95F CFAF, DEC. 2009

Today, a few operators of the private sector provide the public service of electricity, the most significant of which is Energie du Mali (EDM-SA) as a licensee for electricity public service in 38 urban localities. On the other hand, forty small companies got authorization of public service of electricity in rural zones (starting in 2004) including two Decentralized Services Firms (DSF). Other actors are made up of sub-regional entities:

- Société de Gestion de l'Energie de Manantali - SOGEM (Trust company of Manantali Energy), public corporation of estate created by the Member States of the Organization for the Valorization of the Senegal River (OMVS), which include Mali, Mauritania and Senegal.
- ESKOM Energie de Manantali (ESKOM Energy of Manantali), Malian subsidiary of ESKOM Corporations (South Africa), in charge, on behalf of SOGEM, of operating and maintaining the dam, producing and transporting the energy of the hydroelectric power station of Manantali to the three countries.

Petroleum Sector

The petroleum sector falls under different ministries (Finance, Economy-Industry and Trade, as well as Energy). A reform of the sub-sector undertaken in 1992 resulted in the withdrawal of the State from any commercial activity (distribution, storage and marketing) at the profit of private operators. The State limited its role to fundamental missions for supply planning and regulating the whole supply-delivery chain. These missions are ensured through its technical departments which are:

- The National Office of the Petroleum products (O.N.A.P).
- The National Directorate of the Trade and Competition (D.N.C.C).
- The National Directorate of Transport (D.N.T).
- The Directorate-General of Customs (D.G.D).

In 2003, there were twenty five agreed private oil operators were including the members of the "Oil Industry Professionals Group (GPP)" who are local subsidiaries of the multinational companies (Mobil, Shell, and Total-Mali). At present, there are almost sixty private oil operators. Mali counts five sedimentary basins covering about 900.000 square kilometers. From 1960 to 1968, the petroleum exploration was conducted by the national company «SONAREM». From 1968 to 1985, the first petroleum Code was adopted. At that time, the sedimentary basins were opened to all potential investors. The permits were granted to five petroleum companies (Texaco, Sun, Murphy, Elf and Esso). The perimeters of the permits were mainly situated in the Taoudenit basin and the Gao basin (1970-1985). Up to 2005, the history of petroleum exploration in Mali clearly indicates that the sedimentary basins of the country are under explored with a very low level of seismic coverage and a very little number of exploration wells (in average one well per basin). In total, five wells were drilled in the five sedimentary basins. To promote exploration during the last four years, the Government of Mali undertook some major activities:

- A review of the petroleum code. The new code has been adopted by the National Assembly on August 2004 and was proposed to the potential investors.
- The creation of the ''Authority for the Petroleum Exploration Promotion in Mali (AUREP) in September 2004.

Biomass Sector

Biomass-energy is under the supervision of MEA – respectively under its forestry department (see chapter 2.3) all aspects related to the supply, while the MEMW manages the demand aspects including also efficiency and substitution policies. Among the strategies implemented, one can quote the attempt to formalize the wood-energy business, the empowerment of rural communities' through the creation of rural markets, the improvement of the institutional and legal framework of the natural forests management and the promotion of alternative energy sources such as LPG. New forestry framework allows putting in place a better regulation and a more coherent legislation aiming at a sustainable management of forest resources, particularly with regards to household energy issues which need:

- A good wood-fuel supply to urban centers at optimal cost to the consumer and the community surrounding the forest.
- A sustainable management of the wood resources as a significant contribution to the fight against the desertification.
- The new legislation put in place comprises two laws and one decree:
- Law 95-004 of January 18, 1995 fixing the conditions of forest stock management.
- Law 95-003 of January 18, 1995 organizing exploitation, transport and trade of wood fuels.
- Decree 422/P-RM of December 5, 1995 fixing the rates and the distribution of taxes to be perceived during the exploitation of forest resources, replaced by decree N (402/P-RM of December 17, 1998 fixing the rates, modalities of recovering and distributing taxes perceived when harvesting state owned forested areas.

The adoption of this new legislation led to the set up of a National Strategy of Household Energy in Mali (1996) and eased:

- Decentralization of management, tax perception and delivery of transport documents.
- Reinforcement of professional activities in the field of transport and trade of wood energy.
- Constraint to the payment of tax and fees on wood – broad access to energy.
- Rate of tax according to the origin or the mode of exploitation of wood energy.
- Self-reliance of the rural sector in financing issues, forestation and reforestation initiatives.

The decree fixing the rates and the distribution of the taxes is favorable to managed forests where the tax is the lowest, compared to other areas which are not under control. It shares the benefits of taxes between the State and the decentralized Communities. The laws allows thus among populations, communities and the Government to generate incomes within the framework of a concerted and sustainable management of forest resources.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The overall objective of the energy policy of Mali (enacted by the Government in March 2006) is to contribute to the sustainable development of the country, through the supply of energy services accessible to the highest possible number of the population at low cost, and supporting the promotion of socio-economic activities. Its specific objectives are to:

- Fulfil the energy needs of the country in quality, quantity and at low cost.
- Ensure protection of people, property and environment.
- Build capacities in orientation, management, control and strategic monitoring of the energy sector.
- Maximize the advantages of international co-operation for the country in the field of energy.
- The strategic paths include, among other, the valorization of national energy resources and the research for sustainable solutions and lower cost for the implementation and utilization of energy services (production, conveying, distribution, use, and maintenance).

In other words, both the described specific objectives and the strategic paths of the national energy policy indicate the importance attached to the valorization of the RE potentials sources (RE) that the country abounds in the form of sun radiation, wind conditions, hydraulic resources and biomass. The integration of RE in the energy policy of Mali was concretized through institutional and regulatory measures, and also through the practical achievements mentioned further on in this document.

Mali doesn't have a structured renewable energy market. The RE sub-sector still appears mainly as informal. However, Mali has always had a proactive policy with regard to renewable energies, which was concretized by the creation of the „Laboratory of solar energy" in 1964. More recently, a national strategy for the development of RE was worked out and adopted in January 2006. The integration of RE in the energy policy of Mali was concretized through institutional, legislative and regulatory measures including:

- Taking into account the fight against poverty, thus echoed in the energy policy through the objective of satisfying the highest possible number of people with energy services; from that follows the creation of AMADER intended for rural areas, the creation of funds for rural electrification, strategies and research in progress for reducing the impact of energy consumption on households, and from which also results the adoption of adequate systems of environmental protection, etc.).
- Taking into account the new reality of decentralization to better involve local authorities in energy services (delegation of the duties of client to the decentralized communities).
- In the field of decentralized electrification, the Frame of Reference for the Development of Rural Electrification (CdR-ER) constitutes an inventory of the major principles which will guide the set up of the regulation in the sector of rural electrification.
- From a fiscal point of view, the willingness to promote RE is expressed by the Government's renunciation to certain taxes through:
- The Decree 02-026/P-RM of January 30, 2002 stating suspension of the collection of VAT, import duties and taxes on solar and RE equipment is a result of this willingness to promote renewable energies.
- The order 04-1360/MEF-SG of July 12, 2004 defining the tax and customs system applicable to the markets and contracts fulfilled under the responsibility of the AMADER.

The Rural Electrification Fund (REF) plays a key role in this policy for facilitating access to energy services which are based mainly on RE technologies. The Fund is made up of Government endowment, subsidies from development partners, donors, gifts and legacy, loans, 25 % of sales incomes or renewal of authorizations whose holders benefitted from the subsidy provided by AMADER. Its management as ensured by AMADER must be directed in priority towards the operational funding objectives of the investments. It must also reinforce the particular risks relating to the amount invested in the private sector through guarantee mechanisms.

REF is intended to have three types of accounts. Its Subsidy Account is the principal source of funding investment operations in the sector of rural electrification. It is the only one implemented to date. The Guarantee Account of REF should be set up for private operators in order to provide them with guarantees from banks and decentralized finance companies. The Account of Credit, which is the third account type of the REF, is to create long-term sources of financing for operators of the RE sector, by placing long term financial resources at the disposal of banks and decentralized finance companies to ensure adequacy between incomes and expenditures.

Producers and distributors (private operators) regulate their status through a request for authorization or a declaration filed at AMADER. This regulation is a necessary condition before private operators can apply for funding from the REF for the development of their project, and – through this – enjoy exclusive title of exploitation on the area covered by the declaration or authorization.

In order to promote the establishment of the private sector as a major factor in rural electrification within the framework of a public/private partnership, AMADER launched with the assistance of the World Bank and KfW (Kreditanstalt fuer Wiederaufbau – Entwicklungsbank/German Development Bank) the Decennial Program of Rural Electrification (PRODER). The implementation of this program includes two operating modes: the Rural Electrification Priority Programs (PPER) which constitutes the top-down procedure of PRODER and the Projects of Spontaneous Candidacy for Rural Electrification (PCASER) which constitutes the bottom-up procedure besides the central programming of PPERs.

The top-down procedure relates to 10 zones of electrification which cover the whole Malian territory. Each zone, which has a Local Electrification Plan (LEP), will be assigned a permit holder following a competitive bidding organized by AMADER. This permit holder will enjoy exclusiveness in the electrification of the area covered by the permit. The LEP developed in eight Multisectoral Electrification Zones envisage the initial electrification of 136 localities with a population of about 500,000 inhabitants in 2008. The PACSER can be implemented by local communities, groupings of ultimate consumers, NGOs and private investors.

The law provides that when an operator is assigned a Multisectoral Electrification Zone where there are preexisting Projects of Spontaneous Candidacy for Rural Electrification (PCASER), the PCASER actors and the permit holders can make agreements so that the latter could resume the project for a compensation whose amount will be defined during negotiations under the aegis of AMADER.

Decentralized Service Companies (SSD) are added to these PCASERs, operating either at the level of a locality or several localities of a commune. They have a monopoly on the territories which are conceded to them. The first two are a) the SSD of Yeelen Kura which operates in the area of Koutiala and which currently proposes primarily domestic services using photovoltaic kits, and b) the SSD of Koraye Kurumba, which electrified four administrative centers of commune in the area of Kayes, using LV networks and diesel power stations working five hours a day.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

In the field of RE most activities and entrepreneurships relate to trade of equipments. Recent investments and businesses relate especially to the opportunities offered by AMADER in the field of rural electrification and the almost feverish passion for biofuels. Small Hydro Power generating systems and solar energy are offering recent opportunities through the procedures of licensing at AMADER. There are certainly official engineering departments and achievements, but also much of informal trade of RE technologies. The following has been achieved so far:

- Renewable energies adjusted to the concern of end-users.
- Nearly 700 solar PV pumps installed.
- More than 50,000 individual lighting systems are under operation.
- Telecommunications using intensively photovoltaic equipments for the power supply of insulated sites, more than 750 kWp installed.
- A significant decrease of the price of photovoltaic equipments: for example, the price of installed peak Watt decreased from 20,000 CFA Francs as at the beginning of the Eighties to approximately 6,000 (in 2008/2009).

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The ecological diversity of Mali results in a very contrasted forest situation between shrubby savannas in the North of the country (covers less than 10m^{3}/ha), striped bush with stem wood volumes sometimes reaching 20 to 40 m^{3}/ha (covers 25 % of the southern part of the country), then forests of the Sudanian Guinean zone (covering between 50 and 80 m^{3}/ha), and the forests galleries of the West of the country (which sometimes cover even more than 100 m^{3}/ha). The national forest estate is approximately 100 million ha for a production of approximately 21 million ha. The surface with controlled exploitation is more than 350,000 ha. Forest surfaces and their productivity are in perpetual regression. According to various studies, 100,000 to 400,000 ha are lost every year due to anthropogenic actions (such as deforestation, clear cuts etc.) and climatic variations. This regressive evolution of the forests occurring these last decades is - on the one hand - due to the climatic changes. Biomass represents nearly 90 % of the domestic energy source of the country, proving that the other conventional products still have a marginal role in the field.

The potential of animal wastes and plant residues is high and well distributed on the whole territory. Agricultural residues (straw, rice husk, stalks of cotton, millet, sorghum, corn, etc.) are significant almost everywhere except, of course, in the Saharan northern part of the country. The biomass is available, in particular around the agro-industrial units installed in some areas (Office du Niger, Office Riz Segou, Office Riz Mopti and Office de la Haute Vallée du Niger). The enormous potential of biomass energy cultivation in the country (jatropha, sugar canes) would allow the production of vegetable oils and alcohols that can be used as fuels in substitution to hydrocarbons.

The quantity of stems of cotton plant produced per annum is estimated at 400,000 tons in Mali. The potential production of waste from rice production is more interesting. As an example, the potential of biomass from the cultivation of rice in two areas of the region of Ségou is about 265,000 tons of straw and 55,000 tons of husk. In a study entitled “From the Rice husk to Energy”, realized in 2005 by an American company, it is specified that with a current annual production of 800.000 tons rice paddy, the production of rice straw would be approximately 168.000 tons and would make it possible to produce (126 GWh). The study pointed out that the availability of the rice husk could be limited. This limitation is mainly due to the disappearance of large mills which, following the privatization of the industry and the trade of rice at the beginning of the 90s, were closed for various reasons and were replaced by decentralized small systems run by village associations. Raw materials are dispersed within a very extended area, resulting in high collection and transport cost to any energy plant. This study stresses that the only active large mill in the town of Ségou currently produces 2.000 tons of rice husk per annum, while in a group of villages located in the zone of Niono, 10 mills with a capacity of two tons per hour (each) produce approximately 15.000 tons of rice husk per annum.

These mills, which are located in a radius of 10-15 km, should be supplemented by 10 other mills of similar capacity, which would raise the total availability of husk to 30,000 tons per annum. In this context, the study specifies that a capacity of 15,000 tons per annum would make it possible to operate a unit of co-generation of 1.2 MW (consuming 45 tons of husk per day during 330 days per annum). Two other regions, Mopti and Tombouctou, produce enough rice husk which could feed co-generation units that can operate for base load and reduce considerably fossil fuel consumption in EDM – SA power stations of these two towns that are far from being connected to the national grid.

With regards to further biomass applications, so far Mali does not have any significant liquid or gaseous biomass based plant or equipment under utilization. In the past, however, the rice agro-industry[4] had experimented with two 100 kW power plants based on producing methane from rice husk for feeding a diesel engine. This equipment, a Chinese technology, did not overcome the experimental stage. In the same area, the sugar cane industry tested some engines using alcohol, but this small-scale experiment was never expanded. The only biomass based liquid energy producer is Mali Biocarburant. Since 2008, a small-scale bio diesel plant has been extracting jatropha oil and transforming it into biodiesel through an etherification process. The production is expected to reach about 4,500 tons per year. Further information is available at www.malibiocarburant.com.

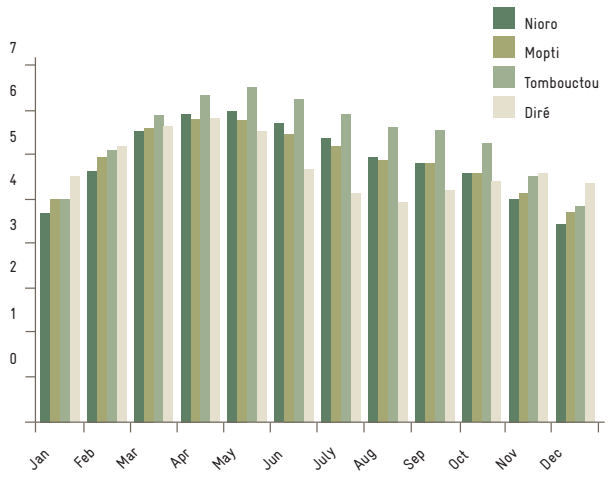
4.2 SOLAR ENERGY

The average solar radiation is 6 kWh/m² per day. The average daily duration of sun lighting varies between 7 and 10 hours. With a little more than 700 PV solar pumping units, more than 50,000 Solar Home Systems (SHS), hundreds of household solar water heating installations solar drying system – the latter mainly used by women for food processing small businesses -, Mali has sufficient experience today to appreciate the root barriers in changing the scale in harnessing RE sources. However, other niches such as solar air-conditioning are experiencing a rather slow development compared to the local potentialities. The most relevant prediction may lie on forecasting electricity generation in isolated cities. The most recent significant RE investment in Mali is a centralized 75 kW PV plant aimed to supply electricity to Kimparana, a village situated in the central part of the country at up to 525 km from the capital city. Other investments in rural electrification, using RE technologies are under preparation.

As a forecasting, there are a lot of possibilities of self generation (solar energy, bio-fuels, etc.), which allow the production of small quantities of electricity to those clients, invoiced on contractual basis, and ensure profitability of the operations. For example, EDM-SA is feeding remote medium sized cities with diesel engines reaching a total of 100 MW. A little share of 20 to 40 % of solar PV make a forecast of almost 27 to 54 MWp of PV panels. These prospects attract a lot of investors. Thus, on January 21, 2008 AMADER was able to sign agreements for a total of 3.2 billion CFA F. Of that amount 2.3 billion were provided by AMADER (under World Bank funding), and 927 million by local private operators. The agency indicated that out of the 30 operators that had expressed their interest for the subsidies, nine tenders of business plans were retained. These projects were subsidized at 65–75 % and 6,154 electrical connected consumers (households and small businesses) will benefit from these projects of rural electrification.

FIGURE 6

Average Solar Insulation in 4 Cities of Mali (KWh/m²/day)



Source: Graph compiled by the author S. Diallo – 2009 (Data from NASA Surface meteorology and Solar Energy Data Set)

4.3 WIND POWER

From 2001 to 2004, GTZ supported the Direction de l'Energie (DNE) within the Ministry of Energy in Mali (MMEE) in appraising a project aiming to integrate wind turbines into the diesel-fuelled isolated grid supplying the provincial capital city of Gao in the northeast of the country. Results of wind measurements (March 2001 - October 2003) showed a relatively low wind potential. Mean wind velocities are 5.3 m/s at a height of 41 m and 4.7 m/s at a height of 26 m. Based on these measurements and with the assistance of DNE and the power utility Energie du Mali (EDM), GTZ undertook a technical and economic feasibility study[5] conducted by Lahmeyer. The study was finalised in July 2004 and showed a positive result. Total investment for a 900 kW wind farm is estimated at EUR 1,7 million. The relatively high level of feed-in tariffs that will be necessary for the wind turbine generating systems (roughly 18 €-cent/ kWh) can be justified on economic grounds, however, as this is below the cost of diesel generation (at the time of the study: approx. 21 €-cent/ kWh). The high cost of diesel is due above all to the expensive and lengthy transport route for the fuel. The study, though, worked on the assumption of an average crude oil price of USD 25 per barrel as applicable in 2004, so the costs of electricity generation from diesel in Gao are likely to be considerably higher by now.

4 OFFICE DU NIGER, AS OF 1969

5 GTZ, AS OF 2004

An exhaustive review shows that more than 150 wind pumps and more than 10 aero-wind pumps (for the production of electricity) were installed throughout Mali, especially in the Sahelian area. The energy services provided by these wind mills were mainly used for supply of drinking water and creation of income generating activities (gardening/truck farming, etc.) as well as for pastoral hydraulics.

TABLE 7

Speed and Frequency of Wind: Series of Measurements in Gao (2003)

Direction (°)	0	30	60	90	120	150	180	210	240	270	300	330
Wind (m/s)	5.3	5.0	5.7	5.8	5.5	4.9	4.8	4.8	5.2	4.6	4.0	5.3
Frequency (%)	12.	9.6	15.2	10.9	5.6	5.0	8.4	7.2	8.9	6.7	3.8	6.4

Source: Direction Nationale de l'Energie, 2003

4.4 HYDRO POWER

A hydroelectric potential of about 1,050 GW and 5,000 GWh of average production is identified for the principal rivers and their tributaries: Out of this national hydroelectric potential, less than 15 % are currently exploited. Table 8 presents the hydro power sites currently in operation, Table 9 indicates the estimated capacity of potential sites for micro Hydro Power Generation.

TABLE 8

Hydro Power Site in Operation

SITES UNDER OPERATION				
N°	Name	River	Capacity MW	Producible GWh
1	Sotuba I	Niger	5.4	40
2	Felo I	Sénégal	0.6	3
3	Sélingué	Sankarani	44	180
4	Manantali	Bafing	200	800
Total			244	1023

Source: Direction Nationale de l'Energie, 2006

TABLE 9

Potential Sites for Micro Hydro Power Generation

N°	Name of the site	River or Region	Fall (H) in meters	Estimated Capacity (KW)
1	Seuil de Talo	Bani	4,5	2400
2	Seuil de Djenné	Bani	2/5	1000
3	Farako 1	Sikasso	7	50
4	Farako 2	Sikasso	15	25
5	Sirakorobougou	Sikasso	7	3
6	Mimbougou	Sikasso	3	8
7	Woroni	Sikasso	60	350
8	Kéniéto	Kéniébal/Kayes	90	250

Source: Direction Nationale de l'Energie, 2006

5 MARKET RISKS AND BARRIERS

The main risk for the RE market development in Mali is the lack of the enforcement of the existing energy policy. Some merchants with a general license of trade could sell RE technologies without any feedback for maintenance and other services, deserving the image of the energy source and/or technologies. There is no dedicated body for quality control at the borders of the country aiming to select good comparative standards for the market.

Investments in RE in Mali are not easily quantifiable because activities in this field are generally built-in as part of multi sector programs (including issues on health, education and energy), and it is often difficult to precisely evaluate the energy share of these projects. Until now, the most active segment of the solar market is for water pumping which received important support from the CILSS (Inter-states Committee for Fight against the Drought in the Sahel) with funds of the European Union. Domestic" and "Community" segments "(the latter being mainly a market for refrigeration) are not very active compared to physical conditions and/or technical potential.

The segment of the professional energy applications offers many opportunities. However, the energy choice made by the national telecom operator was directed, so far, towards the diesel generators. A private company started at the beginning of the 1990s to install 18 solar PV systems (with an average power output of about 2.5 kWp) for telecom relays.

The Code of Investments in Mali established a privileged tax system in order to promote the investments of private (national and foreign) capital for production activities and service deliveries. It offers the necessary guarantee to secure the investments made by the national and foreign operators intervening in the exploration, exploitation, conveyance and refining of liquid or gas hydrocarbons. A survey of entrepreneurs and investors in Mali has identified the stable political climate, safety, costs of various factors (especially labor) and an advantageous tax regime as significant attractions for foreign investors. The survey also emphasized that the institutional reforms and the new regulatory environment were encouraging a climate of trust. Only with respect to the judicial system the survey noted a wish/recommendation for more transparent decision-making processes. This new phase of development presents interesting investment opportunities in specific sectors such as mining, energy, infrastructure and service development (especially in the context of privatization), and cotton.

Any Malian or foreign corporation or individual may acquire or create a commercial, industrial, or banking and financial company in Mali. The Constitution guarantees free enterprise and property rights in Mali. There are no specific restrictions on access to various investment areas or on the creation of companies. And Malian legislation does not oblige foreign investors to make the Malian Government or a Malian person or corporation a partner in their companies, except in the mining and petroleum industries, where the Malian Government reserves a minority interest of approximately 20 %.

The conditions of approval for the creation of a company are defined in Order 95-159/P-RM dated 12 April 1995. In order to minimize formalities, a structure known as the "Guichet Unique" ("single window concept") was created by the Direction Nationale des Industries (National Directorate of Industries). The Guichet Unique is under the Ministry of Economy, Industry and Trade and is responsible for informing, advising and assisting investors concerning the procedures they must take. It has four sections: Registration; Manufacturing and Agricultural Activities; Buildings, Public Works and Real Estate; and Service Activities.

All areas of activity are covered by the Guichet Unique, except health care, education, communications, audiovisual, print media, purely commercial activities, petroleum and mine prospecting and exploitation, which are governed by other laws. The Guichet Unique is an ideal contact for project promoters, acting as their interface with the administration.

Recently, Mali sped up property registration by decentralizing and reorganizing their registries. The country also reformed business start-ups by introducing a single company identification number. Mali has also cut the time for start-up processes. However, the country's rank is still very low in the "World Bank doing business profile" (166 out of 181 countries). The results are presented in Table 10.

Further information regarding potential investments could be obtained at the "Agence pour la Promotion des Investissements au Mali"[6].

TABLE 10

Ease of Doing Business Ranking of Mali

SELECTED INDICATORS	
Ease of doing business	166
Starting a business	162
Dealing with construction permis	106
Employing workers	94
Registering property	94
Getting credit	145
Protecting invastors	150
Paying t???	156
Trading across boarders	166
Enforcing contracts	158
Closing a business	114

Source: World Bank, The Doing Business Project, 2008

6 SEE ALSO WEBSITE OF THE AGENCY: WWW.APIMALI.GOV.ML

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACT

TABLE 11

Governmental Institutions

NAME	ADDRESS & TEL	FIELD OF ACTIVITY	EMAIL
Ministry of Energy, Mines and Water	Colline de Badalabougou BP 19 Bamako – ex CRES	Policy and general planning (demand and supply)	www.mmee.gov.ml
National Direction of Energy	Badalabougou BP 134 Bamako – ex CRES	Evaluation of the potential of energy resources and ensuring of their valorization	dne@afribone.net.ml
The National Center of Solar Energy and Renewable Energies (CNESOLER)	Badalabougou BP 19 Bamako – ex CRES	Research and promotion of RE	cnesoler@yahoo.fr
National Engeneering School (ENI)	BP 242 Bamako – Mali	Training on energy issues	eni@spider.toolnet.org
The Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER)	Badalabougou BP E 715 Bamako – Mali	Household energy substitution programs and access to electricity in rural and peri-urban areas	amader@amadermali.net
National Office of Petroleum Products (ONAP)	Quartier du fleuve, Bamako	Pricing and regulation for petroleum products	onapmali@afribone.ml.net
National Representative of the Organization for the Valorization of the Senegal River (OMVS)	Zone industrielle-Route de Sotuba – Rue 851 Porte 407 BP E 2618 BAMAKO – MALI	Valorization of the Senegal River in cooperation with Mali, Mauritania and Senegal	cnomvsmali@omvs-mali.org
Trust Company of Manantali Energy (SOGEM)	ACI 2000 – BP E 4015 BAMAKO – MALI Tel:20298350/20290422	Public corporation of estate created by the member states of the OMVS	sogem@sogem-omvs.com
Énergie du Mali (EDM-SA)	Square Patrice LUMUMBA BP 69 BAMAKO – MALI	Licensee for electricity public service	edm@edm-sa.com.ml/edm@edmsa.net
ESKOM Energy Manantali SA (ESKOM)	Hyppodrome – Avenue Al Quods – Immeuble Boubacar Koïta – BAMAKO – MALI	Operation and the maintenance of the dam, production and transport of energy of the hydroelectric power station of Manantali	eskom@eskom-mali.com
The Malian Agency for Radioprotection (AMARAP)	Badalabougou ex – CRES BAMAKO – MALI	Pacific use of nuclear energy and protection against harmful ionizing radiations	amarap@buroticservices.net.ml
The National Direction of Geology and Mines (DNGM)	Route de Sotuba, Bamako Tel: +223 221 78 81/Fax: +223 221 02 31	Oil geology, geophysics and exploration/ quality control of petroleum products	www.dngm.net
The Commission of Electricity and Water Regulation (CEWR)	Rue 23/23 B.P. 115 Bamako	Regulatory body of the sector of electricity and potable water	cree@creemali.org

TABLE 12

Commercial Partners in the Field of Renewable Energies

NAME	ADDRESS & TEL	FIELD OF ACTIVITY	EMAIL
Ministry of Energy, Mines and Water	Colline de Badalabougou BP 19 Bamako- ex CRES	Policy and general planning (demand and supply)	www.mmee.gov.ml
National Direction of Energy	Badalabougou BP 134 Bamako- ex CRES	Evaluation of the potential of energy resources and ensuring of their valorization	dne@afribone.net.ml
The National Center of Solar Energy and Renewable Energies (CNESOLER)	Badalabougou BP 19 Bamako- ex CRES	Research and promotion of RE	cnesoler@yahoo.fr
National Engeneering School (ENI)	BP 242 Bamako - Mali	Training on energy issues	eni@spider.toolnet.org
The Malian Agency for the Development of Domestic Energy and Rural Electrification (AMADER)	Badalabougou BP E 715 Bamako- Mali	Household energy substitution programs and access to electricity in rural and peri-urban areas	amader@amadermali.net
National Office of Petroleum Products (ONAP)	Quartier du fleuve, Bamako	Pricing and regulation for petroleum products	onapmali@afribone.ml.net
National Representative of the Organization for the Valorization of the Senegal River (OMVS)	Zone industrielle-Route de Sotuba - Rue 851 Porte 407 BP E 2618 BAMAKO - MALI	Valorization of the Senegal River in cooperation with Mali, Mauritania and Senegal	cnomvsmali@omvs-mali.org
Trust Company of Manantali Energy (SOGEM)	ACI 2000 - BP E 4015 BAMAKO - MALI Tel:20298350/20290422	Public corporation of estate created by the member states of the OMVS	sogem@sogem-omvs.com
Énergie du Mali (EDM-SA)	Square Patrice LUMUMBA BP 69 BAMAKO - MALI	Licensee for electricity public service	edm@edm-sa.com.ml/edm@edmsa.net
ESKOM Energy Manantali SA (ESKOM)	Hyppodrome - Avenue Al Quods - Immeuble Boubacar Koïta - BAMAKO - MALI	Operation and the maintenance of the dam, production and transport of energy of the hydroelectric power station of Manantali	eskom@eskom-mali.com
The Malian Agency for Radioprotection (AMARAP)	Badalabougou ex – CRES BAMAKO - MALI	Pacific use of nuclear energy and protection against harmful ionizing radiations	amarap@buroticservices.net.ml
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The Commission of Electricity and Water Regulation (CEWR)	Rue 23/23 B.P. 115 Bamako	Regulatory body of the sector of electricity and potable water	cree@creemali.org

Source: Table compiled by the author S. Diallo, 2009 (data from various documents & address books)

7 BIBLIOGRAPHY

- Direction Nationale de l'Energie (2006): Sites de Microcentrales.
- ECOWAS, EMUWA (2004). Country Profile Mali: Access to the energy services in rural and peri-urban area to achieve the Millennium Development Goals.
- Energie du Mali-SA (2002-2007): Rapports annuels.
- GTZ (2004): Wind energy in Mali. Feasibility study (WWW.GTZ.DE/DE/DOKUMENTE/EN-WINDENERGY-MALI-FEASIBILITY-STUDY-GAO-2004.PDF)
- L'Observatoire des énergies renouvelables (2008): www.energies-renouvelables.org.
- Malian Agency for Domestic Energies and Rural Electrification - AMADER (2004/2005): Textes de creation, manuel de procedures de l'AMADER.
- Ministry of Energy, Mines and Water (2006): Document de politique énergétique.
- Ministry of Energy, Mines and Water/Direction of Energy (2005): Multisector Committee of follow-up of the European Initiative.
- Ministry of Finance/Project Coordinating Unit (2004): Annual Report of First Year implementation of the Strategic Framework of Fight against Poverty, CSLP.
- Ministry of Finance (2003): Ex-post evaluation Report on the results obtained within the framework of programs FASR/FRPC of the IMF.
- Ministry of National Education of Mali (2000): Document of the „Decennial Education Project (PRODEC).
- Ministry of Public Health: Document of the „Decennial Health Project (PRODES)".
- NASA (2008): Surface Meteorology and solar Energy Data Set (http://eosweb.larc.nasa.gov/sse).
- National Center for Solar and Renewable Energies (CNESOLER)/UNDP Country Office Mali (2001): Reinforcement of the role of women in the promotion of Renewable energies/Impact studies on new and renewable energy technologies.
- Office National des Produits Petroliers (2008): Structure indicative des Prix des Carburants.
- Office National des Produits Pétroliers (2008): Valeurs en douane des produits pétroliers au titre des importations.
- Plan National d'accès à l'Eau potable – PNAEP 2004-2015.
- UEMOA (2007): Rapport du Comité de Convergence.
- UNCTAD (2001): An Investment Guide to MALI: Opportunities and Conditions.
- UNDP Country Office Mali (2002): Project Document titled „Adoption of New and Renewable Energies on broad scale in Mali.
- UNDP Country Office Mali (2004): Report of Follow-up of Implementation of the Millennium Development Goals (MDGs).
- UNDP/Project PTF (2004): Improve living conditions in rural areas through access to energy/A review of the multipurpose platform in Mali.

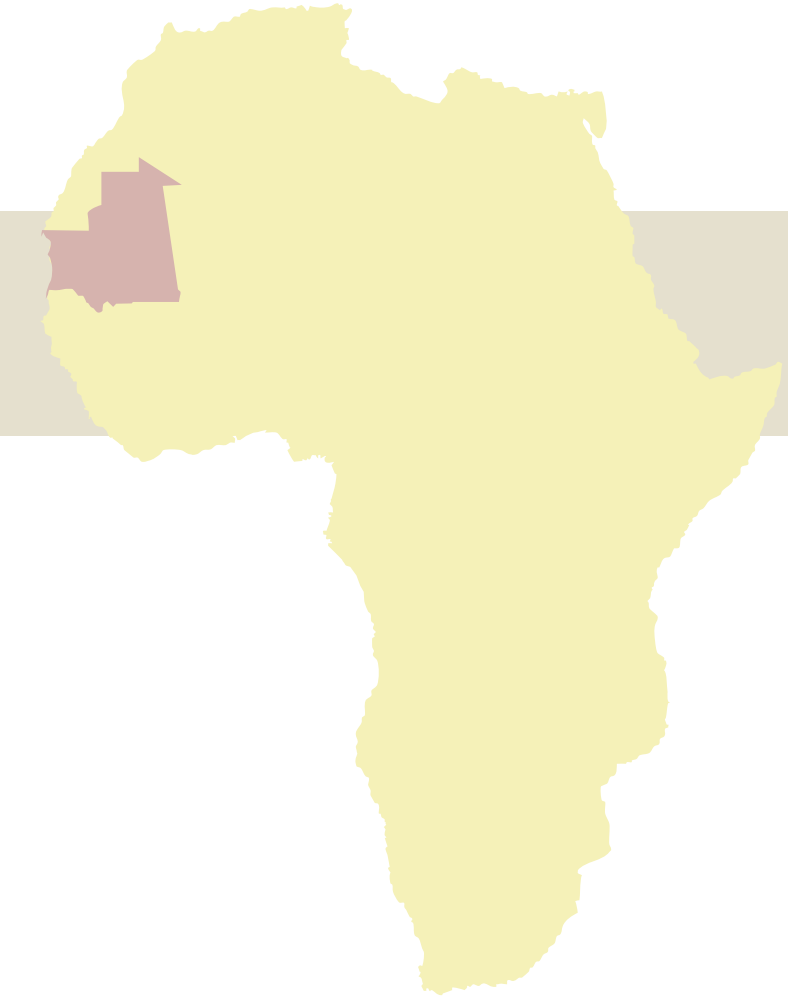
8 ANNEX

TABLE 13

Evolution of Petroleum Imports (2001–2007)

	VOLUME OF PETROLEUM PRODUCTS IMPORTED IN MALI (TONS)						
	2001	2002	2003	2004	2005	2006	2007
Petrol	99.339	105.455	94.818	103.729	103.472	102.726	117.664
Kerosene	45.027	44.396	28.763	36.166	31.267	31.650	16.129
Jet A1	24.494	21.114	20.319	19.758	23.875	20.245	21.790
Diesel	268.180	277.668	21.6066	239.533	354.467	410.356	405.769
Full Oil	98.820	57.126	110.987	121.275	40.378	36.369	52.721

Source: Graph compiled by the author S.Diallo, Data from ONAP, 2008



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ACRONYMS AND ABBREVIATIONS

MAURITANIA

ADER	Agence du Électrification Rural (Rural Electrification Agency)
ARM	Agence de Régulation Multisectoriel (Multisector Regulation Agency)
AU	African Union
CFPT	Centre de Formation Professionnel et Technique (Center for Professional and Techical Training)
CSLP	Cadre Stratégique de Lutte Contre la Pauvreté (The Strategic Framework of Fight against Poverty)
DRSP	Document de la Stratégie de Réduction de la Pauvreté (Poverty Reduction Strategy Paper)
EAM	Enquête Auprès des Ménages (Census of households)
ECOWAS	Economic Community Of West African States
EEC	European Economic Community
EPCV	Enquête Permanente sur les Conditions de Vie des Ménages (The Permanent Investigations into the Living Conditions of Households)
ESAF	Enhanced Structural Adjustment Facility
FLM	Federation Lutherans Mondale (Lutheran World Federation)
FOB	Free One Board
GDP	Gross Domestic Product
GRET	Groupe de Recherche et d'Échanges Technologiques (Research Groupe on Technolgy Exchange)
IPPTE	Initiative en Faveur des Pays Pauvres Très Endettés (Initiative of the Heavily in Debt Poor Countries)
IMF	International Monetary Fund
IPP	Independent Power Producer
LPG	Liquified Petroleum Gas
MDG	Millinium Developement Goal
MEP	Ministry of Energy and Power
MTEF	Medium Term Expenditure Framework
NTIC	New Technologies of Information and Communication
PREDAS	Programme Régional de Promotion des Énergies Domestiques et Alternatives au Sahel (Regional Programme for the Promotion of Domestic and Alternative Energies of the Sahel Region)
PRS	Programme Régional Solaire (Regional Solar Programme)
PRSP	Poverty Reduction Strategy Paper
PSAE	Projet d'Énergie Solaire Photovoltaïque (Project of Photovoltaic Solar Energy)
RE	Renewable Energy
RPTES	Regional Program for the Traditional Energy Sector
SHS	Système Solaire Photovoltaïque (Solar Home Systeme)
SNDE	Société Nationale Des Eaux (National Water Society)
SOMAGAZ	Société Mauritanienne des Gaz (The Mauritanian Gas Company)
SOMELEC	Société Mauritanienne d'Électricité (state owned national power company)
TER	Technologie d'Energie Renouvelable (Renewable Energy Technology)
UNDP	United Nations Development Programme
USD	United States Dollar
WAEMU	West African Economic and Monetary Union

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 Kilowatt hours (kWh))
kg	kilogramm
km²	square kilometer
ktoe	kilotons of oil equivalent (= 1,000 toe)
kWh	kilowatt hour
kV	kilovolt
m/s	meters per second
m³	cubic meter
mm	millimeters
Mtoe	million tons of oil equivalent (1 Mtoe = 1,000,000 tons of oil equivalent)
MW	megawatt (1 MW = 1,000 kW)
toe	tons of oil equivalent
°C	degree Celsius

SUMMARY

The Country Study of Mauritania is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Mauritania. The study is structured as follows:

Chapter one provides **Background Information on Mauritania**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Mauritania.

Chapter two summarizes facts and figures of **Mauritania's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Mauritania. This includes an overview of support mechanisms mainly for PV as well as already existing regulations, incentives and legislative framework conditions also for other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Mauritania.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Mauritania

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Mauritania is located in the Sahara Desert belt of West Africa and shares borders with Morocco, Algeria, Mali and Senegal. The capital city and major port is Nouakchott, other major cities are Kaedi and Zouerate and the port of Nouadhibou. The country has a total area of 1,030,700 km² and possesses a 700 km Atlantic coastline; approximately 75 % of Mauritania is desert or semi-desert area. Due to the desert in the North and the Sahelien in the South, the climate of Mauritania is characterized by a continuous regression of precipitations, which shows great interannual variations that can exceed an 80 % deficit as compared to the normal.

The climate is generally hot and dry with mild and short winters (3 months). Rainfall varies between less than 50 mm in North and more than 450 mm in the South (see the chart of the isohyets for the period of 1961 to 1990 above). In most areas, the temperatures often exceed 40 °C during the hot season. The coercive and random climatic conditions are likely to predispose the country with the instability and the degradation of the natural resources.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Constitution of the Islamic Republic of Mauritania was approved of in 1991, providing for a multi-party system with an elected president, comparable to the French presidential model. The national economy is dominated by animal breeding, agriculture, fishing and mining activities. Mauritania's major export industries are iron ore, fish and fish products, while it's most important imports are machinery and equipment, petroleum products, capital goods, food and some consumer goods. Mauritania has only limited agrarian resources, but the country has remarkable mineral deposits of iron, copper and gold. Some crude oil reserves were discovered in various offshore oil fields in 2001.

The majority of Mauritania's population still depends on agriculture and livestock, even though most of the rural inhabitants were forced into the cities by recurrent droughts in the 1970s and 1980s. In recent years, drought and economic mismanagement have resulted in a build-up of foreign debt. In March 1999, the Government signed an agreement with a joint World Bank – International Monetary Fund (IMF) mission on a USD 54 million Enhanced Structural Adjustment Facility (ESAF). The economic objectives have been set for 1999–2002. Privatization remains one of the key issues. Mauritania is unlikely to meet ESAF's annual GDP growth objectives of 4–5 %.

Mauritania has transformed from a country with limited economic base and poor social indicators to a highly urbanized and increasingly market-driven economy. However, the rural sector still employs about 40 % of the labor force. Due to the recent stabilization and new revenues, the per capita income was about USD 938 in 2007. The average economic growth of Mauritania was 4.8 % between 2001 and 2004, reaching 5.4 % in 2005 and increasing to 11.4 % in 2006, mainly due to the start of oil production (non-oil GDP growth was 4.1 %).

Besides existing natural resources, the economic growth was mainly accomplished by the expansion of the secondary and tertiary sectors of the economy. The national economy, however, still suffers from high costs, underdeveloped financial markets, low human resources and lack of appropriate infrastructures. Despite the recent socio-economic progress, Mauritania ranked at position 137 (out of 177 countries) in the Human Development Index (HDI) of 2008[1].
Since 1994, several programs and strategies of fight against poverty have been implemented. The Strategic Framework of Fight against Poverty (CSLP) worked out by the Mauritanian Government in 2000 summarizes the main trends and is based on interdependent sector strategies. As a matter of fact, the strategy of fight against poverty consists of four major objectives: (i) the acceleration of the economic growth and its

1 UNDP, 2008
2 ÉNERGIE ET PAUVRETÉ, TAMCHIR THIAM, 2004

anchoring in the sphere of the poor; (ii) the development of human resources; (iii) the expansion of the basic services and (iv)the promotion of an institutional development and good governance.

2 ENERGY MARKET IN MAURITANIA

2.1 OVERVIEW OF THE ENERGY SITUATION

Based on figures of the Cellule de Contrôle de l'Énergie, the per capita energy consumption in Mauritania is estimated at 0.3 toe (0.17 toe without biomass) and 190 kWh of electricity. The energy balance of the Mauritania is composed of about 67 % of biomass (firewood and charcoal), followed by various petroleum products (33 %). The detailed energy consumption figures are presented in Table 1.

According to various investigations made from 1990 by the Regional Program for the Traditional Energy Sector (RPTES), the dominance of wood fuel (firewood and charcoal) was evident in the national energy balance. The wood energy (firewood and charcoal) accounted for 93 % in meeting the needs of cooking in households and more than 50 % in final energy consumption in the residential sector (59.5 % for charcoal and 27.5 % for firewood) against 9 % for butane gas, 3.4 % for electricity and 0.4 % for kerosene and for insignificant traces of RE such as solar and wind power2.

The energy sector of Mauritania is characterized by an increasingly significant demand for domestic energy. The total consumption is more than the energy produced due to the high need of consumption of electricity in various sectors, which are estimated at 35–39 %. The energy sector is divided in three parts, i. e. the electricity sector, the petroleum sector and the biomass sector.

TABLE 1

Energy Consumption in Mauritania

PRODUCT	CONSUMPTION (ktoe)
Gasoline	47.566
Jet fuel	79.054
Fuel oil	23.260
Gas oil	446.124
LPG	30.0866
Kerosene	13.650
Total consumption – petroleum products	626.228
Firewood	902.8
Charcoal	361.120
Total consumption – biomass	1,263.392
Total energy consumption	1,890.148

Source: Cellule de Contrôle de l'Énergie (reviewed by the author), as of 2004

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

Between 1960 and 1997, the country's total installed and operating electricity-generating capacity was about 130 MW from 13 power stations all over the country driven by diesel engine generator units. In 2009, the state owned national power company (SOMELEC) evaluated the current total installed capacity excluding auto-producers (mining, industrial and commercial) at about 200 MW of which 49 MW are located in Nouakchott.

SOMELEC is exclusively responsible for the distribution and commercialization of electricity in Mauritania. The company manages the electric utilities in 20 urban centers with a total capacity of 93.6 MW (against 75 MW in 2005) and 18 power stations in the center of the country. The net production is 402 GWh in 2006 (against 374 GWh in 2005). Due to the high demand for energy, total consumption exceeds the national energy production with about 35–39 %. In 2000, the per capita electrical energy consumption was 190 kWh. Consumption increased to 320 kWh in 2002 and decreased gradually to 190 kWh in 2006. Even though there are several self-sufficient energy producers in the country (with an estimated capacity of 40 MW), the majority of mining companies, industrial, commercial and domestic consumers continue to be customers of SOMELEC.

The continuous decline of electricity generation by SOMELEC in Mauritania towards the end of 2007 can be explained by the appearance of Independent Power Producers (IPP) in the country. Moreover, the currently installed capacities are not sufficient to meet the national demand, and some production capacities are not interconnected. Concerning the overall electrification rate, the proportion of the households connected to the electric network passed from 22 % in 2000 to 24 % in 2004 (with a rate of 47 % in wealthy areas). At the national level, the principal source of lighting for households remains nevertheless the torch, (51.2 %), while in urban areas 57.6 % of the households used electricity in 2004 (as compared to 49 % in 2000). In the capital of Nouatchott, this rate reaches 62.5 %, whereas it amounts to 64.6 % for Nouadhibou and more than 89.1 % for Zouerate.

The electricity provided by the SOMELEC is currently sold according to an official price fixed on 1 January 2002 by the Government (Multisector Regulation Agency (ARM). Table 2 presents the pricing structure of electricity in Mauritania. The Government of Mauritania intends to diversify the electricity production and plans to set up appropriate regulations (technical issues and feed-in tariffs) for electricity from RE.

TABLE 2

Electricity Prices

CONSUMPTION KWH/MONTH	FIXED COSTS/MONTH	PRICE/KWH
Up to 25	1.850 Euro	0.137 Euro
Between 25 and 120	4.550 Euro	0.213 Euro
More than 120	20.100 Euro	0.237 Euro

Source: M. Ahmedou Ould Mohamed Mahmoud, Chef de Service ADER, Dakar Workshop on CDM, as of 2009

Petroleum Sector

Due to recent discoveries of oil resources, Mauritania is receiving increased international attention as a new player in the global oil industry. First supplies from the Chinguetti field started to flow in 2006, followed by the conducting of successful offshore explorations. Up to now however, the energy consumption of petroleum products is mainly covered by imported fuels.

In 2004, the utilization of LPG for cooking purposes reached a total of 35 %. Even though there was an increase of about 7 % (compared to 2000), the difference is still considerable between the different social strata. In urban areas, about 62.8 % of the households are cooking with LPG as compared to only 16.2 % of the households in rural areas. Kerosene is mainly used for lighting purposes. The consumption, however, remains more or less static due to the extension of the electrical network and the existence of other energy sources for lighting purposes. Table 3 presents the evolution of energy consumption by type of fuel. Figure 2 visualizes the figures.

According to Ordinance No. 2002–2005[3] of 28 March 2002, Mauritania's prices for petroleum products are set by the individual distribution companies according to their actual economic costs. The liberalization of prices, the information requirements of users faced by distribution companies and the information to be regularly communicated to the competent authorities and to the National Commission of Hydrocarbons is specified by decree on the proposal of the Ministry of Energy and Power (MEP). As specified in Article 21, the National Commission of Hydrocarbons is in charge of monitoring the market prices on the basis of a determination system. This ensures free competition, high quality and just service standards as well as a market with fair prices and the protection of customers.

The selling price of LPG is fixed by a joint decree of the Ministries of Energy and Power and the Ministry for Trade and Industry (MTI). Since 1987, the price is given on the basis of quotation FOB (Free One Board) of the international market. The elements of the price are fixed by decree N 089.118 of 6 September 1989. In theory, the price for LPG is fixed every month according to the fluctuation of spot market prices; the prices, however, have not been modified since 18 July 2001. Table 4 presents an overview of current prices for petroleum products.

TABLE 3

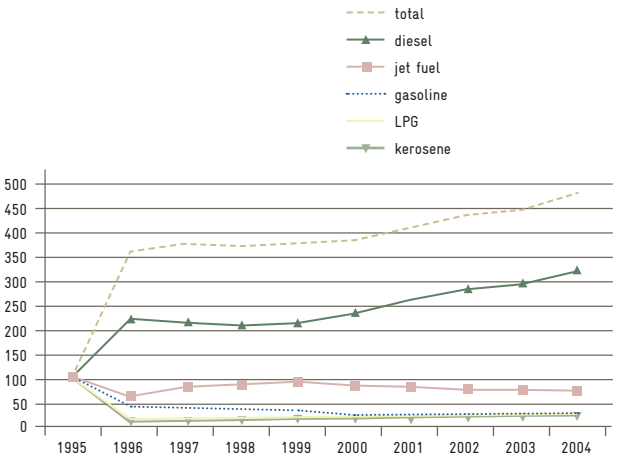
Consumption of Petroleum Products (10^3 metric tons)

PRODUCT	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Gasoline	42.16	41.66	38.33	37.90	33.63	26.18	23.31	27.40	26.61	27.98
Jet fuel	60.02	61.31	85.52	87.48	89.12	87.20	81.77	76.86	76.51	75.29
Kerosene	12.17	15.22	15.76	17.41	19.15	20.63	20.31	20.09	22.95	24.23
Diesel	207.34	220.90	214.78	206.48	210.57	228.64	258.52	280.26	290.49	318.66
LPG	13.99	16.76	17.03	14.76	19.07	17.84	18.72	20.72	22.58	26.62

Source: Direction de l'Approvisionnement, Ministère Chargé de l'Énergie, as of 2006

FIGURE 2

Consumption of Petroleum Products (103 metric tons)



Source: Direction Provisioning, Ministry of Energy, as of 2006

TABLE 4

Price of Petroleum Products

PRODUCT	PRICE
Gasoline	0.676 Euro/liter
Diesel	0.594 Euro/liter
Kerosene	0.119 Euro/liter
LPG	12.196 Euro/38 kg bottle
	4.013 Euro/12.5 kg bottle
	1.700 Euro/6 kg bottle
	0.724 Euro/2.5 kg bottle

Source: market research by the author, as of 2009

3 DROIT AFRIQUE, 2005

Biomass sector

Wood remains the first source of energy for cooking purposes with a total of about 44.6 %, while charcoal accounts for about 19.1 %. Table 5 and Figure 3 present an overview of consumption figures.

The prices of firewood and charcoal are freely determined by the market. The MEP and the MTI, however, have fixed the general price structure. The most recent price structure with the final selling price is presented in Table 6.

TABLE 5

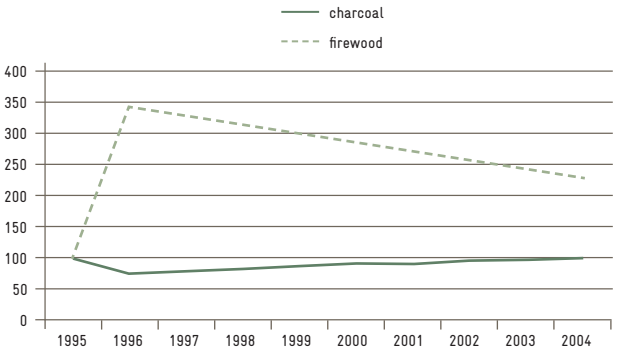
Consumption of Firewood and Charcoal (10^3 metric tons)

PRODUCT	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Firewood	348.8	340.0	326.9	312.0	296.9	284.0	270.9	252.6	240.6	225.7
Charcoal	72.5	74.9	78.8	82.4	86.9	89.9	90.5	95.2	97.8	98.6

Source: Direction of Environment, as of 2008

FIGURE 3

Consumption of Firewood and Charcoal



Source: Direction of Environment, as of 2008

TABLE 6

Price Structure of Firewood and Charcoal

PRICE ELEMENT	EURO/kg
Forest tax	0.0042
Communal tax	0.0004
Remuneration of the	0.0200
Loading	0.0022
Transport	0.0150
Renewal bag	0.0010
Unloading	0.0009
Tax placing on tip	0.0004
Stroke owner	0.0430
Stroke wholesaler	0.0220
Price returned deposit	0.1090
Conditioning	0.0135
Remuneration of the retailer	0.0354
Final selling price	0.2670

Source: Direction of Environment, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The Ministry of Energy and Power (MEP) is the governmental authority in charge of the energy and water sector. Its mandate includes dedicated policy formulation as well as sector planning and coordination. The MEP focuses on the electric power supply, including RE matters like Hydro Power, solar and wind energy.

The Ministry of Agriculture (MA) is in charge of all biomass issues (plant as well as animal derived matter) with special focus on wood. The overall market for petroleum products is coordinated by the Ministry of Trade and Industry (MTI) with participation of the Ministry of Finance (MF) playing a significant role in the import and storage of petroleum products. The ongoing and planned oil exploration and extraction is part of the responsibility of a Presidential Petroleum Commission. The Ministry of Mineral Resources (MMR) deals with the exploitation of minerals.

It is interesting to note that the special duties of every ministry are listed in the 2001 Local Government Regulations. For the MEP, however, only the specific fields of "rural water supply", "community ownership of wells", "bulk supply of water" (except where privatized) and "sanitation" are considered and listed. There is no specific focus on energy and electricity provision for local communities under these regulations.

SOMELEC is the monopoly supplier of electricity in Mauritania. The company is exclusively responsible for power generation, transmission, distribution and supply in Mauritania.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

Up to now, there is no adequate set of policy instruments to address the specific energy issues in Mauritania. The following overview presents the facts and figures available.

In 2001, the World Bank provided a dedicated funding to Mauritania to be used for the formulation of a national energy policy. Furthermore, the Government of Mauritania adopted a law that is to open up the electricity market for broad competition. Another action was the release of the first Poverty Reduction Strategy Paper (PRSP) for the period of 2005–2007. Its objective is to strengthen the energy sector and to expand the access to modern energy services while improving the overall supply reliability. The draft energy policy document of Mauritania aims to provide an electricity access rate of 35 % for the country's entire population by 2015. In view of RE, the key elements pointed out are:

- Establishment of appropriate institutions in order to manage the RE sector
- Consideration of tax reduction for RE equipment
- Investments in and promotion of national production of RE technologies

In order to successfully reach these goals, it will be necessary to facilitate adequate financing schemes for RE by establishing sustainable financing mechanisms. Furthermore, it is necessary to establish appropriate norms, codes of practice, guidelines and standards for the overall RE sector.

Today, the Government of Mauritania is in the process of building a set of policies and strategies for the promotion of RE. The regulatory and legislative frameworks need to facilitate rural electrification with strong contribution from RE. This reconstruction process is currently being developed. The main targets are to increase the rural electrification rate from 3 % in 2001 to 40 % in 2020. Furthermore, the contribution of RE to the national energy mix is to be increased to 15 % in 2015 and 20 % in 2020.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

As already mentioned, the focus within the electricity sector is the increase of the rural electrification rate. Up to now, only about 1 % of the rural population has access to electricity mainly coming from fossil energy. The rural electrification framework of Mauritania is regulated by the MEP, the Regulatory Authority, the Agency for the Promotion of Universal Access to Regulated Services and the Rural Electrification Development Agency. While the MEP determines the sector development policy including standards and decentralized electrification strategy, the Regulatory Authority prepares related laws and regulations. Furthermore, it provides licenses and amends proposals on the regulatory authority. The Rural Electrification Development Agency deals with programs and investment incentives for rural electrification. Recently, Mauritania joined the International Renewable Energy Agency (IRENA).

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

In general, Mauritania offers a broad variety of biomass resources. Formerly, about 556,000 tons of crop waste (rice husk, rice straw, etc.) were produced annually and offered an energy potential of about 3.7 GWh. Due to the ten year civil war (1991–2001) and the drastic interruption of the country's agricultural output, these former estimates are not valid anymore and therefore need to be revised for a more accurate assessment of the energy potential of crop wastes. In 2006, the Direction of Energy presented figures that estimate the available land area to 3.5 million hectares (3.5 % of the overall territory), leading to a total output of about 100,000 m^3.

4.2 SOLAR ENERGY

The solar energy potential of Mauritania is significant and offers around 4 to 6 kWh/m^2/day with an average sunshine duration of 8 hours per day. Up to now, there is no detailed assessment of existing solar energy installations in Mauritania. Due to the significant solar energy potential, the implementation of PV installations is highly promising. Table 7 presents an overview of the available solar energy potential at different sites.

4.3 WIND POWER

According to data of the National Company of Meteorology of Mauritania, the wind potential of Mauritania is considerable, with an annual average of 5–8 m/s. A study of potential wind energy production capacities was conducted by the Department of Energy and the Electric Alizés project. Results show that two areas offer very high wind energy potential (Nouadhibou and the Marine Band Trarza between Nouakchott and the Senegal River) with wind speeds of more than 7 m/s. Another promising area for wind energy is located around the eastern border of Mauritania, offering average wind speeds of 6 m/s. As for the rest of the country, the average wind speed is around 3 m/s. In general, Mauritania offers a significant potential for small and medium wind power installations, especially in rural areas and in the North of the country.

4.4 HYDRO POWER

The hydroelectric network ensures an interconnection of the regional network of the Manantali dam that has been supplying the major cities of the valley (Rosso, Boghé and Kaédi) and the town of Nouakchott since 2002. The Manatali Hydro Power project was completed in 2003 and comprises of a 200 MW power station and a network of 1,300 km connecting the capitals of Mali, Mauritania and Senegal.

TABLE 7

Solar Energy Potential (kWh/m²/day)

	NOUAKCHOTT	ATAR	BIR-MORGHREIN	KIFFA	NEMA	NOUADHIBOU	TIDJIKJ	MINIMUM	MAXIMUM	AVERAGE
January	4.61	4.56	4.01	4.88	4.88	4.36	4.71	4.01	4.88	4.57
February	5.21	5.23	4.89	5.59	5.60	5.01	5.41	4.89	5.60	5.28
March	5.91	6.02	5.80	5.47	5.97	5.80	6.12	5.47	6.12	5.87
April	6.45	6.62	6.61	6.37	6.37	6.19	6.65	6.19	6.65	6.47
May	6.38	6.73	6.86	5.90	5.90	6.24	6.48	5.90	6.86	6.36
June	6.04	6.58	6.87	5.84	5.84	6.19	5.96	5.84	6.87	6.19
July	5.91	6.48	6.59	6.11	6.11	5.71	6.43	5.71	6.59	6.19
August	5.81	6.22	6.31	6.04	6.04	5.83	6.25	5.81	6.31	6.07
September	5.71	5.55	5.76	5.82	5.82	5.50	5.82	5.50	5.82	5.71
October	5.12	5.07	5.61	5.88	5.88	4.93	5.43	4.93	5.88	5.42
November	4.78	4.65	4.17	4.89	4.89	4.40	4.76	4.17	4.89	4.65
December	4.51	4.31	3.93	4.71	4.71	4.17	4.53	3.93	4.71	4.41
Minimum	4.51	4.31	3.93	4.71	4.71	4.17	4.53	3.93	4.71	4.41
Maximum	6.45	6.73	6.87	6.37	6.37	6.24	6.65	6.24	6.87	6.53
Average	5.54	5.67	5.62	5.63	5.67	5.36	5.71	5.36	5.71	5.60

Source: SEMIS, as of 2003/2004

5 MARKET RISKS AND BARRIERS

The lack of adequate policies and an appropriate legal and regulatory framework are the most significant barriers for the broad implementation or RE and the increased electricity access rate. Up to now, there is no energy policy that allows and supports private sector investments in the energy sector in general and RE in particular. The existing uncertainties for potential investors strongly ask for a commitment of the Government to liberalize the overall power sector of Mauritania. Some of the issues relating to the development of entrepreneurship for rural electricity supply and grid connection projects remain totally unclear.

Another critical barrier is the lack of financing and funding mechanisms. Up to now, there is only very little interest in the exploitation of RE, as funding and collaboration is one of the main challenges. Operators and investors wanting to get involved in the sector have often abandoned their activities because of the lack of sufficient support mechanisms.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

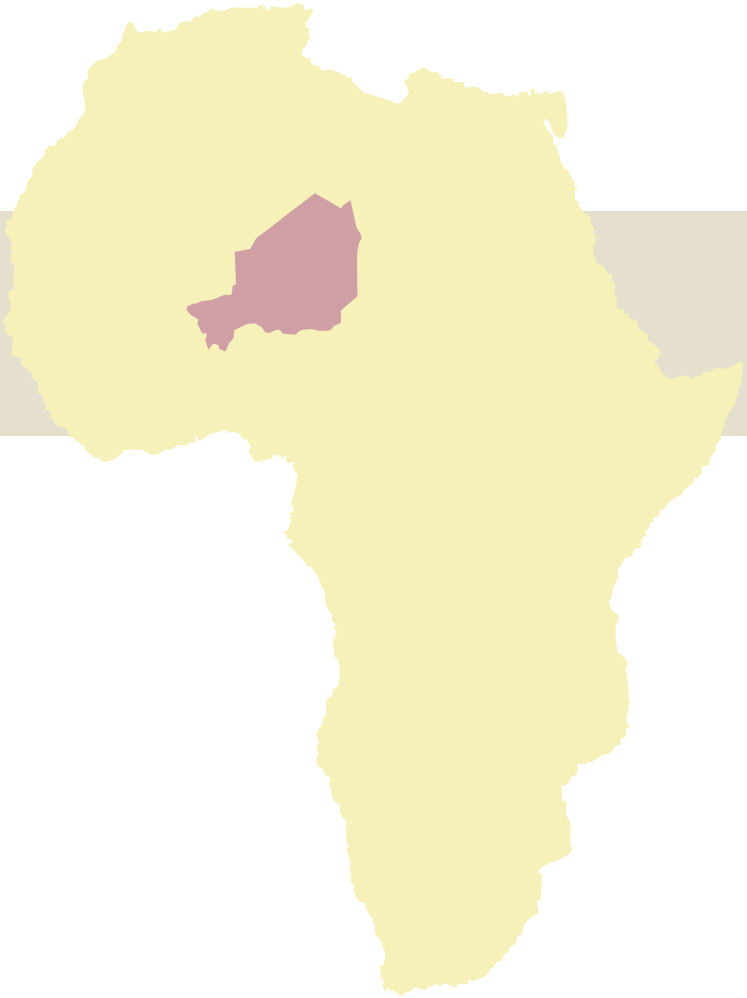
TABLE 8

Relevant Institutions in Mauritania

INSTITUTION	PROFILE	CONTACT
Ministry of Energy and Petrol (MEP)	Electricity sector policy formulation, planning and coordination	BP 335 Nouakchott Phone: +222 5252699
Ministry of Economic Affairs and Development	Economic affairs and development sector policy formulation, planning and coordination	BP 238, Nouakchott Phone: +222 5290435
Ministry of Finance	Sector policy formulation, planning and coordination	BP 197, Nouakchott Phone: +222 5253080
Ministry of Rural Development and Environment	Rural development and environment policy formulation, planning and coordination	BP 333, Nouakchott Phone: +222 5251500
Ministry of Equipment and Transport	Policy formulation, planning and coordination of the transport sector	BP 237, Nouakchott Phone: +222 5255640
Ministry of Mining and Industry	Policies, planning and coordination of the mining and industry sector	BP 199, Nouakchott Phone: +222 5253582
Société Mauritanienne de l Électricité (SOMELEC)	National company for water and electricity supply	BP 335, Nouakchott Phone: +222 5256783

7 BIBLIOGRAPHY

- APERE (2003/2004): Développement des Énergies Renouvelables en Mauritanie, renouvelle n°8 6–7, 4e trimestre 2003 – 1er trimestre 2004 (www.apere.org/doc/0608-ER_mauritanie.pdf)
- Cellule de Contrôle de l'Énergie (2004): various data reviewed by author
- CIA – Central Intelligence Agency (2009): World Fact Book (www.cia.gov/library/publications/the-world-factbook)
- CIE (2007): Les Énergies Renouvelables en Mauritanie
- République de Maurétanie (2001): Code de l'Électricité 25/01/2001 Loi n° 2001 – 19/ Portant 2001
- Direction de l'Approvisionnement, Ministère en Chargé de l'Energie (2006): various publications (www.mauritania.mr/fr/index.php?niveau=6&coderub=4&codsoussous=124&codesousrub=9&codsoussous1=145)
- Direction of Environment (2008): various publications (www.mauritania.mr/fr/index.php?niveau=6&coderub=4&codsoussous=124&codesousrub=9&codsoussous1=138)
- Droit Afrique (2005): Mauretanie (WWW.DROIT-AFRIQUE.COM/IMAGES/TExTES/MAURITAnIE/MAURITAnIE)
- %20-%20PETROLE%20AVAL.PD
- N. N. (1999–2002): Document Tallies of Economic Policy of Universal Access
- Fall Mamadou (2002): SEMIS – Traditional Energy Use in the Sahel in ESI Africa
- FAO (without year): FOSA Document National de Prospective, par la FAO, Département des Forêts (www.fao.org/docrep/004/ab591f/AB591F09.htm)
- Government of IRM (2002): Letter of Intent, Memorandum of Economic and Financial Policies, and Technical Memorandum of Understanding – IMF
- Helimax Energie Inc (2004): Strategic Study of Wind Energy Deployment in Africa – Strategic Plan for Wind Energy Deployment in Africa (Executive Summary)
- IMF (2007): Poverty Reduction Strategy Paper, January 2007, IMF Country Report No. 07/40
- IMF (2003): Poverty Reduction Strategy Paper Progress Report, IMF, Country Report No.03/316
- IMF (2002): Mauritania. Letter of Intent, Memorandum of Economic and Financial Policies and Technical Memorandum of Understanding published by International Monetary Fund
- Institut de l'Énergie et de l'Environnement de la Francophonie – IEPF (2006): various publications (www.iepf.org/ressources/ressources.php)
- Islamic Republic of Mauritania (2002): Poverty Reduction Strategy Paper Implementation Report
- Kazadi Beneki TSHIBINGU (2004): Eskom Energie Manantali Presentation to NARUC
- Ministry of Water and Energy (2004): Sustainable Energy Management Program
- Ministère des Affaires Economiques et du Développement (2006): Rapport sur la Mise en Œuvre du Programme d'Action de Bruxelles (2001–2010) en Faveur de Pays les Moins Avancés (PMA)
- SEMIS (2003/2004): Plan d'Investissement pour l'Électrification Rurale en Mauritanie
- SOMELEC (2005): Statistiques de Consommation Énergétique de SOMELEC
- SOMELEC (2003): Coût des Facteurs de Production MAED
- N. N. (2003): Synthetic Note on the Strategy of Universal Access to the Basic Services in 2003
- UNCTAD (2006): Least Developed Countries Report 2006. Part II Chapter 5
- UNDP (2005): Human Development Report 2005 – International Cooperation at a Crossroad. Aid, Trade and Security in an Unequal World, United Nations, New York
- UNDP/International Institute for Sustainable Development (2005): Connecting Poverty and Ecosystem Services: Focus on Mauritania
- UNDP (2008): Human Development Index 2008 (HTTP://HDR.UnDP.ORG/En/STATISTICS)
- UNFPA (2005): State of World Population 2005 – The Promise of Equality. Gender, Equity, Reproductive Health and the Millennium Development Goals
- UNIDO: Les Énergies Renouvelables et le MDP en Mauritanie:
- (www.unido.org/fileadmin/import/ 42703_Mauritanie.pdf).
- US Department of State (2006): Background Note Mauritania
- World Bank: Mauritania Power and Water Sector Reform – Technical Assistance Project Vol. 1



COUNTRY CHAPTER: NIGER

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ACRONYMS AND ABBREVIATIONS

NIGER

AIPO	African Intellectual Property Organization
ALG	Autorité du Liptako Gourma (Authority for Integrated Development of the Liptako Gourma Region)
ANDP	Alliance Nationale pour la Démocratie et le Progrès (National Alliance for Democracy and Progress)
ARM	Autorité de Régulation Multisectorielle (Authority of Multisector-based Regulation)
BIRD	Banque Internationale pour la Reconstruction et le Développement (International Bank for Development and Reconstruction)
CDM	Clean Development Mechanism
CDS	Convention Démocratique et Sociale (Social and Democratic Convention)
CFC	Companies Formalities Center
CILSS	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel (Interstate Committee for Fight Against the Drought in the Sahel)
CNPG	Centre National de Perfectionnement et de Gestion (National Center for Perfection in Management)
CNEDD	Conseil National de l'Environnement pour un Développement Durable (National Environmental Council for a Sustainable Development)
CNIP	Conseil National des Investissements Privés (Private Investors National Council)
CNL	Conseil National de Liaison (National Connection Council)
ECOWAS	Economic Community of Western Africa States
GDP	Gross Domestic Product
GEF	Global Environmental Facility
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
MFP	Multifunctional Platforms Project
MNSD	Mouvement National pour la Société de Développement (National Movement for a Development Society)
NDA	National Designated Authority
NIGELEC	Société Nigérienne d'Électricité (Nigerian Electricity Society)
PAC	Programme d'Actions Communautaires (Community Actions Program)
PEC	Politique Énergétique Commune (Common Energy Policy)
PRASE	Programme de Référence d'Accès aux Services Énergétiques (Reference Program of Access to Energies Services)
PRBE	Programme Régional Biomasse Énergie (Regional Biomass Energy Programm)
PREDAS	Programme Régional de Promotion des Énergies Domestiques et Alternatives au Sahel (Regional Programm for Promotion of Domestic and Alternative Energies in the Sahel)
PV	Photovoltaic
RAF	Resource Allocation Framework
RE	Renewable Energy
RSD	Rassemblement Social et Démocrate (Social Democritic Assembly)
RDP	Rassemblement pour la Démocratie et le Progrès (Assembly for Democracy and Progress)
SDR	Stratégie du Développement Rural (Strategy of Rural Development)
SDRP	Stratégie du Développement Accéléré et de la Réduction de la Pauvreté (Strategy for Accelerated Development and Poverty Alleviation)
SNASEM	Stratégie Nationale d'Accès aux Services Énergétiques Modernes (National Strategy Access to Modern Energy)
SNCC	Société Nationale de Carbonisation du Charbon Minéral (National Company of Carbonization of Mineral Coal)
SONICHAR	Société Nigérienne de Charbon (National Coal Company of Anou Araren)
SONIDEP	Société Nigérienne des Produits Pétroliers (Nigerien Society of Petrol Products)
SONIHY	Société Nigérienne des Hydrocarbures (Gas Company Niger)
SNER	Stratégie Nationale sur les Énergies Renouvelables (National Renewable Energies Strategy)
SNED	Stratégie Nationale des Énergies Domestiques (National Strategy for Domestic Energies)
UNDP	United Nations Development Program
VAT	Value Added Tax
WIPO	World Intellectual Property Organization
UEMOA	Union Économique et Monétaire Ouest Africaine (West African Economic and Monetary Union)

MEASUREMENTS

km	kilometer
mm	millimeter
kg	kilogram
t	tons
m^3	cubic meter
m^2	square meter
kWh	kilowatt hours
kWp	kilowatt peak
m/s	meter per second
MW	megawatt (1 MW = 1,000 kW)

SUMMARY

The Country Study of Niger is to provide an overview of the country's energy market and to support decision-making for private investments for the renewable energy sector in Niger. The study is structured as follows:

Chapter one provides **Background Information on Niger**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Niger.

Chapter two summarizes facts and figures of **Niger's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Niger. This includes an overview of support mechanisms for PV as well as already existing regulations, incentives and legislative framework conditions.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Niger.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on Renewable Energies.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Niger.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

The Republic of Niger is an enclosed West African country, the nearest coast is about 600 km away. It is situated between longitudes 0 ° 16' East and 16 ° East and latitudes 11 ° 1' North and 23 ° 17' North. The country is limited by Algeria and Libya in the North, by Nigeria and Benin in the South, by Chad in the East and by Mali and Burkina Faso in the West.

FIGURE1

Map of the Republic of Niger

The territory is divided into 8 areas, 36 provinces and 265 districts. The country is crossed by the Niger River, the country's only permanent river, covering a length of 550 km. Niger covers a surface area of 1,267,000 km² two-thirds of which are desert. According to the last population census of 2001, Niger's population is estimated at 11,060,291 inhabitants with an annual average population growth of 3.1 %. In 2006, the population was estimated at approximately 13 million inhabitants equaling 4.7 % of the Economic Community of Western Africa States (ECOWAS) population estimated at over 270 million people. About 47.6 % of Niger's population is under 15 years, and 83 % are living in rural areas.

Three quarters of the population live in the southern part of the country, representing 25 % of the total surface area of the country. The environmental constraints (decrease and bad repartition of rainfalls) were followed by a progressive decrease of the agricultural areas representing only 12 % of the national territory today. The climate is of Sahelian type characterized by two main seasons: a long dry season lasting up to nine months and a rainy season covering three to four months. The country has four agro climatic zones:

- The Sahelo-Sudanese zone representing approximately 1 % of the total surface area of the country with up to 600 to 800 mm of rain during a normal year
- The Sahelian zone covering 10 % of the country with 350 to 600 mm of rain
- The Sahelo-Saharan zone representing 12 % of the total surface area of the country with 150 to 350 mm of rain per year
- The Saharan zone covering 77 % of the country with less than 150 mm of rain

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Republic of Niger was a former French colony that gained its independence in August 1960. Since 1993, the country has been a multiparty democratic sovereign state with a semi-presidential government system where the deputies are elected democratically. The current President is Mr. Tandja Mamadou from the MNSD (Mouvement National pour la Société de Développement – National Movement for a Development Society), the dominant political party of the country. The parliament counts 113 deputies from seven political parties. The Government includes ministers from the CDS (Convention Démocratique et Sociale – Social and Democratic Convention), RSD (Rassemblement Social et Démocrate – Social Democratic Assembly), RDP (Rassemblement pour la Démocratie et le Progrès – Assembly for Democracy and Progress) and ANDP (Alliance Nationale pour la Démocratie et le Progrès – National Alliance for Democracy and Progress) which were in coalition with the MNSD during the run-off election in 2004.

Classified as one of the poorest countries in the world, Niger's Republic Gross Domestic Product (GDP) per capita was 216 Euro in 2006, representing 1.83 % of the GDP in the ECOWAS zone. All parameters related to the poverty level evaluation show that poverty still exerts high impact on the country. Poverty lines corresponding to a minimal annual spending of 220 Euro in urban areas and 161 Euro in rural areas indicate that 62.1 % of Nigerians are poor (as of 2005 and without significant improvement up to now). In the household sector, the impact of poverty is estimated at 53 %, about 66 % of the households consider themselves as relatively poor, while 20 % of them perceive themselves as being extremely poor. The relation is similar in both, rural and urban areas. Today, the struggle against poverty and the research for sustainable and steady economic growth are the most important issues for Niger.

Against this background, the SDRP (Stratégie du Développement accéléré et de la Réduction de la Pauvreté – Strategy for Accelerated Development and Poverty Alleviation) was adopted by the Government and approved of by the development partners for financial issues in 2007. The SDRP has seriously taken into account the fact that the reduction of poverty goes along with a strong and sustained growth of resources and creation of employment, notably in the sphere of people considered as poor and in rural areas, by guaranteeing an overall cross-linking of the existing sector-based programs and strategies.

The economy of Niger is dominated by the agro-pastoral sector representing 36 % of the GDP (with 42 % of the earnings resulting from exportations) and employing 85 % of the population. In 2006, Niger's exports within the ECOWAS came to about 147,765 tons (consisting mainly of agro-pastoral and forest-related products) with earnings of 58 million Euros. Niger's major export customers are Nigeria (50.7 %), Ghana (29.3 %) and Côte d'Ivoire (11 %). The imports come

to about 454,366 tons with spendings of 150 million Euros. 33.5 % of the exports come from Benin, 16 % from Nigeria, 14.7 % from Togo and 13.34 % from Côte d'Ivoire. The volume of exports and imports of the country (2.58 % of the whole ECOWAS) is much smaller than in the other countries in the region.

The mining sector constitutes an important pillar of the country's economy. Uranium still represents one of the main resources of the country (55 % of GDP in 2004) with Niger being the No. 1 producer of uranium in the third world. With the renewed international demand for uranium, the national economy experienced a considerable increase in the years 2006 to 2008.

With the current rate of economic and social development of the country, it will be very difficult to achieve the Millennium Development Goals (MDGs) until 2015. The improved access to energy services appears as an option to achieve the MDG for the social basic sectors (health, education, water supply). The Government of Niger adopted an energy policy statement in 2004 with focus on:

- The increase of accessibility for households to energy source, particularly in rural areas
- The promotion of energies substituting wood energy
- The securing of energy supplies
- The evaluation of the national energy resources
- The promotion of environmental protection
- The control of the energy-related statistical data
- The intensification and development of cooperation within the energy sector

This statement corresponds to the ECOWAS regional energy policy, namely the White Paper[1] adopted in January 2006 in Niger by the 29th Summit of the Authority of Heads States and Government. The White Paper aims at engaging ECOWAS member states and the region in an ambitious regional policy towards the increment of access to modern energy services. Its objective is to establish electrification for at least half of the population in rural and peri-urban areas by the year 2015, i.e. enabling 36 million more households and 49,000 extra localities to access modern energy services.

On the basis of the white paper directives a Multisectoral Energy Committee was created in Niger. It aims at developing synergies between the energy sector and other strategic sectors, to support cooperations in order to integrate energy objectives in their projects and programs and to increase access to energy within the social infrastructures. In order to achieve the regional policy global objective, the committee has prepared the SNASEM (Stratégie Nationale d'Accès aux Services Energétiques Modernes – National Strategy Access to Modern Energy). The PRASE (Programme de Référence d'Accès aux Services Energétiques – Reference Program of Access to Energies Services) was set up to implement the White Paper objectives in the National Policy framework. The program is meant to bridge the existing gap between the current effective access rate to energy services and the necessary access to energy rates in order to achieve the MDG. The program focuses on the access to energy facilities for social and productive sectors (health, education, agriculture and water) through:

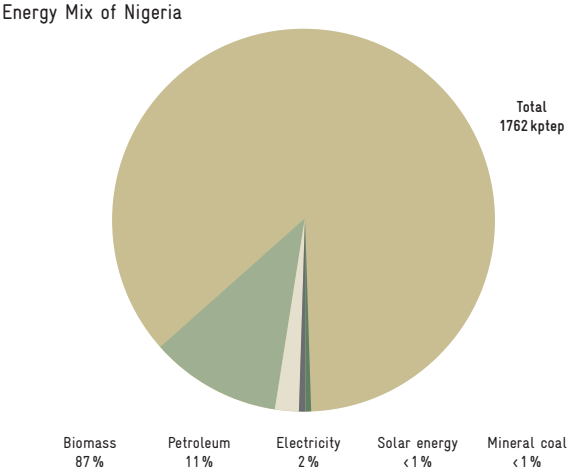
- Access to modern fuels for cooking (mineral coal, butane gas, biogas)
- Access to motive power (solar multi-functional platforms, wind energy)
- Access to electricity

2 ENERGY MARKET IN NIGER

2.1 OVERVIEW OF THE ENERGY SITUATION

The overall energy situation of Niger can be divided into two aspects. The first aspect deals with the modern energies inter alia conventional electricity, oil products and renewable energies (RE). In Niger, 87 % of the electricity is imported from Nigeria through an interconnecting network. The local thermal coal and diesel production represents 13 %. Oil products, essentially gasoline, diesel oil, kerosene and LPG, are imported from Persian Gulf Countries and Nigeria. Figure 2 visualizes the energy mix of Niger.

FIGURE 2
Energy Mix of Nigeria



Source: SIE, as of 2006

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

As already stated, about 87 % of the electricity are imported from Nigeria. The local production (thermal power from coal and diesel) contributes but 13 %. Table 1 presents an overview of the electricity sector key facts. The current price of electrical power is indicated in table 2.

Petroleum Sector

The petroleum sector mainly depends on imports. Gasoline, diesel oil, kerosene and LPG are almost exclusively imported from Persian Gulf Countries and Nigeria. Table 3 indicates the imports and investments in the petroleum sector of Niger. Current prices are presented in table 4.

1 ECOWAS/UEMOA, 2005

TABLE 1

Consumption and Investment in the Electricity Sector

	2000	2001	2002	2003	2004	2005	2006
Production Sonichar (GWh)	134.870	134.400	143.670	148.830	154.750	158.470	167.500
Production Nigelec (GWh)	64.280	39.723	40.666	42.642	45.856	43.166	26.300
Total Production (GWh)	199.150	174.123	184.336	191.472	200.606	201.636	193.800
Imports (GWh)	203.826	219.882	210.995	234.766	295.340	339.002	356.590
Consumption	402.976	394.005	395.331	426.238	495.946	540.638	550.390
Investments (Euro)	3,810,996	7,454,159	10,113,288	7,650,690	13,156,298	18,420,650	13,595,391

Source: Ministry of Mines and Energy and Ministry of Trade, Industry and Normalization, as of 2008

TABLE 2

Electricity Prices

DOMESTIC USE	INDUSTRIAL USE
0.122 Euro/kWh	0.084 Euro/kWh

Source: Ministry of Mines and Energy and Ministry of Trade, Industry and Normalization, as of 2008

TABLE 3

Imports and Investments in the Petroleum Sector of Niger

TYPE OF FUEL	2000	2001	2002	2003	2004	2005
Kerosene (m^3)	11,892	8,912	11,009	13,589	13,995	8,802
Gasoline (m^3)	66,000	97,934	96,387	105,365	98,385	96,148
Jet (m^3)	17,755	9,256	12,057	12,566	14,430	15,665
Diesel (m^3)	72,466	70,061	85,210	90,500	96,616	105,818
Heavy fuel (m^3)	10,832	8,288	5,511	9,974	11,544	3,658
Jet (t)	350	141	197	96	75	45
Lubricant (t)	2,829	3,853	3,496	2,966	391	3,123
Bitumen (t)	137	829	7,232	11,004	15,159	4,373
Investments (Million Euro)	78	69	74	84	98	115

Source: SONIDEP, as of 2007

TABLE 4

Price of Petroleum Products

DIESEL	GASOLINE	KEROSENE	LPG
1.021 Euro/liter	0.983 Euro/liter	0.633 Euro/liter	0.671 Euro/kg

Source: Ministry of Mines and Energy and Ministry of Trade, Industry and Normalization, as of 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The import, transport, distribution and production of electricity and oil products are controlled by the Ministry of Mining and Energy (MME), the Ministry of Trade, Industry and Normalization through numerous laws and their decree of implementation in collaboration with the ARM (Autorité de Régulation Multisectorielle – Authority of Multisector-Based Regulation). The Ministry of Environment and the MME are responsible for the management of traditional energies, respectively the matching of demand and supply. The legislation is governed by an order that regulates the organization of the marketing and the transport of firewood in big cities, the applied tax system and the detailed guidelines.

Like other UEMOA/ECOWAS countries, Niger is subject to the Common Legislative System stipulating the free movement of people and materials and the application of the Common External Tariff for importation within the Community.

The Ministry of Mining and Energy (MME) is in charge of sector-based policy and defines the legislative and statutory frame of the activities for production, transport, import, export and distribution of energy in Niger.

The Ministry of Environment and Struggle Against the Desertification is in charge of the management of the supply of the wood energy.

The Ministry of Trade, Industry and Normalization is in charge of the regulation of trade issues.

The CNEDD (Conseil National de l'Environnement pour un Développement Durable – National Environmental Council for a Sustainable Development) created by the Government in January 1996 defines the orientation and coordination of environmental policies related to sustainable development.

The ARM (Autorité de Régulation Multisectorielle – Authority of Multisector-Based Regulation) was created in 1999 and regulates the sectors of energy, telecommunication, transport and water.

The CNES (Centre National de l'Énergie Solaire – National Center of Solar Energy) is a public administrative structure created in 1998. It conducts research work and is in charge of the realization of prospective and diagnostic studies as well as of the involvement of the training and promotion of the distribution of equipments in the field of RE.

NIGELEC, a national electrical company created in 1968, has the monopoly of the transport and distribution of the electricity power supply nationwide.

SONICHAR, the national coal company of Anou Araren created in 1975, produces electricity from coal and provides it to mining companies and the neighboring towns.

SONIDEP was created in 1977 in order to assure the continuity and safety of hydrocarbons and sub-products supply in the country, notably in terms of the constitution and the inventory control of safety in association with the other existing companies.

SNCC (Société Nationale de Carbonisation du Charbon Minéral – National Company of Carbonization of Mineral Coal) was created in 2004 and aims at the promotion of mineral coal as energy for cooking in households.

Activities related to the import and distribution of LGP are carried out by the three local companies of **SONIHY, Niger Gas and Total Gas**.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The statement for energy policy adopted by the Government in 2004 has been followed by many strategies and action plans for the promotion of RE. In the following, a brief overview of this policy is presented.

SNER (Stratégie Nationale sur les Énergies Renouvelables – National Renewable Energies Strategy) aims at the increased contribution of RE to the national energy balance from less than 0.1 % in 2003 to 10 % by 2020 by:

- Facilitating the promotion of supply systems based on RE
- Alleviating women's domestic tasks
- Reducing the impact on forest resources and reforestation of natural resources
- Promoting rural electrification on the basis of RE resources
- Promoting education, training, research and the development related to RE technologies

SNASEM aims to improve the supply of a higher percentage of the population with modern energies by 2015 through granting:

- Access to modern fuels for cooking
- Access to motive power for villages with 1,000–2,000 inhabitants
- Access to electricity for rural and peri-urban populations to reach a cover rate of 66 %

SNED (Stratégie Nationale des Energies Domestiques – National Strategy for Domestic Energies) aims at the creation of a global and coherent frame for intervention in the subsector of domestic energies by:

- Assuring a sustainable use of forest resources and better reforestation
- Promoting alternative sources of energy (other than wood) and improving the efficiency of the appliances
- Strengthening the capacity of the main actors for a better management of the sector and setting up an adequate frame of operation
- Setting up an adequate frame of communication to inform and educate the actors on issues related to the production and use of domestic energies

RE programs have been described in the major reference documents for the development of the country. The SDRP, as stated above, plans to endow the country with economic infrastructures through its "Development of Infrastructures". It

is intended to stimulate the growth and to facilitate the access to social facilities by promoting RE. **SDR (Stratégie du Développement Rural – Strategy of Rural Development)** with its sub-program "4–4 – Renewable Energy and Rural Electrification" considers the access to electricity to help rural communities in developing their local economy and the improvement of their living conditions. The same strategy plans in its program „10 – Environmental Protection" the use of alternative sources of energy for the substitution of wood.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Up to now, RE is not subject to any legislative text of Niger. A law on renewable energy, however, is currently being formulated. Through this law, the Government can provide support in the form of loans, subsidies, fiscal advantages etc. in order to promote the increased utilization of RE. This is very important because PRASE grants (see page 9) a privilege for RE projects.

Companies importing RE equipment can benefit from incentive measures facilitating the acquisition. At present, imported RE equipment is rated and taxed as electronic material. The new law intends to exonerate all imported equipment used in the field of rural electrification and rural water pumping from taxes. It also aims to create a national rural electrification fund.

Quite a number of sub-sectors are in charge of the implementation of projects regarding the CDM (Clean Development Mechanism). As the national focal point of three "Post-Rio" Conventions, CNEDD was appointed as National Designated Authority (NDA) of the CDM in Niger on 5 June 2006. As such, the CNEDD registered and approved the first MDP project of the Niger "Initiative Bio-Carbon of the PAC" (Programme d'Actions Communautaires – Community Actions Program). This project is financed by the World Bank[2] One of its objectives is the restoration of land through the plantation of 23,000 trees (acacia senegal) throughout the whole territory.

RE attract increasing interest due to their advantages as compared to fossil fuel. Therefore, many financing mechanisms for promoting RE are being started on regional and international level. In Niger, the following actions have so far been taken:

- Technical and Financial Partners' Round Table for PRASE Financing in 2009
- Resource Allocation Framework (RAF 4) of the Global Environmental Facility (GEF) Program
- European Union Energy Facility
- Clean Development Mechanism (CDM)
- Small Grant Program of GEF for the RE Promotion
- The Regional Program for the Promotion of Household and Alternative Energies in the Sahel of the Permanent Inter States Committee for Drought Control in the Sahel
- Regional Biomass Energy Program of UEMOA/ECOWAS
- Regional Program Energy Against Poverty of UNDP

Locally, the UNDP representation grants institutional support and finances pilot projects in order to promote the use of the RE within the framework of its annual Country Program Support.

Governmental Projects and Programs

The Special Energy Program, which ended in 2001, is the last German RE program conducted in Niger. In 2004, during the Bonn International Conference for Renewable Energies (renewables 2004), Germany has emphasized its interest to support the implementation of an RE strategy for Niger adopted by the Government in January. Just after this meeting, the RE sector was integrated into the Niger/Germany bilateral cooperation.

The Programme Régional de Promotion des Énergies Domestiques et Alternatives au Sahel (PREDAS) is implemented by the CILSS and the state members with financial support of the EU and the German Development Cooperation. It aims at helping the country members to organize sustainable supply and rational use of domestic energies by the inhabitants of Sahelian zone avoiding harmful impact on the environment.

The Programme Régional Biomasse Énergie (PRBE) is implemented by the ECOWAS/UEMOA with the financial support of the Netherlands. This program joins the framework of the implemented PEC (Politique Energétique Commune – Common Energy Policy) of the UEMOA and contributes to the long-term management of biomass energy in a policy to fight poverty and promote environmental protection.

ALG (Autorité du Liptako Gourma – Authority for Integrated Development of Liptako Gourma Region) has elaborated a plan for developing the energy sector in this region (located between Burkina Faso, Mali and Niger) from 2007 to 2025. This plan aims to fight poverty and contribute to a harmonious and integrated development of the region through the introduction of modern forms of energy (electricity, mobility) and the reduction of harmful environmental influences.

PRASE is part of the program to reduce poverty in Niger. The program focuses on the access to energy facilities for social and productive activities (cooking, motive power and electricity) for the entire population of Niger in order to achieve the MDG.

The GEF has accorded 1,525,000 Euro for the development of RE projects through its Resource Allocation Framework (RAF). Also GEF is financing some demonstrative projects for the promotion of RE through its Small Grant Program.

The Multi-Functional Platforms Project (MFP) aims at bringing motive power to rural areas. The project was initiated in Mali in 1996 with the backing of UNDP and UNIDO and has since then been extended to Senegal, Burkina Faso, Ghana, Nigeria and Guinea. Its goal is poverty reduction in general, but specifically poverty of rural women, by enabling them to create income generating opportunities through the supply of energy services.

2 BANQUE MONDIALE/WORLD BANK,2009

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The potential for energy from biomass is substantial in Niger. Table 5 presents the technical potential for energy from biomass. Biogas is only used at experimental scale. Currently, about 10 small-scale biodigesters (dome type) are in operation.

TABLE 5

Technical Potential for Energy from Biomass

TYPE	POTENTIAL	EXPLOITED	LOCALIZATION	DETAILS
Forest Animal waste Agricultural waste	9.9 million ha 55,018,000 tons 4,084,200 tons	3.52 million ha 50,180 tons 40,842 tons	all over Niger	Used for cooking purposes
Biofuels	999,451 ha	100 ha	South of Niger	Jatropha

Source: Inventory 2006 CNES, as of 2006

4.2 SOLAR ENERGY

The average solar energy potential ranges between 5–7 kW/m² per day, while the average period of sunshine varies between 7 and 10 hours per day. In 2006, the power installed in the sector of solar photovoltaic (PV) was estimated at 1,170 kWp. The current use of solar thermal energy (hot water) accounts for about 2,000 m² of absorbers. The use of solar cooking and drying is very low. Table 6 presents an overview of solar energy technologies already implemented in Niger.

TABLE 6

Solar Energy Technologies in Niger

TECHNOLOGY	INSTALLATIONS	UTILIZATION PURPOSE
Solar drying	31	Industrial drying of meat, cereals, fruit etc.
Solar water heating	600	Household use, industrial water heating
PV Systems	no data available	Lighting, ventilation, water pumping, refrigeration etc.

Source: CNES Inventory, as of 2006

4.3 WIND POWER

The average wind speed is 5 m/s in the northern part of the country and about 2.5 m/s in the South. Currently, about 30 small-scale installations are used for water pumping purposes.

4.4 HYDRO POWER

Niger has more than 270 MW of economic Hydro Power potential that is only partially developed up to now. Potential and already exploited Hydro Power capacities are summarized in Table 7.

TABLE 7

Hydro Power Potential of Niger

POTENTIAL	EXPLOITED	LOCALIZATION	DETAILS
125.0 MW	125.0 MW	Kandadji Niger River	since 2008
122.5 MW	–	Gambou Niger River	not exploited yet
26.0 MW	–	Dyondounga Affluant Niger River	not exploited yet

Source: CNES Inventory, as of 2006

5 MARKET RISKS AND BARRIERS

In view of administrative, economic and political issues, there are almost no risks for investments in Niger. In the promotion of the private sector, the legal security of business is a major objective aiming at the implementation of business jurisdiction. The Chamber of Trade, Agriculture, Industry and Crafts is establishing a Center of Promotion and Reference as a specialized institution for the promotion of business in Niger consisting of:

- The CNPG (Centre National de Perfectionnement et de Gestion – National Center for Perfection in Management) for the intensification of the managing capacities of the human resources
- The CFC (Companies Formalities Center) assisting companies and individuals in dealing with formalities and official statements of all relevant regulations in the legal, administrative, social, fiscal and statistical sector
- The Center for Investments Promotion supporting potential investors and providing orientation, advice and assistance as stated by the private investment promotion policy of Niger

As to scientific work, Niger applies the WIPO (World Intellectual Property Organization) and AIPO (African Intellectual Property Organization) legislation in a systematic way. The national office related to the Federal Ministry of Commerce represents the African Intellectual Property Organization of CNL (Conseil National de Liaison – National Connection Council). This office is in charge of the application of the administrative procedures and the recordings at national level. In general, the rights of property are granted and guaranteed. Professional activity is based on the principle of free enterprise complying with the liberalization of the economy. Only some activities related to the sectors of bars, cattle and meat, leather and skins as well as mining and oil exploitation are governed by legislative and statutory documents or a specific organization. Investments are encouraged and put down by the implementation of the CNIP (Conseil National des Investissements Privés – Private Investors National Council) proposing measures for the elimination of problems inhibiting the creation and exploitation of companies. In order to fulfill the requirements for efficient commercial activities, the investment code defines the conditions for the implementation of the investments and specifies guarantees and favors as well as the obligations involved.

In article 2, the code stipulates that the Republic of Niger guarantees a constant legal and judicial protection to all private investments in the realization of economic and social development programs. Article 7states that the Republic of Niger Republic guaranties to existing or future enterprises not to undertake any act of expropriation or nationalization, except such cases that are of public use and at the same time covered by the law. If – in the latter case - measures of expropriation or nationalization are carried out compensation for the private actors concerned is also covered by the law. Article 6 of the same code states: "The settlement of problems related to the validity, interpretation or implementation of the agreement act and the eventual determination of the allowance due to the ignorance or no respect to the commitment will be solved through a legal procedure established within the agreement act", i. e.:

- The implementation of collegial referees
- The possibility for citizens to appeal to the International Center of Jurisdictional Court related to the investments created by the International Bank for Development and Reconstruction (BIRD, Banque Internationale pour la Reconstruction et le Développement)

According to article 9, the present code applies to both, physical persons and companies of all nationalities operating or intending to operate on the following sectors:

a. Agricultural activities
   - Industrial agriculture
   - Activities related to vegetal or animal products
   - Animal breeding, fishing etc. for exportation

b. Manufacturing/production activities
c. Energy production
d. Exploitation of mineral products and substances as well as the transformation, except those that are already governed by the mineral law and petroleum cod
e. Social habitation implementation program in the propose of selling or inheriting
f. Industrial equipment maintenance activities
g. Air transportation
h. Hotel construction and equipment
i. Telecommunication (telephone and internet)

Finally, the code allows three privileged regimes:

1. Regime A, related to promotional objectives, for investments of less than 76,220 Euro during a period of 5 years; according to this regime, the enterprise in step of investment has a total exoneration on:
   - Duty and tax excluding VAT on the statistics royalties
   - Duty and tax with VAT of the services offering, services related to the investment program
2. Regime B, related to priority objectives, for investments ranging from about 76,220 to 152,440 Euro; in this regime, the enterprises have the followings advantages (tax exemptions):
   - Duty and tax with VAT of the services offering, services related to the investment program
   - Duty and tax excluding VAT on the statistics royalties

But, in case of availability of an equivalent product, the importation of materials and equipments is not entitled to exoneration. In the course of the implementation, a total exoneration is given to:

- License
- Tax on real estate
- Landowner tax
- Tax on industrial and commercial benefit
- The minimum basic allocation tax

3. Regime C, relating to conventional objectives, obtained after a convention signed between the Government of Niger and the company concerned. In this regime, other advantages in addition to that of regime A and B are considered, as the reduction of 50 % of the tax (tax exemption) on fuel and energies used in the related process.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 8

List of Local Business Partners

NAME	ADDRESS	FIELD of Activity
BETP	P.O. Box: 2272 Niamey/Niger Phone: +227 20 73 54 15 Fax: +227 20 73 80 48 betp@intnet.ne	Telecommunication, electricity, electronics
Sahel Energy	P.O. Box: 45 Filingué/Niger Phone: +227 96 96 26 10 seolien@yahoo.fr	Wind energy installations
Solaris	P.O. Box: 12 040 Niamey/Niger Phone: +227 20 72 21 90 ernstzippel@hippos.de	Renewable energy
SIC Solar COM	P.O. Box: 13 643 Niamey/Niger Phone: +227 20 35 04 18 sic-int@intnet.ne	Renewable energy, Hydraulics and Telecommunication
TOUTHYDRO-Niger	P.O. Box: 13 613 Niamey/Niger Phone: +227 20 74 01 73 Fax: +227 20 74 02 91 thn@intnet.ne	Water, electricity, solar energy
Entreprise Electro-mécanique (ENTRELEC)	P.O. Box: 10 830 Niamey/Niger Phone: +227 20 73 45 03 Fax: +227 20 73 32 83 entrelec@intnet.ne	Mechanical and electrical industries
Société Nigérienne d'Energie Solaire (SONIES)	P.O. Box: 631 Niamey/Niger sonies@intnet.ne	Import of solar energy equipment
Manutention Africaine-SA	P.O. Box: 10387 Niamey/Niger Phone: +227 20 73 36 10 Fax: +227 20 73 33 48 maniger@intnet.ne	Solar energy equipment and training
Total Fina Elf Niger	P.O. Box: 10349 Niamey/Niger Phone: +227 20 74 27 67 Fax: +227 20 74 26 92 totelfdg@intnet.ne	Distribution of petroleum products
Nigerian Enterprise of Electricity (ENGE)	P.O. Box: 12517 Niamey/Niger Phone: +227 20 74 30 86 Fax +227 20 74 34 23 enge@intnet.ne	Electricity, electrical equipment, solar energy
Toutelec Niger-SA	P.O. Box: 12755 Niamey/Niger Phone: +227 20 74 01 15 Fax: +227 20 74 07 84 toutelec@intnet.ne	Supply and maintenance of telecommunication equipment
AMI Services Plus	P.O. Box: 12602 Niamey/Niger Phone: +227 20 73 35 32 Fax: +227 20 73 20 17	Electricity supply and solar energy equipment
BATIMAT	P.O. Box: 2968 Niamey/Niger Phone: +227 20 73 42 12 Fax: +227 20 73 41 99 batimat@intnet.ne	Electrical and PV equipment
Nigerian Group of Electricity	P.O. Box: Niamey/Niger Phone: +227 20 73 49 44	Electrical and PV equipment

Technical Enterprise of Electromechanical Equipment	P.O. Box: 12096 Niamey/Niger Phone: +227 20 74 17 71 atembym@intnet.ne	Installation, maintenance and repair of electrical equipment
KBC	P.O. Box: 10541 Niamey/Niger Phone: +227 20 74 12 25 Fax: +227 74 11 09	Electrical and PV equipment
CFAO Niger	P.O. Box: 204 Niamey/Niger Phone: +227 20 74 01 58 Fax: +227 20 74 28 87 cfaongr@intnet.ne	Air Conditioning and refrigeration
SNS	P.O. Box: 11512 Niamey/Niger Phone: +227 20 310123	Hydraulics and solar equipment

TABLE 9

List of Local Experts

NAME	ADDRESS	Field of Activity
DOGARI Ingenierie	P.O. Box: 10470 Niamey/Niger Phone: +227 20 74 07 98 dogari@intnet.ne	Engineering of solar energy and hydraulics
SCP Agence ARCHI Plus	P.O. Box: 638 Niamey/Niger Phone:+227 20 73 41 25 Fax: +227 20 73 65 19 archi-pl@intnet.ne	Engineering of solar energy, hydraulics and civil building
Techni-Consult	P.O. Box: 11732 Niamey/Niger Phone: +227 20 73 80 04 Fax: +227 20 73 81 23 tconsult@intnet.ne	Engineering of hydraulics and civil building
NAMOSOLAR sarl	P.O. Box: 11489 Niamey/Niger Phone: +227 96 99 70 88 namosolar@yahoo.fr	Hydraulics engineering, civil engineering
KRB	P.O. Box: 10265 Niamey/Niger Phone: +227 20 73 47 53 Fax +227 20 73 53 83 krb@intnet.ne	Hydraulics engineering, civil engineering, engineering in solar energy
BS RA	P.O. Box 13646 Niamey/Niger Phone: +227 20 73 99 15 bsira niger@yahoo.fr	Hydraulics engineering, civil engineering, engineering in solar energy, biofuels
I3EA	P.O. Box: 10209 Niamey/Niger Phone: +227 20 34 02 97 ibrah04@yahoo.fr	Engineering, water, energy and environment

Source: UNESCO, Étude sur l'Identification des Centres d'Excellence en Énergies Renouvelables au Niger; as of 2007

TABLE 10

List of Public Institutions

NAME	ADDRESS	FIELD OF ACTIVITY
Ministry of the Mines and Energy–MME	P.O. Box: 11 700, Niamey/Niger Phone: +227 20 73 45 82 Fax: +227 20 73 27 59 mme@intnet.ne	Mining, geology, energy
Direction of Renewable Energies and Domestic Energies–DERED/ mmE	P.O. Box: 11 700 Niamey/Niger Phone: +227 20 73 65 30 Fax: +227 20 73 27 59 mme@intnet.ne	Renewable energies and domestic energies
Energy Information System SIE–Niger	P.O. Box: 11 700 Niamey/Niger Phone: +227 20 73 97 87 zmouhou@yahoo.fr	Management of energy information
MME Rural Electrification Cellule	P.O. Box 11 700 Niamey/Niger Phone: +227 96 53 48 37 mme@intnet.ne	Strategy of rural electrification
Ministry of Hydraulics and Environment	P.O. Box: 257 Niamey/Niger Phone: +227 20 72 38 89 dregef@intnet.ne	Environment and struggle against the desertification
Ministry of the Trade, Industry and Promotion of the Private Sector	Phone: +227 20 73 69 46 Fax: +227 20 73 21 50	Trade, industry and promotion of the private sector
Ministry of Local Communities Development	Phone: +227 20 72 53 22	Communities development
Ministry of the Population and Social Action	Phone: +227 20 72 23 30 Fax: +227 20 73 61 65	Population and social aspects
Ministry of Economy&Finance	Phone: +227 20 72 23 74	Economy and finance
Ministry of Transport	Phone: +227 20 73 47 82 Fax:+227 20 73 54 89	Transport
National Council of Environment and Sustainable Development–CNEDD	P.O. Box: 10193 Niamey/Niger Phone: +227 20 72 25 59 Fax: +227 20 72 29 81 biocnedd@intnet.ne	Environment, renewable energy, domestic energy

Source: UNESCO, Étude sur l'Identification des Centres d'Excellence en Énergies Renouvelables au Niger, as of 2007

TABLE 11

List of Research Institutes

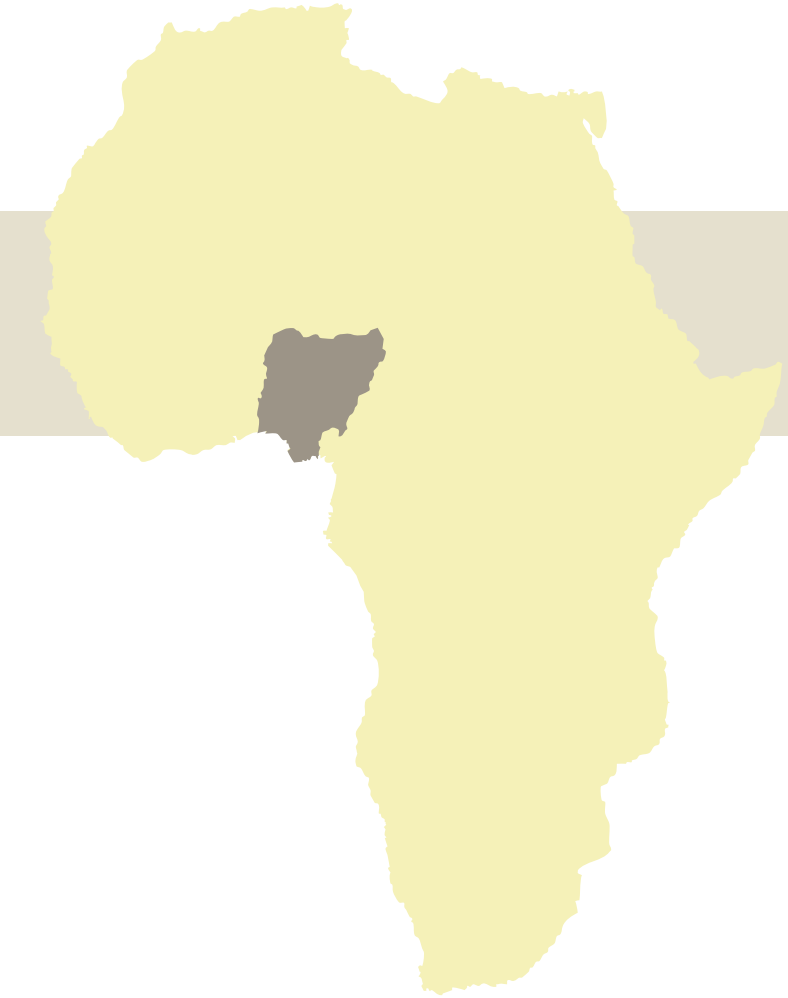
NAME	ADDRESS	FIELD OF ACTIVITY
Abdou Moumouni University of Niamey–UAM	P.O. Box: 237/10896 Niamey/Niger Phone: +227 20 73 25 31 Fax : +227 20 73 38 62 ilimi@uam.ne	Research on energy, environment, hydraulics, health, education, agronomy, social science etc.
National Center of Solar Energy–CNES	P.O. Box: 621 Niamey/Niger Phone: +227 20 72 39 23 Fax: +227 20 72 55 60 cnes@intnet.ne	Renewable energies, energy efficiency research of solar energies
National Institute of Agronomic Research–INRAN Niger	P.O. Box: 429 Niamey/Niger Phone: +227 20 72 27 14 Fax: +227 20 72 34 34 inran@intnet.ne	Research on solar energy, food conservation, agronomy and environmental aspects
School of Mining and Geology–EMIG	P.O. Box: 732 Niamey/Niger Phone: +227 20 31 51 00 Fax: +227 20 73 37 97 emig@intnet.ne	School of engineering, training, research on solar energy, education, engineering, environment etc.
Regional Center of AGRHYMET–CRA	P.O. Box: 11 011 Niamey/Niger Phone: +227 20 73 31 16 Fax: +227 20 73 24 35 admin@sahel.agrhymet.ne	School of engineering, training, research on solar energy, food security, climatology, energies

7 BIBLIOGRAPHY

- ANCR (2006): Étude sur l'Évaluation des Capacités à Renforcer
- Banque Mondiale/World Bank (2009): Programme d'actions communautaires (http://go.worldbank.org/42CLOX67G0)
- Cabinet du Premier Ministre (2007): Stratégie de Développement Accéléré et de Réduction de la Pauvreté (SDRP)
- CNEDD (2006): Inventaire des Gaz à Effet de Serre „Secteur de l'Energie"
- CNEDD (2001): Réactualisation Bilan Diagnostic des stratégies programme et projets passés en cours et en attente dans le domaine des ER au Niger
- CNEDD (2007): Seconde Communication Nationale, Inventaire des Gaz à Effet de Serre, Utilisation des Terres, Changement Affectation des Terres et Foresterie
- CNEDD (2006): Etat des Lieux en Besoins de Renforcement des Capacités dans le Cadre de la Convention Cadre des Nations Unies sur les Changements Climatiques
- CNES (2006): Inventaire des Installations Solaires
- Centre de Promotion des Investissements/Sis à la Chambre de Commerce d'Agriculture,
- d'Industrie et d'Artisanat du Niger (2009): Conditions et Opportunités d'Investissement au Niger (www.investir-au-niger.org/oportunites.htm)
- Centre de Promotion des Investissements/Sis à la Chambre de Commerce d'Agriculture,
- d'Industrie et d'Atisanat du Niger (2009): Code Douanier du Niger (www.investir-au-niger.org)
- ECOWAS/UEMEOA (2005): White Paper for a regional policy (www.gm.undp.org/Reports/ECOWAS%20energy%20white%20paper.pdf)
- Ministère des Mines et de l'Énergie (2006): Étude sur la Définition d'une Stratégie et Élaboration d'un Plan d'Actions en Énergies Domestiques
  Ministère des Mines et de l'Énergie (2006): Stratégie Nationale d'Accès aux Services Énergétiques Modernes
- Ministère des Mines et de l'Énergie (2005): Code de l'Électricité (www.sie-niger.ne)
- Ministère des Mines et de l'Énergie (2004): Déclaration de Politique Énergétique
- Ministère des Mines et de l'Énergie (2003): Stratégie Nationale et Plan d'Actions sur les Énergies Renouvelables
- Ministère des Mines et de l'Énergie (2006): Stratégie du Développement Minier
- Nigelec (2008): various data and information
- Société Nigérienne des Produits Pétroliers - Sonidep (2007): various publications (www.sonidep.com)
- N. N. (2007) : Rapport d'Activités de la Direction des Energies Renouvelables et des Energies Domestiques
- UNESCO (2007): Étude sur l'Identification des Centres d'Excellence en Énergies Renouvelables au Niger

Websites

- Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel, CILSS: www.cilss.bf
- Economic Community of Western Africa States, ECOWAS: www.ecowas.int
- Système d'Information Énergétique Niger, SIE: www.sie-niger.ne
- Union Économique et Monétaire Ouest Africaine – UEMOA : www.uemoa.int



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ACRONYMS AND ABBREVIATIONS

NIGERIA

AES	Applied Energy Services
CAC	Corporate Affairs Commission
CDM	Clean Development Mechanism
ECN	Energy Commission of Nigeria
ECOWAS	Economic Community of West African States
EPSR	Electric Power Sector Reforms
FDI	Foreign Direct Investment
FIIRO	Federal Institute of Industrial Research Oshodi
FOTE	Friends of the Environment
GDP	Gross Development Product
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
IMF	International Monetary Fund
IPP	Independent Power Producer
IPPA	Investment Promotion and Protection Agreement
ITCZ	Inter-Tropical Convergence Zone
JV	Joint Venture
LGHQs	Local Government Headquaters
LPG	Liquefied Petroleum Gas
N	Nigerian Naira (currency of Nigeria, also NGN)
NAPEP	National Poverty Eradication Program
NBRRI	Nigerian Building and Road Research Institute
NCC	National Coal Corporation
NDA	Niger Dam Authority
NEEDS	National Economic Empowerment and Development Strategy
NEPA	Nigerian Electricity Power Authority
NERC	Nigerian Electricity Regulatory Commission
NESCO	Nigeria Electricity Supply Company
NGC	Nigerian Gas Company
NGOs	Non Governmental Organizations
NIMET	Nigeria Meteorological Services
NIPC	Nigerian Investment Promotion Commission
NNPC	Nigerian National Petroleum Corporation
NNRA	Nigerian Nuclear Regulatory Authority
NREMP	National Renewable Energy Master Plan
PHCN	Power Holding Company of Nigeria
PRODA	Project Development Agency
R&D	Research and Development
REA	Rural Electrification Agency
REF	Rural Electrification Fund
REMP	Renewable Energy Master Plan
SESN	Solar Energy Society of Nigeria
SHP	Small Hydro Power
TCN	Transmission Company of Nigeria
UNIDO	United Nations Industrial Development Organization
USD	United States Dollars
VAT	Value Added Tax

MEASUREMENTS

GWh	gigawatt hour
kg	kilogram
km	kilometer
kV	kilovolt ampere
kVA	kilovolt
kWh	kilowatt hour
kWp	kilowatt peak
m	meter
m^2	square meter
/	meters per second
MJ	megajoule
MVA	megavolt ampere
MW	megawatt (1 MW = 1,000 kW)
MWh	megawatt hour
PJ	petajoule (1 PJ = ca. 277,778 million kWh)
scf	standard cubic feet
yr	year

SUMMARY

The Country Study of Nigeria is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Nigeria. The study is structured as follows:

Chapter one provides **Background Information on Nigeria.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Nigeria.

Chapter two summarizes facts and figures of **Nigeria's Energy Market** including stakeholders and market actors and involved as well as related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Nigeria. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions, concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Nigeria.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Nigeria.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Nigeria covers a total area of 923,768 km². With over 140 million people (as of 2008), Nigeria is the most populated country in Africa and the ninth populated country in the world. About 45 % of the inhabitants live in urban areas; nearly 42 % of the population is under 14 years. The fertility rate in 2008 was 5.01 and the population growth rate about 2.03 %. Life expectancy rate in 2008 was estimated at 46.5 years, while adult literacy is 68 %.[1] In 2003, 5.4 % of adults lived with HIV/AIDS. Infant mortality in 2008 remained very high with 95.78 deaths per thousand live births[2]. Nigeria is divided in the geographical regions North, South, the Central Region and the Guinea coastlands.

FIGURE 1
Map of Nigeria

Because of its location just north of the equator, Nigeria enjoys a truly tropical climate characterized by the hot and wet conditions associated with the movement of the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator. It is important to note that the climatic conditions of the country vary considerably due to its close proximity to the Equator and the Tropic of Cancer. There are two main seasons prevalent in Nigeria. One is the rainy season from May to September in the northern part of Nigeria and from March to November in the southern part. The dry season, also known the Harmattan season in Nigeria, lasts from December till January.

The country experiences consistently high temperatures all year round. The seasonal pattern of climatic conditions over Nigeria gives rise to four seasons in the South and two in the North. This is the result of annual total rainfall occurrence and distribution, which is more predominant in the South than in the North.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

Nigeria became an independent country on 1 October 1960 and a republic on 1 October 1963. The country operates as a federal system of governments, consisting of the Federal Government, 36 State Governments and 774 Local Governments. While the country has been governed by a succession of military and civilian governments, Nigeria is currently experiencing the longest period of democracy since becoming an independent nation. The Fourth Republic started on 29 May 1999 with the election of President Olusegun Obasanjo. Obasanjo was followed by the current President Umaru Musa Yar'Adua who was elected on 29 May 2007. While Nigeria operated a Parliamentary System of Government when it gained its independence, the country currently operates a Presidential System of Government with three tiers of Government, i. e. executive, legislative and judiciary.

Nigeria's population consists of about 250 ethnic groups speaking 500 indigenous languages and following two major religious, i.e. Islam and Christianity. The largest ethnic groups are the Hausa-Fulani, the Yorubas and the Igbos. Nigeria's economy is primarily driven by oil and gas. Oil and gas account for 25 % of the country's Gross Development Product of 115.4 billion USD (as of 2006) measured at current prices. Oil and gas account for over 80 % of governmental revenues and more than 95 % of total export earnings in 2006[3]. GDP per capita has recently risen considerably to 858 USD as opposed to 350 USD in 2000. The Nigerian economy is experiencing the fastest growth in over two decades due to the development in the energy sector, especially the oil and gas sub-sector. Growth averaged 5.7 per cent annually between 2000 and 2005, picking up across a broad range of sectors[4]. Nigeria's vision is to become one of the 20 largest economies by the year 2020.

However, in spite of the massive revenue from oil (estimated at over 600 billion USD since 1970), the standard of living is still very low, poverty is widespread and income distribution is highly skewed. Over 70 % of the population lives on less than 1 USD a day and 91 % live on less than 2 USD a day according to a 1990–2001 poverty study. Income distribution is highly skewed with the poorest 10 % of the population controlling just 1.6 % of the wealth, while the richest 10 % control 40.8 % of total wealth.[5] The Gini index stands at 50.6 %. Nigeria with a Human Development Index of 0.461 was classified among the countries with low human development by the United Nations. The International Monetary Fund (IMF) ranked Nigeria at 165 out of 179 countries in terms of per capita income in 2006. The major causes for poverty in Nigeria are bad governance, neglect of the agricultural sector, inadequate social and economic infrastructure and unstable policy environment.

1 CIA, AS OF 2009
2 CIA, AS OF 2009
3 CBN, AS OF 2007
4 KWAKWA ET AL., AS OF 2008
5 NBS, AS OF 2005

2 ENERGY MARKET IN NIGERIA

2.1 OVERVIEW OF THE ENERGY SITUATION

Nearly 60 % of the country's 140 million people have no reliable access to electricity from the national energy grid. Most people rely on lighting with kerosene lanterns, candles, torches etc. Nigeria has a National Energy Policy as well as a draft National Energy Master Plan and Renewable Energy Master Plan. The most important legislation guiding the power sector is contained in the Electric Power Sector Reforms (EPSR) Act of 2005. In 2008, the Government also approved of a new oil and gas policy.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Nigeria is fortunate to have huge energy resources enabling the country to transform its economy and the lives of its citizens. Nigeria sits astride of over 36 billion barrels of oil, 187 trillion cubic feet of gas, 4 billion metric tons of coal and lignite as well as huge reserves of tar sands, Hydro Power and solar radiation. An overview of Nigeria's energy reserves is presented in table 1.

TABLE 1

Energy Reserves and Potential of Nigeria

Crude oil	35.2 billion barrels
Natural gas	187.44 trillion scf
Tar sands	30 billion barrels of oil equivalent
Coal & lignite	4 billion tons
Large Hydro Power	11,250 MW
Small Hydro Power	3,500 MW
Fuel wood	13,071,464 hectares
Animal waste	61 million tons/year
Crop residue	83 million tons/year
Solar radiation	3.5–7.0 kWh/m²/day
Wind	2–4 / at 10 m height

Source: Sambo, as of 2008

The energy mix of Nigeria is dominated by oil which accounts for about 57 %, followed by natural gas (36 %) and hydroelectricity (7 %) as of 2005. Other energy sources such as coal, nuclear and renewable energies currently play no significant role in the country's energy consumption mix. Between 1980 and 2005, the share of oil in energy mix decreased from 82 % to 56 %. Natural gas consumption increased from 9 % to 35 %. Hydroelectricity experienced a slight increase from 6.6 % to about 7 %.

Over the period of 1989–2005, the share of non-commercial energy in total energy consumption fluctuated within the range of 30–40 %. About 95 % of total fuel wood consumption falls to households for cooking and domestic industrial activities, which are closely related to household activities. A smaller proportion of the fuel wood and charcoal consumed are used in the service sector.

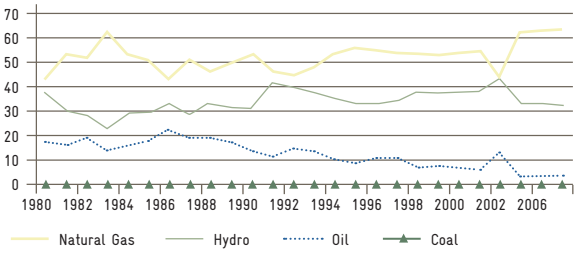
Electricity Sector

Electricity in Nigeria is supplied through large-scale thermal power and hydroelectric power plants and a 330 kV and 132 kV nationwide transmission network through the Power Holding Company of Nigeria (PHCN). Power demand developed from 3,233 MW in 2002 to 3,479 MW in 2003 and 3,403 MW in 2004. The maximum power demand in 2003 exceeded the available capacity of 3,477 MW in 2005. The Government has clearly fallen short of the national targets defined in the National Economic Empowerment and Development Strategy (NEEDS) in order to increase the generation capacity of power facilities to 10,000 MW, the transmission capacity to 9,340 MVA and the distribution capacities to 15,165 MVA by the year 2007. Most of the generating facilities are old and outdated, yet cannot be overhauled due to the lack of reserve capacity. This situation was caused by insufficient maintenance, the suspension of new investments and the high rate of auto-generation as a result of frequent large-scale blackouts.

The residential sector accounted for 63 % of the total electricity consumption in 2005, followed by the commercial sector (27 %) and the industrial sector (10 %). Natural gas dominates the electricity generation mix, accounting for an average of 63 % of the total power generation. After natural gas, hydro is also a significant factor in power generation, though its contribution has decreased. Figure 2 presents the evolution of the total power generation shares by type of fuel.

FIGURE 2

Share of Energy Sources in Total Power Generation (%)



Source: World Bank, as of 2006

Meanwhile, the contribution of oil, though marginal since 1980, has also drastically decreased contributing as little as 3 % to the total power generation in 2004. In Nigeria, the problems in the Niger Delta have often affected the supply of gas to the power stations leading to major disruptions in electricity generation. Occasional low levels of water in the hydrostations together with the gas disruptions lead to blackouts in most parts of the country. Energy prices in Nigeria are very low compared to other countries and relative to the marginal cost of production. The average electricity tariff in Nigeria is about 6.75 N per kWh (approximately 5 €-Cents per kWh). It is estimated that the generation cost of electricity from winds power in Nigeria is about 8–10 Euro Cent per kWh. The current electricity prices (as of November 2008) vary between 3 and 5 €-Cents per kWh.

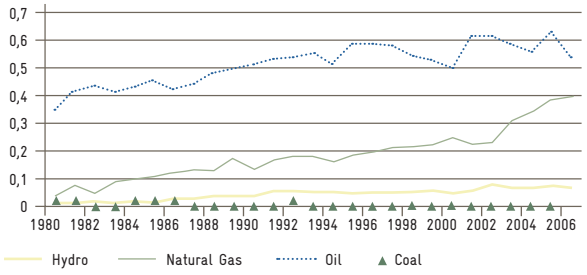
Petroleum Sector

The commercial energy consumption mix in Nigeria is dominated by oil accounting for about 57 %, followed by natural gas (36 %). Besides hydroelectricity (7 %) and very little utilization of coal, other energy resources play no significant role in the country's energy consumption mix. Figure 3 presents an overview of the country's energy mix with main contributions from oil and natural gas.

Refined petroleum products can be classified into two categories, namely those whose prices are still regulated (i.e. gasoline and kerosene) and those whose prices are fully deregulated (i.e. diesel and LPG). Due to the poor state of local refineries, nearly 70 % of total consumption of refined products in Nigeria are imported. The current prices of petroleum products (as of November 2008) are presented in table 3.

FIGURE 3

Evolution of the Energy Consumption Mix in Nigeria (1980–2006) (Quadrillion Btu)



Source: EIA, as of 2009

TABLE 3

Overview of Prices for Selected Petroleum Products

TYPE OF FUEL	PRICE
Gasoline	0.46 Euro per liter
Diesel	0.92 Euro per liter
Kerosene	0.33 Euro per liter
LPG	17.71 Euro per 12.5 kg bottle

Source: market research conducted by the authors, as of November 2008

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The Federal Ministry of Energy oversees the administration of the energy sector in Nigeria primarily through its two main executive bodies, namely the Nigerian National Petroleum Corporation (NNPC) and the PHCN. The NNPC's primary function is to oversee the regulation of the Nigerian oil industry while also being responsible for upstream and downstream developments. The Nigerian Electricity Power Authority (NEPA) was established in 1972 as a result of the merger of the former Electricity Company of Nigeria and the Niger Dam Authority (NDA). NEPA was structured as a vertically integrated monopoly with responsibility to generate, transmit and distribute electricity throughout the country. The NEPA Act was further amended in 1990 and 1998 to pave way for further liberalization of the electricity industry.

One of the major institutional and legislative reforms in the power sector in recent years was the Electric Power Sector Reform (EPSR) in 2005. The EPSR introduced important regulatory changes, which involve dismantling the monopoly of NEPA. It aimed at encouraging competition and efficiency through private participation, especially in the generation and distribution of electricity. The EPSR provided for the division of NEPA into 18 autonomous companies consisting of 6 generating companies, 1 transmission company and 11 distributing companies. The Act also provided for the creation of an independent regulatory agency, i.e. the Nigerian Electricity Regulatory Commission (NERC), and the Rural Electrification Agency (REA) to oversee the extension of electricity to rural and peri-urban areas. The REA is supervised by the Federal Ministry of Energy. The Act also provided for the establishment of a Rural Electrification Fund to promote access of rural dwellers to electricity. In some areas, electricity supply is provided by the REBs of state governments or through an Independent Power Producer (IPP)) system such as NESCO (Nigeria Electricity Supply Company) or the AES Corporation.

There is, however, no agency with direct control of the RE sector in Nigeria. The responsibilities for RE objectives are shared between various Ministries, Departments and Agencies of the Government, e. g. the Energy Commission of Nigeria (ECN), REA, NNPC and the National Poverty Eradication Program (NAPEP). The ECN exercises jurisdiction over RE-related institutions in Nsukka and Sokoto, implements pilot projects on both, technology utilizing solar heat and PV generation, and promotes the introduction of these RE technologies. Silicon is mined in Nigeria and research and development on the domestic manufacturing of PV modules is being planned.

Other key actors in the energy sector are the Nigerian Gas Company (NGC), the Nigerian Nuclear Regulatory Authority (NNRA) and the National Coal Corporation (NCC). The Ministry of Science and Technology is responsible of planning and policy matters related to research and development in the field of science and technology including energy. Other agencies and NGOs also considering RE include the Federal Institute of Industrial Research Oshodi (FIIRO), the Project Development Agency (PRODA), Friends of the Environment (FOTE), the Solar Energy Society of Nigeria (SESN) to mention but a few.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

The NEP was drafted in 1993 by the ECN and represents a comprehensive energy policy that covers all energy sectors. The key objectives and targets for the power sector are:

- To expand electricity access to 75 % of the population by 2020
- To provide electricity supply for all 774 local government headquarters and other cities by 2010
- (only 660 LGHQs have been electrified so far)
- To promote private sector participation
- The key elements in the national policy position on the development and application of RE and its technologies are:
- To develop and promote the country's RE resources and include all viable ones into the national energy mix
- To promote decentralized energy supply, especially in rural areas, based on RE resources
- To discourage the use of wood as fuel
- To promote efficient methods in the use of biomass energy resources
- To keep abreast of international developments in RE technologies and applications

At present, there are no special incentives for distributors, manufacturers and users of RE systems, also due to the huge subsidies granted for conventional energy, in particular conventionally generated electricity and petroleum products. The country is also yet to provide a PPA for developers of RE based electricity projects. The only RE sector that attracts special incentives is the biofuel industry. These incentives include (i) the granting of a pioneer status to all registered businesses engaged in activities related to the production of biofuels or the production of feed stocks for biofuel production and cogeneration, (ii) exemptions from withholding tax and capital gains tax; (iii) exemptions from the payment of customs duties, taxes and other charges of similar nature on biofuels imports and exports, imports of inputs and machineries, (iv) waivers on VAT payments on all products and services consumed by biofuel companies and (v) access to preferential loan arrangements with the Bank of Industry, the Nigerian Export and Import Bank, commercial banks, agriculture banks and other development finance agencies.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Most RE technologies are imported, as there is virtually no manufacturing capacity in the country. In Nigeria, customs tariffs for ordinary electrical products are applied for PV-related equipment resulting in high tariffs which are lacking any incentives and are discouraging the country's PV business. ECN has submitted an "Importation of Renewable Energy Equipment" bill to the Nigerian Senate in 2002, asking for tax exemptions for the import duty of PV equipment.

The Nigerian Government allows for 100 % foreign ownership or joint ventures (JV) with Nigerian partners in all sectors of the economy including the PV sub-sector. The Government has also effected an Investment Promotion and Protection Agreement (IPPA) which guarantees investors adequate and prompt payments in the event of expropriation, free transfer of funds as well as provisions for international arbitration in the event of disputes. This agreement is to facilitate the attraction of Foreign Direct Investment (FDI) to the economy and protect investments in all sectors including the RE sub-sector. Additional incentives to encourage industrialists and investors in all sectors of the economy including the RE sub-sector provide:

- Five years tax holiday for pioneer products and industries
- Tax-free dividend for a period of three years
- 95 % capital allowance for replacement investment
- Elimination of double taxation
- Abolition of excise duty

All excise duties were abolished with effect from 1 January 1999. It should also be mentioned that any investments in the energy sector are rated as pioneer initiatives entitled to a tax holiday of 5–7 year.

The EPSR Act provided for the establishment of the Rural Electrification Agency. The Federal Government has set a target for increasing electricity access in rural areas from currently 40 % to 75 % by 2015. The rural electrification strategy and plan aim at the expansion of the main grid, the development of isolated and mini-grid systems, the creation of an enabling environment to promote investments in RE power generation and the fostering of public and private sectors partnerships designed to supply electricity for the rural population. The targets against which these policies will be measured are: (i) ensuring that 75 % of the rural population has electricity by 2010, (ii) providing electricity to all the 774 local government headquarters and other strategic towns by 2010 and (iii) reducing cost per connection of rural electricity schemes on a sustainable basis. The strategies being contemplated by REA for expanding energy access comprise two elements: pilot projects aimed at testing innovative approaches to expanding rural electricity and activities related to implementation support for the National Renewable Energy Master Plan (NREMP).

To encourage the private sector for investing in rural electrification, governmental subsidy is set at a 304.5 N/month flat rate. The REA and the Rural Electrification Fund (REF) were established in March 2006. Any organization intending to start a rural electrification project can do so by obtaining a business license from the REA without providing or being related to an existing distribution company in the relevant area. The REA will approve of the proposed site for a rural electrification project and allot funds for the REF in accordance with fair and transparent rules. The REA will also formulate and establish minimum safety regulations, technical standards and criteria for the services level.

The NERC is a regulatory and supervisory organ for electric power entities (including private companies) working in power generation, transmission and distribution projects in

general. Although rural electrification projects fall under the authority of NERC, projects with less than 1 MW generating facilities and 100 kW distribution facilities are not subject to their regulation, so off-grid rural electrification projects are not included for the time being.

In general there is no restriction for foreign companies and investors doing business in Nigeria. They must, however, incorporate a local vehicle before commencing business. All companies are approved and regulated by the Corporate Affairs Commission (CAC). Decree No. 16 pf (as of 1995) of the Nigerian Investment Promotion Commission (NIPC) allows for 100 % foreign participation in Nigerian businesses. It also allows for repatriation of capital and dividend without any inhibition from the Government. The NIPC is a one-stop office for dealing with all requirements for investments in the country. The Companies and Allied Matters Act 1990 (The Companies Act) is the principal law regulating the incorporation of businesses in Nigeria.

The approval procedures for foreign investors in Nigeria can be stated as follows: The first port of call is the NIPC office for enquiries about investment opportunities and procedures in Nigeria. Second step is the registration of the company with the CAC. Third is to notify the Industrial Inspectorate Department of the Federal Ministry of Industries of the intended capital expenditure. Next step is to ask for approval of location with the Federal Ministry of Industries. Moreover, approval or a proper business permit with or without expatriate quota allocation must be sought in writing from the Ministry of Internal Affairs. Finally, to know whether the company will obtain pioneer status, it must apply to the Federal Ministry of Industry. The same Ministry also approves the user licenses.

There is an opportunity in the Nigerian power sector to leverage carbon finance from the energy loss reduction and efficiency program embarked upon recently with the assistance of the World Bank. The Transmission Company of Nigeria (TCN) is currently finalizing the Emission Reduction Purchase Agreement. The conversion to a High Voltage Distribution System lead to technical loss and therefore a substantial reduction of carbon emissions due to avoided generation. This represents the first step for the Nigerian power sector in accessing the benefits of Clean Development Mechanism (CDM) under the Kyoto Protocol.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

An overview of the status (as of 2005) and future potential (outlook by 2025) for RE is presented in Table 4.

The Renewable Energy Master Plan (REMP) envisages to aggregate the electrification demand of 14,000 MW by 2015 of which RE will constitute about 5 % (701 MW). In 2025, the electricity demand is projected to increase to 29,000 MW with new RE satisfying up 10 % of the country's overall energy demand. The mix of RE making up the 10 % is projected as follows: small Hydro Power 66 %, PV 17 %, biomass 14 %, wind 1.3 % and solar thermal 0.7 %. The REMP estimated the cost of REMP implementation up to 2025 at 4.8 billion USD. Table 5 presents the targets for electricity generation in Nigeria.

TABLE 4

Technical Potential for Renewable Energy in Nigeria

ENERGY SOURCE	ESTIMATED POTENTIAL	CURRENT UTILIZATION	SHARE OF ELECTRICITY SUPPLY (%) UP TO 2005	SHARE OF ELECTRICITY SUPPLY BY 2025 (%)
Large Hydro Power	14,750 MW	1,930 MW	29.30	25.00
Small Hydro Power	734 MW	30 MW	0.46	9.90
Fuel wood, animal waste and crop residue	144 million tons/		0	0.41
Solar radiation	3.5–7.0 kWh/m²/day	marginal	0	0.26
Wind	2–4 /	marginal	0	0.02

Sources: ECN, Renewable Energy Master Plan, as of 2005/ECN, Energy Demand Projection Document, as of 2004

TABLE 5

Targets for Electricity Generation (MW)

RESOURCE	SHORT-TERM (2005–2007)	MEDIUM-TERM (2008–2015)	LONG-TERM (2016–2025)
Large Hydro Power	1,930	5,230	48,000
Small Hydro Power	100	3,500	19,000
Solar PV	5	120	500
Solar thermal	–	1	5
Biomass	1	100	800
Wind	1	20	40
All renewables	2,036	6,905	68,345
All energy resources	15,920	30,210	192,000
% of renewables	13 %	23 %	36 %

Source: Energy Commission of Nigeria, as of 2007

4.1 BIOMASS/BIOGAS

The biomass resources of Nigeria consist of wood, forage, grass and shrubs, animal wastes arising from forestry, agricultural, municipal and industrial activities as well as aquatic biomass. Biomass remains a leading source of energy for Nigeria contributing an estimated 37 % of total energy demand and being the energy of choice for the vast majority of rural dwellers and the urban poor. The country's biomass energy resources are estimated at 144 million tons per year. Nigeria currently consumes 43.4 billion kg (equivalent 43.4* 109 kg) of fuel wood annually. The average daily consumption is about 0.5–1.0 kg of dry fuel wood per person. The rate of consumption hardly matches the rate of reforestation.

4.2 SOLAR ENERGY

Nigeria is situated in a belt of high sunshine. The solar radiation is fairly well distributed throughout the country. The annual average of total solar radiation varies from about 12.6 MJ/m^2/day (equivalent 3.5 kWh/m^2/day) in the coastal latitudes to about 25.2 MJ/m^2/day (equivalent 7.0 kWh/m^2/day) in the far North. This equals an average annual solar energy intensity of 1,934.5 kWh/m^2/. Thus, over a whole year, an average of 6,372,613 PJ/year (1,770 thousand TWh/year) of solar energy falls on the entire land area of Nigeria. The national average is 5.5 kWh/m^2/day and the average solar radiation time is 6 hours/day, which are favorable conditions for PV power generation.

The only survey on the business units dealing with solar business in Nigeria shows that a total of 44 companies and 2 research centers were active in the importation and/or installation of PV systems. 30 of them were located in Lagos (68 %) and 14 in the rest of the country (32 %). Among the 27 respondents in the survey, 22 (81 %) were involved in solar business. The bulk of the companies were either consultants, vendors or contractors. Many of the existing companies claimed to be distributors for one foreign company or the other. The survey identified only one manufacturer of solar PV components or systems, namely Solar Electric systems, based in Jos. It assembled solar-PV refrigerators and manufactured solar cookers and solar heaters.

The PV components which are marketed in the country include modules, batteries, inverters, converters, charge controllers, bulb/tubes, refrigerators, lighting systems, solar lanterns, solar lamps, and junction boxes. The total module installation for 1999 was estimated at 264 kWp. The REMP estimated the PV modules installation in 2005 at 800 kWp. Most of the distributors of solar PV components and systems in Nigeria obtain their products from America (49 %), Germany (13.7 %) and Britain (21.5 %). Recently, the Asian countries of India and China have taken over increasing shares of the market. One of the emerging issues in the Nigerian solar market, however, is product quality. The country is yet to establish product standards. Presently, there are no capacities to actually test the products that are brought into the country.

Solar PV technologies are being more and more accepted in Nigeria. Despite improvements in local R&D efforts, however, the knowledge of these technologies and their market potentials is considerably inadequate. Presently, all the PV modules in the Nigerian market are imported. Solar PV systems are being extensively used for a wide range of electrical energy requirements including solar home systems, water pumping, refrigeration and telecommunication.

4.3 WIND POWER

Wind speeds in Nigeria range from 1.4 to 3.0 m/s in the southern areas and 4.0 to 5.12 / in the extreme North. Wind speeds in Nigeria are generally weak in the South except for the coastal regions and offshore locations. In Nigeria, peak wind speeds generally occur between April and August on most sites. Initial studies show that the actual total exploitable wind energy reserve at a height of 10 m may vary from 8 MWh/ in Yola to 51 MWh/ in the mountainous areas of Jos plateau and rise to 97 MWh/ in Sokoto. Hence, Nigeria has poor to moderate wind conditions.

Wind energy utilization in Nigeria is practically minimal. The hundreds of wind pumps scattered all over the country are badly maintained and some have been abandoned altogether. Some state governments like Jigawa and Kano are making an effort to install new wind pumps. There is one pilot wind electricity project in operation, namely the 5 kWp Sayya Gidan Gada wind electricity project at Sokoto. Moreover, a 0.75 kWp wind electricity project in the center of the town is being run on an experimental basis to prove the viability of wind farming in the area.

4.4 HYDRO POWER

According to NEPA's most recent estimate, the country's gross hydro potential is approximately 14,750 MW. On the basis of a 1980 survey of 12 of the old states of the federation, it was assessed that some 734 MW of small Hydro Power (SHP) could be harnessed from 277 sites. Unfortunately, the database on SHP in Nigeria is limited, incomplete and substantially obsolete. No new surveys have been conducted since those undertaken in only three states over 20 years ago to confirm or verify the data. The REMP, however, estimates that SHP potential is about 3,500 MW. More detailed information can be found in the Annex of this report.

Hydrogen, Marine, Ocean and Geothermal Energy

Hydrogen, marine, ocean and geothermal energy are important in the long-term vision of providing secure, abundant, cost effective and clean sources of energy for Nigeria. Their impact, however, is still negligible at present. The Nigerian Energy Policy seeks to promote capacities to enable Nigeria to include these new energy sources in the country's future energy mix. Nigeria has an Atlantic Ocean coastline stretching over 800 km from Badagry to Bakassi. Tides in the coastal areas have a height range of 100–300 cm and an incursion of 30–40 km on the average. With respect to geothermal energy, there are two known geothermal resources in Nigeria: Ikogosi Warm Springs in Ondo State and the Wikki Warm Spring in Bauchi. Moreover, high geothermal gradient trends have been identified in the Lagos sub-basin, the Okitipupa ridge, the Auchi-Agbede within the Benin flank/hinge line as well as in the Abakaliki anticlinorium.

5 MARKET RISKS AND BARRIERS

Price distortions, poor regulatory environment and inadequate infrastructure define the current energy market conditions in Nigeria reducing the scope for competition, growth and innovation in the market. The Nigerian business environment is characterized by weak infrastructure, poorly implemented incentives (especially fiscal and tariff regimes), massive smuggling, counterfeiting and dumping of products, lack of standardization required for international competitiveness, unfavorable international trade rules, a national trade policy stance which is endemically unpredictable (especially in the application of tariffs and exemptions), high transaction costs at ports, complicated customs clearance procedures, tariffs and non-tariff barriers which on the average exceed those of other ECOWAS countries and high level of official corruption.

The 2009 Report on "Doing Business Index" jointly authored by the World Bank and the International Finance Corporation shows that Nigeria dropped from position 108 out of 178 in 2008 to position 118 out of 181 in 2009. Nigeria slides down on most of the scales used to measure efficiency of business transactions. While the number of procedures required for obtaining licenses reduced from 18 to 16, the number of the days required in concluding the process increased from 350 to 360 days. Similarly, while the number of payments in business taxes reduced from 35 to 32, the percentage of the tax (related to the company profit) rose from 29.9 %to 32.2 %. Nigeria, however, recorded some improvements such as the reduction of the number of procedures for registering a business from 9 to 8 or the reduction of the number of days required for the process from 34 to 31. The costs for registering a new business in Nigeria however raised from 56.6 % in the 2008 Report to 90.1 % in the 2009 Report (indicated as percentage of per capita income). Employers have high flexibility to hire and fire employees.

Moreover, there are no clear and consistent institutional structures helping to overcome barriers and create expanded opportunities for RE. Some of the current initiatives of various actors are rather spontaneous and lacking systematic approaches. The Government's Agencies and Ministries active in the RE sector include the Energy Commission of Nigeria (through two of its renewable energy centers located at Sokoto and Nsukka), the Nigeria Meteorological Services (NIMET), the Nigerian Building and Road Research Institute (NBRRI), the Project Development Institute (PRODA), the Federal Institute of Industrial Research Oshodi (FIIRO), REA, the Federal Ministry of Environment, the Federal Ministry of Science and Technology, the Federal Ministry of Energy as well as some of Nigeria's universities and polytechnics.

There is a need to create a level playing field in the energy market by removing all price distortions, by granting special incentives to market operators for the introduction of RE technology systems and by encouraging consumers to access RE products.

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 6

Local Business Partners

NAME	ADDRESS	BUSINESS FOCUS
Jon Paca Investments Ltd.	Suite 38, Kogi Street, Garki, Abuja Phone: +234 803 703 490 6	Solar water pumping systems, solar street lighting
Aero Systems & Tech Nig. Ltd.	Plot 7, Durban Street Wuse 2, Abuja Phone: +234 806 602 033 3	PV systems, batteries, inverters, solar charge controllers, solar water pumping systems
Solarec Engineering Ltd.	2nd Floor, 6A Ahmadu Bello Way, Kaduna Phone: +234 301 568 05	PV modules, inverters, DC lighting, charge controllers, solar water pumping systems
Afri-Asia Global Services Ltd.	1, Ilesanmi Idowu, Ogudu GRA, Ogudu, Ojota, Lagos Phone: +224 806 008 651 2 www.afasglobal.com	Hydroenergy system components, solar street lighting, solar water pumping systems, wind energy system components
EastWind Laboratories	8, Lagere Road, Ile-ife, Osun State Phone: +234 803 455 154 6 Web: www.eastwindlabs.com	Solar electric power systems, battery charge controllers, PV module components, inverters
Pamtronics Nigeria Ltd.	Suite C3 Royal Plaza, Area 3 Junction, Garki, Abuja Phone: +234 803 701 270 3 Web: www.pamtronics.com	Solar electric power systems, batteries deep cycle, DC to AC power inverters sine wave, DC lighting, modules
Borodo & Co. Ltd.	P.O. Box 7328, Kano Phone: +234 803 587 005 8	Solar electric power systems, lead acid batteries, solar modules, inverters
Cedicon Ltd.	13th Floor, Zenon House, No.2 Ajose Adeogun St., Victoria Island, Lagos Phone: +234 806 572 208 5	Solar electric power systems, wind power plants, inverters
Rubitec Nigeria Ltd.	72 Adeniyi Jones Avenue, Ikeja, Lagos Phone: +234 803 449 967 0	Solar lighting systems, solar water pumping systems, power inverters, water filtering and purification systems, wind systems and small Hydro Power
Royal Power and Energy Ltd.	Plot 10b, 2 Ashabi Adewale Close, Off Chief Harmann St., Lekki Phase 1, Lagos Phone: +234 176 096 83 www.rpeltd.com	Solar and wind power batteries, UPS and surge protectors
Solar Energy Services Ltd.	No. 14, Muri Okunola St., Suite 2, Victoria Island, Lagos Phone: +234 146 133 56	Solar streetlights, park lights, solar lighting
KXN Nig, Ltd.	3B, Ribadu Road, Ikoyi, Lagos Phone: +234 177 478 87 kxn@solarsolve.com	Solar PV modules, refrigeration, batteries, controllers, water pumping, small home systems
OEIE Nig. Ltd.	14 Woji Road, Eugene Plaza, Rumuogba, Port Harcourt Phone: +234 846 100 452	Solar water borehole system, refrigeration, solar panels, streetlight billboards
Berekotry Detergents Ltd.	KM 1, Oremoje Rd., Iseyin, Oyo State Phone: +234 803 422 244 8	Biodiesel, bioplastics, cooking stoves

TABLE 7

Local Business Institutions

NAME	ADDRESS	BUSINESS FOCUS
Lagos Chamber of Commerce and Industry	1 Idowu Taylor St., Victoria Island Phone: +234 177 466 17 Fax: +234 127 010 09 www.lagoschamberng.com	Pioneer Chamber of Commerce and Industry in Nigeria
Manufacturers Association of Nigeria	MAN House, Ikeja, P.O. Box 3835, Lagos Phone: +234 149 742 403 Fax: +234 149 742 47 www.manufacturersnigeria.org	Umbrella body for all local manufacturers in Nigeria
Kaduna Chamber of Commerce and Industry	Kaduna International Trade and Investment Centre, Km 4, Kaduna-Zaria Rd., P.O. Box. 728, Kaduna Phone: +234 623 187 94 Fax: +234 623 187 94 www.kadunachamberofcommerce.org	One of the leading chambers of commerce and industry in the North
Kano Chamber of Commerce and Industry	Trade Fair Complex, Zoo Road, P.O. Box 10, Kano City, Kano Phone: +234 646 671 38 Fax: +234 646 671 38 kaccima@hotmail.com	One of the leading chambers of commerce and industry in the North
Enugu Chamber of Commerce, Industry, Mines and Agriculture	Trade Fair Complex, Abakaliki Road, P.O. Box 734, Enugu Phone: +234 422 505 75 Fax: +234 422 521 86 www.enuguchambers.net	One of the leading chambers of Commerce and Industry in the South East
Onitsha Chamber of Commerce and Industry	Achike House, 38, Ogota Road, P.O. Box 2578, Onitsha, Anambra State Phone: +234 464 141 40 Fax: +234 462 511 34 oniccima02@yahoo.co.uk	One of the leading chambers of Commerce and Industry in the South East
Abuja Chambers of Commerce and Industry	Abuja International Trade Fair Complex, Km8, Airport Road, P.M.B 86, Garki, Abuja Phone: +234 967 072 18	Leading chamber of commerce and Industry in the Federal Capital

TABLE 8

Relevant Governmental Institutions and Agencies

NAME	ADDRESS	AREA OF FOCUS
Energy Commission of Nigeria (ECN)	Plot 701C, 358, Garki, Abuja, Nigeria dg@energy.gov.ng www.energy.gov.ng	Strategic energy planning, coordination and performance, laying down guidelines on the utilization of energy types for specific purposes
Sokoto Energy Research Centre, Sokoto	Uthman Dan fodio University, Sokoto www.edusok.edu.ng	Mandate for research of RE and implementation of relevant pilot programs
National Centre for Energy Research and Development	University of Nigeria, Nsukka, Enugu State	Mandate for research in renewable energy with a number of completed pilot projects
Rural Electrification Agency (REA)	No. 16, Gwani Street, off IBB Way, Wuse Zone 4, PMB, 5072, Wuse, Abuja www.reang.ng	Provision of reliable and affordable electricity supply to all rural dwellers using both grid and non-grid options
UNIDO Regional Center for Small Hydro Power	WAEC Building, Plot 10 (2nd Floor), Zambezi Crescent, Maitama, PMB 175, Garki, Abuja www.unidorc.org/nigerian	Established in Abuja for the promotion and acceleration of SHP in the region; development of cost effective technologies, capacity building and training
Renewable Energy Section (NNPC)	Block B, NNPC Towers, Central Business District, P.M.B. 190, Garki, Abuja www.nnpcgroup.com	National secretariat for biofuel policies and implementation

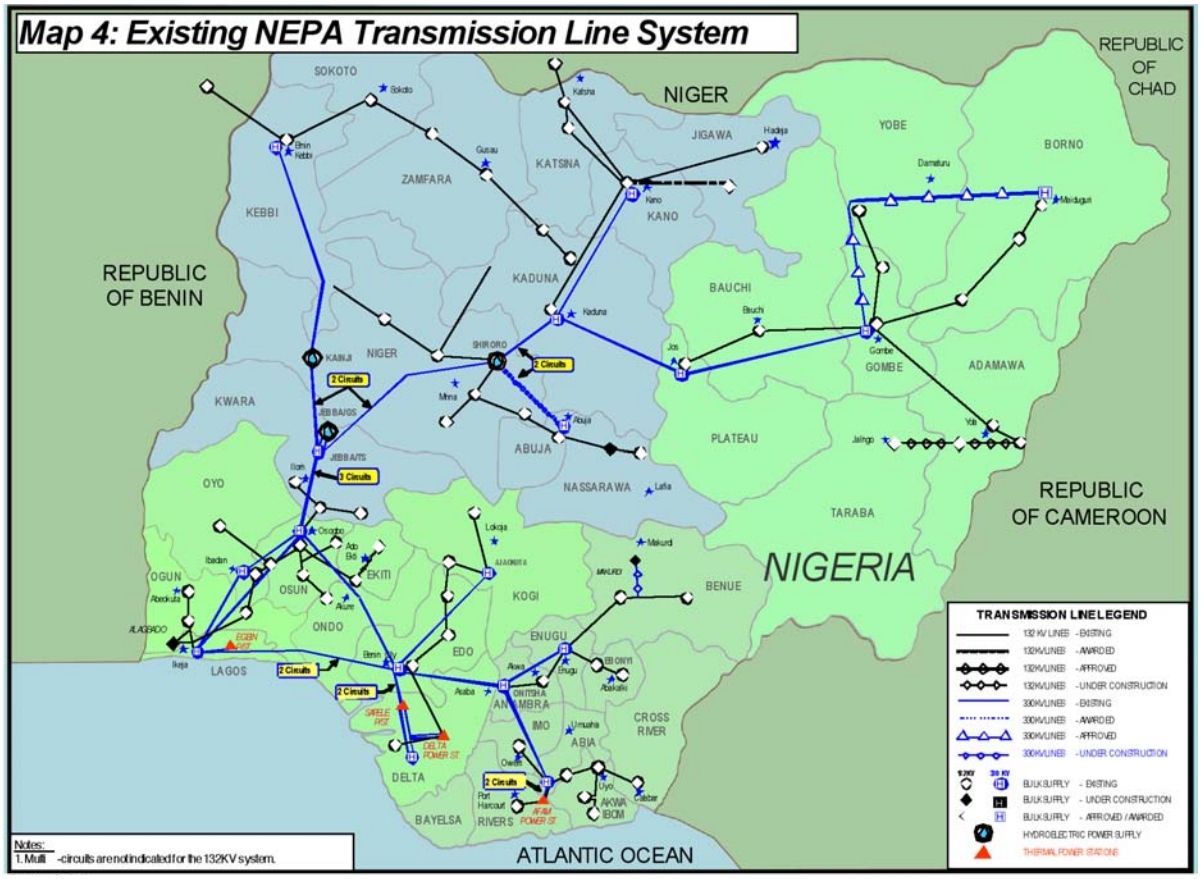
7 BIBLIOGRAPHY

- Business Day (2008): Achieving a Sustainable Source of Energy (special report)
- Central Bank of Nigeria (2006): Annual Report and Statement of Accounts
- Central Bank of Nigeria (2006): Statistical Bulletin, Vol. 17, Abuja
- Corporate Affairs Commission (without year): (www.cacnigeria.org)
- Energy Commission of Nigeria (2004): Energy Demand Projection Document, Mimeo
- Energy Commission of Nigeria (2005): Renewable Energy Master Plan (final draft report)
- Energy Commission of Nigeria (2007): National Energy Databank: Compendium of Renewable Energy Systems Deployed in Nigeria
- Energy Commission of Nigeria (2007): Draft National Energy Master Plan
- Energy Information Agency (2009): Annual Report
- Energy Information Agency (without year): Energy Annual 1980–2005 (www.eia.doe.gov/international)
- Iloeje, O. C. (2002): Report of Business Activities in Solar PV in Nigeria, Technical Report No .ECN/EPA/02/3, Energy Commission of Nigeria
- JICA (2006): The Federal Republic of Nigeria Master Plan Study for Utilization of Solar Energy (Interim Report)
- Kwakwa, V. A., Adenikinju, P., Mousley and Owusu-Gyamfi, M. (2008): Binding Constraints to Growth in Nigeria (published in "Economic Policy Options for a Prosperous Nigeria", Palgrave Macmillan, New York)
- Maigida, S. (2008): Power Sector Infrastructural Development by 2020: Issues and Challenges (paper presented at the 1st International Conference of NAEE/IAEE)
- National Bureau of Statistics (2005): The Nigerian Statistical Fact Sheets on Economic Development, Lagos
- Nigerian Investment Promotion Corporation (without year): (www.nipc.gov.ng)
- Oke, C. A. (2008): Resuscitating and Sustaining the Nigerian Power Sector (paper presented to the Nigerian Association for Energy Economics)
- Power Holding Company of Nigeria (2008): (www.phcnonline.com/my tariffs)
- Sambo, A. S. (2008): Proposed National Master Plan for Nigeria (paper presented at the 1st International Conference of NAEE/IAEE)
- Theodora (2007): Maps of Nigeria (www.theodora.com/maps, revised March, 28th 2007)
- World Bank (2007): World Development Indicators (CD-Rom)

8 ANNEX

FIGURE 4

Map of Existing Transmission Lines in Nigeria



Source: Oke, as of 2008

TABLE 9

Installed Power Generating Capacity on the Nigerian Grid (2006)

TYPE	INSTALLED CAPACITY (MW)	%
Hydro		
Kanji	760	28.9
Jebba	540	
Shiroro	600	
Gas turbines		
Sapele	300	40.0
Afam	920	
Delta	840	
AES	270	
AGIP	300	
Steam turbines		
Egbin	1,320	31.1
Sapele	720	
Total capacity	6,570	100

Source: Oke, as of 2008

TABLE 10

Electricity Tariffs in Nigeria

RESIDENTIAL CLASS						
Class	Demand Level	Demand Charge/KVA	Max. Charge/Month	Fixed Charge	Meter Maintenance Charge/Month	Energy Charge/KWH
R1	< 5 kVA	–	–	20	100.00	1.2
R2	< 5–15 kVA	–	–	30	100.00	4.0
R3	< 15–45 kVA	–	–	120	500.00	6.0
R4(MD)	LV: < 45–500 kVA	–	5,000.00	120	1,600.00	8.5
R5(MD)	HV: < 500 kVA – 20 MVA	–	31,250.00	–	2,200.00	8.5

COMMERCIAL CLASS						
Class	Demand Level	Demand Charge/KVA	Max. Charge/Month	Fixed Charge	Meter Main Charge/Month	Energy Charge/KWH
C1	< 5–15 kVA			90	500.00	8.5
C2	< 15–45 kVA			120	1,600.00	8.5
C3(MD)	LV:<45–500 kVA	230,00	5,000.00	240	2,200.00	8.5
C4(MD)	HV: < 500 kVA – 20 MVA	230,00	31,250.00			

INDUSTRIAL CLASS						
Class	Demand Level	Demand Charge/KVA	Max Charge /Month	Fixed Charge	Meter Main Charge/Month	Energy Charge /KWH
D1	< 5–15 kVA	–	–	90	100.00	6.5
D2	< 15–45 kVA	–	–	120	500.00	8.5
D3	LV: < 45–500 kVA	230	5,000.00	240	1,600.00	8.5
D4	HV: < 500 kVA – 20 MVA	250	31,250.00		2,200.00	8.5
D5	> 20 MVA	270	–	1.5 M	2,200.00	8.5

PREPAYMENT CLASS			
Tariff Index	Rate	Meter Maintenance Fee	Fixed Charge
Residential 3 phase (R3) index 2	6.0	500	120
Commercial 3 phase (C2) index 5	8.5	500	120
Commercial 3 phase (C3) index 6	8.5	1,600	240
Residential single phase (R2) index 1	4.0	100	30
Commercial single phase (C1) index 4	6.5	100	90

Source: PHCN, as of 2008

TABLE 11

NEPA Estimate of Current Exploitable Hydro Power Sites in Nigeria

LOCATION	RIVER	POTENTIAL CAPACITY (MW)
Donka	Niger	225
Zungeru II	Kaduna	450
Zungery I	Kaduna	500
Zurubu	Kaduna	20
Gwaram	Jamaare	30
Izom	Gurara	10
Gudi	Mada	40
Kafanchan	Kongum	5
Kurra II	Sanga	25
Kurra I	Sanga	15
Richa II	Daffo	25
Richa I	Mosari	35
Mistakuku	Kurra	20
Korubo	Gongola	35
Kiri	Gongola	40
Yola	Benue	360
Karamti	Kam	115
Beli	Taraba	240
Garin Dali	Taraba	135
Sarkin Danko	Suntai	45
Gembu	Dongu	130
Kasimbila	Kasina Ala	30
Katsina Ala	Katsina Ala	260
Makurdi	Benue	1,060
Lokoja	Niger	1,950
Onitsha	Niger	1,050
Ifon	Osse	30
Ikom	Cross	730
Afokpo	Cross	180
Atan	Cross	180
Gurara	Gurara	300
Mambilla	Danga	3,960
Total		12,220

Source: ECN, Renewable Energy Master Plan, as of 2005

TABLE 12

Small Hydro Potential in Surveyed States of Nigeria

STATE (PRE 1980)	RIVER BASIN	TOTAL SITES	TOTAL CAPACITY (MW)
Sokoto	Sokoto-Rima	22	30.6
Katsina	Sokoto-Rima	11	8.0
Niger	Niger	30	117.6
Kaduna	Niger	19	59.2
Kwara	Niger	12	38.8
Kano	Hadeija-Jamaare	28	46.2
Borno	Chad	28	20.8
Bauchi	Upper Benue	20	42.6
Gongola	Upper Benue	38	162.7
Plateau	Lower Benue	32	110.4
Benue	Lower benue	19	69.2
Rivers	Cross River	18	258.1
Total		277	734.2

Source: ECN, Renewable Energy Master Plan, as of 2005

TABLE 13

Existing Small Hydro Schemes in Nigeria

RIVER	STATE	INSTALLED CAPACITY (MW)
Bagel I	Plateau	1
Bagel II	Plateau	2
Ouree	Plateau	2
Kurra	Plateau	8
Lere I	Plateau	4
Lere II	Plateau	4
Bakalori	Sokoto	3
Tiga	Kano	6

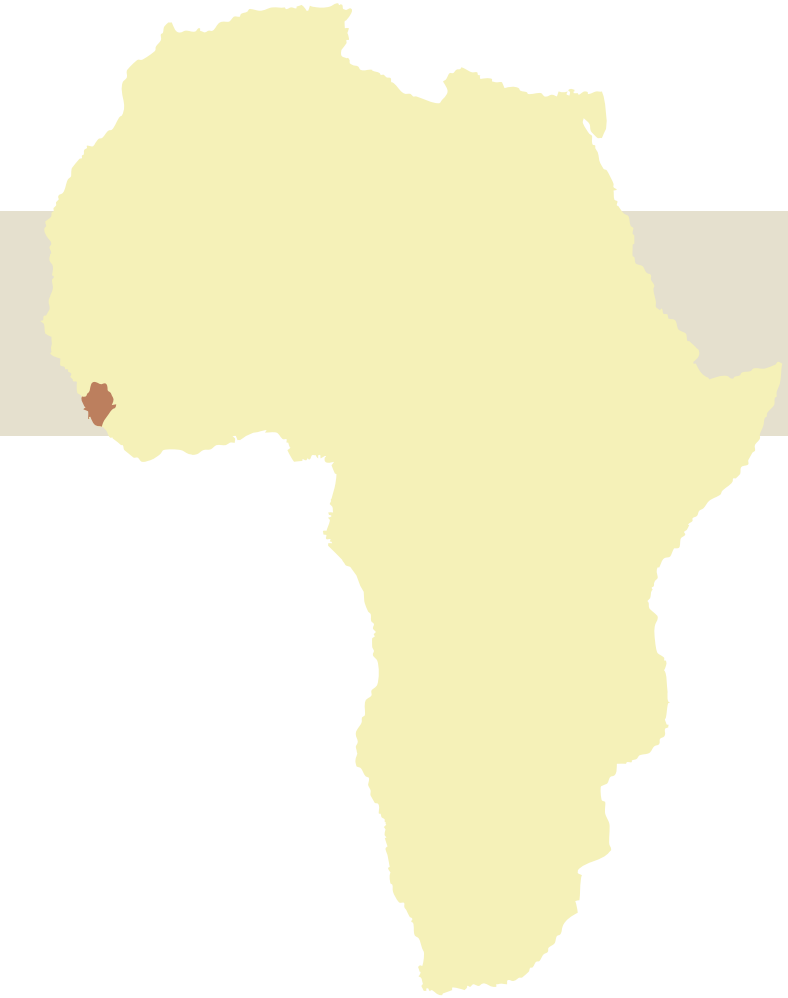
Source: ECN, Renewable Energy Master Plan, as of 2005

COUNTRY CHAPTER: SENEGAL

The Regional Report "Renewable Energies in West Africa" does not include a separate Country Chapter for the ECOWAS country Senegal, as key information on the Senegalese RE market is already available by two other studies edited and compiled by GTZ on behalf of the German Government:

GTZ / TERNA (2009):
Energy policy Framework Conditions for Electricity Markets and Renewable Energies – 16 Country Analyses, part Senegal (in English)
›› http://www.gtz.de/de/dokumente/gtz2009-en-terna-senegal.pdf

GTZ / Owsianowski, R.-P. (2007): Projekterschließung Senegal
Erneuerbare Energien und ländliche Elektrifizierung.
Länderreport & Marktanalyse
›› http://www.gtz.de/de/dokumente/de-projekterschliessung-senegal-laenderreport.pdf



COUNTRY CHAPTER: SIERRA LEONE

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ACRONYMS AND ABBREVIATIONS

SIERRA LEONE

APC	All People's Congress
BADEA	Arab bank for economic development in Africa)
BHEP	Bumbuna Hydroelectric Project
BKPS	Bo-Kenema Power Services
CFL	Compact Fluorescent Lamp
DANIDA	Danish International Development Agency
DC	Direct Current
EFA	Environmental Foundation for Africa
e.g.	ex gregie/for example
FOB	Free of Board
GDP	Gross Domestic Product
GoSL	Government of Sierra Leone
GTG	Global Trading Group
HDI	Human Development Index
IEL	Income Electrix Limited
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
KPS	Kingtom Power Station
Le	Leone (Sierra Leonean currency)
LPG	Liquefied Petroleum Gas
MAFS	Ministry of Agriculture and Food Security
MEP	Ministry of Energy and Power
MF	Ministry of Finance
MFO	Marine Fuel Oil
MLIRSS	Ministry of Labor, Industrial Relations and Social Security
MMR	Ministry of Mineral Resources
MoU	Memorandum of Understanding
MTI	Ministry of Trade and Industry
NCP	National Commission for Privatization
NP	National Petroleum Company
NPA	National Power Authority
PIU	Project Implementation Unit
PPP	Public-Private Partnerships
PSP	Private Sector Participation
PU	Petroleum Unit
PV	Photovoltaic
RE	Renewable Energy
SDF	Saudi Development Fund
SHS	Solar Home System
SLEDIC	Sierra Leone Export Development and Investment Corporation
UNAMSIL	United Nations Mission in Sierra Leone
UNECA	United Nations Economic Commission for Africa
UNIDO	United Nations Industrial Development Organization
USD	United States Dollar

MEASUREMENTS

GWh	gigawatt hour (1 GWh = 1,000,000 Kilowatt hours (kWh))
kg	kilogram
km^2	square kilometer
kWh	kilowatt hour
kVA	kilovolt-ampere
m/s	meters per second
m^3	cubic meters
mm	millimeter
MW	megawatt (1 MW = 1,000 kW)
MWh	megawatt hour
MT	million tons
toe	tons of oil equivalent
yr	year
t	ton
W	Watt
Wp	Watt-peak
°C	degree Celsius
€	Euro (1 Euro = 4,233.01 Le)

SUMMARY

The Country Study of Sierra Leone is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Sierra Leone. The study is structured as follows:

Chapter one provides **Background Information on Sierra Leone.** This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Sierra Leone.

Chapter two summarizes facts and figures of **Sierra Leone's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Sierra Leone. This includes an overview of support mechanisms for RE technologies as well as other already existing regulations, incentives and legislative framework conditions.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Sierra Leone.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Sierra Leone.

1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Sierra Leone is a tropical country that stretches along the West coast of Africa between latitudes 7° North and 10° North, and longitudes 13°30' West and 10°30' West. It has a total surface area of 72,000 km² (≈ 28,000 square miles). Its borders are the Atlantic Ocean with a coastline of approximately 340 km (≈ 210 miles) in the West, Guinea in the North West and East and Liberia in the South East.

For administrative purposes, the country is divided into three Provinces (Northern Province, Southern Province and Eastern Province) and one Area (Western Area that houses the capital city of Freetown). The Provinces are further divided into twelve districts. The western area is divided into the Western Rural District and the Western Urban District. The Western Rural District consists of the following wards: Koya, Mountain rural, Waterloo and York rural, while the Western Urban consists of Central 1 and 2, East 1, 2 and 3 and West 1, 2 and 3.

FIGURE1:
Map of Sierra Leone

The climate of Sierra Leone is tropical with constantly high temperatures and marked wet and dry seasons. The daily average temperature varies but little throughout the year. The lowest average temperatures occur in the mid-wet seasonal months of July and August with thickest cloud cover. The highest temperatures occur in March and April when insulation is high and cloud cover low. Sierra Leone's mean temperature throughout the year is about 27°C. The country has a fairly high rainfall; it records an average of about 2,950 mm of rainfall in 2003 making it one of the wettest countries in West Africa.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

The Republic of Sierra Leone was a former British colony that gained its independence in April 1961. It is a multi-party democratic sovereign state that has just got over a ten-year rebel conflict, which devastated the country's physical and social infrastructures. According to the 1991 constitution, the three arms of the Government are the Executive, the Parliament, and the Judicial. The current president is Dr. Ernest Bai Koroma (as to 2009). He is the leader of the All People's Congress (APC), which is the dominant political party in the country.

For over two decades, the institution of local governments was on hold. In 2004, however, local governance was once again reinstated through an Act of Parliament. 19 Local Councils (LCs) were established, covering all districts and town centers in Sierra Leone, including the capital of Freetown. According to section 20 (1) of the Act, the LCs are the highest political authority in their localities. They have legislative and executive power to be exercised in accordance with the Act or any other enactment. The LCs are responsible for promoting the development of their localities and the welfare of the people and are entitled to use any resources at their disposal including resources and capacities they can obtain from the central government and its agencies, national and international organizations and the private sector.

The LCs are financed through revenue collections of their own, by central Government grants for devolved functions and by transfers for services delegated from Government ministries. In terms of political stability, civil liberties, and political rights, Sierra Leone is now comparable to the average of the West African region. According to the 2004 census, the current population of Sierra Leone is 5,473,530 million with a growth rate of about 2.6 %. Women account for about 51 % of the population. The population is youthful; those in the age range of 15–64 years account for about 52 %. Over the years, the urban population has increased at a faster rate than the rural, largely due to rural neglect and the civil conflict. However, at least 65 % of the population still live in rural areas and are mostly engaged in agricultural, mining and other non-farm activities.

Table 1 shows the projected national population. The country's population is expected to reach about 6.5 million by 2015. Future percentage of the rural population is envisaged to decrease over the years due to migration to the urban areas for better life.

TABLE 1
Projected Demographic Indicators for Sierra Leone (2006–2016)

INDICATOR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Population (x 1000)	5,217	5,343	5,474	5,610	5,747	5,189	6,038	6,190	6,348	6,506

Source: SSL, as of 2005

Though the country is endowed with substantial mineral resources – diamonds, rutile, bauxite, gold and iron ore as well as rich agricultural and marine resources (which are the major sources of its export earnings) – it is one of the least developed countries in the world. This is largely due to the undeveloped economic and social infrastructures, serious social disorders and the ten-year civil conflict that continues to hinder economic activities. As stated in the CIA World Fact Book 2008[1], the 2007 estimations show the country's low level of social development: life expectancy is only 43 years, infant mortality is 15.6 %, about 64 % of those over 15 years are illiterate and about 93 % of the population have no access to electricity.

Sierra Leone's economy is predominated by agriculture, followed by the service sector and industry. Agriculture accounts for about 45 % of the Gross Domestic Product (GDP) (see Fig 2), 61 % of employment and 12 % of export earnings. The service sector constitutes about 35 % of the GDP while industry accounts for about 8 %. Before the civil conflict in 1991, mining was the second most important economic activity in the country, accounting for about 10 % of GDP, 14 % of total employment and 85 % of exports. Currently, alluvial and kimberlite diamond mining are the major sources of hard currency earnings. Manufacturing consists mainly of the processing of raw materials and of light manufacturing for the domestic market.

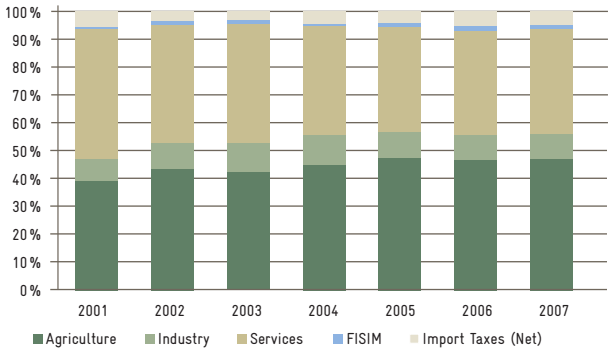
Figure 3 shows the nation's GDP at constant market prices in 2001 and inflation from 2001–2007. The average growth rate (year-to-year) of the GDP is over 10 %. There was a steady increase in the economy over the period under consideration. Inflation in 2004 was the highest, equaling about 14 %, while the current inflation rate is about 8 %. The high inflation rates adversely affect the poor (representing the majority of people) by reducing their purchasing power.

Sierra Leone is a poor African country with tremendous inequality in income distribution. According to the 2007/2008 Human Development Report[2], the country ranked 177 out of 177 with a Human Development Index (HDI) of 0.336 and a GDP per capita of 806 USD based on purchasing power parity.

The GINI index[3] reveals the wide gap between the rich and the poor in Sierra Leone. Table 2 illustrates the levels of poverty in Freetown, rural areas, other urban areas and on the national level. On the national level, about 26 % of the population are poor in food meaning that they cannot afford adequate daily nutrition. When non-food basic needs are also taken into account, the total rate of poor people rises to about 70 %.

FIGURE 2

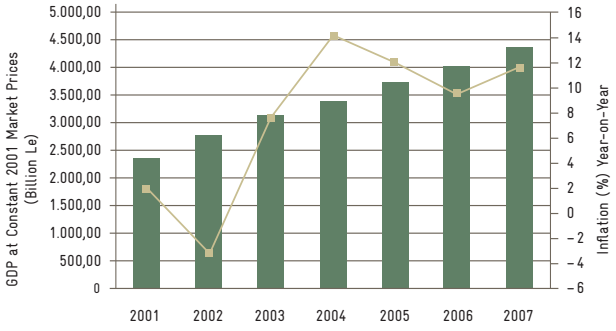
Sectoral Composition of GDP



Source: Bank of Sierra Leone, as of 2001–2007

FIGURE 3

GDP and Inflation (2001–2007)



Source: Bank of Sierra Leone, as of 2008

TABLE 2

Incidence, Depth and Severity of Poverty by Area

AREAS	SHARE OF SAMPLE (%)	FOOD POOR (%)	TOTAL POOR P0 (%)	POVERTY GAP INDEX P1 (%)	POVERTY SEVERITY INDEX P2 (%)	PROPORTION OF SIERRA LEONE'S POOR (%)	INCOME GAP RATIO (P1/P0)
Freetown	10.4	2.0	15.0	4.0	4.0	2.2	27.0
Rural areas	64.4	33.0	79.0	34.0	19.0	72.8	43.0
Other urban areas	25.1	20.0	70.0	26.0	14.0	25.1	37.0
National	100.0	26.0	70.0	29.0	16.0	100.0	41.0

Source: Sierra Leone PRSP, as of 2005

1 CIA, 2008

2 UNDP, 2007/2008

3 THE GINI COEFFICIENT IS A MEASURE OF STATISTICAL DISPERSION DEVELOPED BY THE ITALIAN STATISTICIAN CORRADO GINI AND PUBLISHED IN HIS 1912 PAPER „VARIABILITY AND MUTABILITY". IT IS COMMONLY USED AS A MEASURE OF INEQUALITY OF INCOME OR WEALTH.

2 ENERGY MARKET IN SIERRA LEONE

2.1 OVERVIEW OF THE ENERGY SITUATION

Over the last 20 years, the supply of electricity has steadily decreased in Sierra Leone. During the civil war, most of the production units and distribution infrastructure were destroyed. Sierra Leone is slowly emerging from the protracted civil war, yet the rebuilding of energy infrastructure takes more time than expected.

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The electricity industry consists of the Western Area grid centered in Freetown and the provincial systems. The provincial systems originally consisted of 12 isolated systems located in the headquarter towns. Due to the destruction during the civil conflict, all systems are beyond sensible economic repair except for the Bo-Kenema Power Services (BKPS) system. In general, the country's power systems are operated by the National Power Authority (NPA) and BKPS.

In 2007, the electricity generation in Freetown was very unsatisfactory; it declined continuously and the available generating capacity by the end of the year was about 6 MW. As a result of the low available generating capacity, the electricity market was opened to the private sector. Therefore, the Government of Sierra Leone (GoSL) engaged two Independent Power Providers: the Global Trading Group (GTG) for the provision of 15 MW at Kingtom for one year (December 2007 to December 2008) and the Income Electrix Limited (IEL) for the provision of a total of 25 MW to be installed at Blackhall Road and other locations in Freetown to salvage the electricity supply crisis.

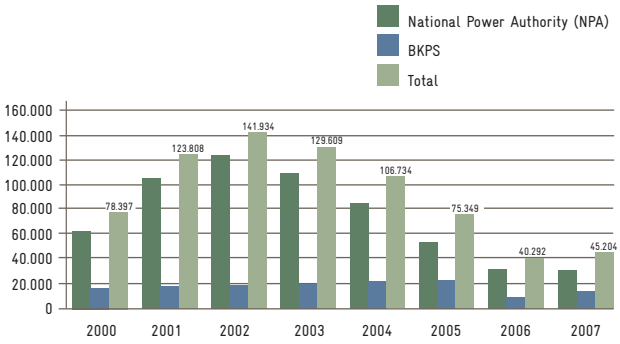
Between 1960 and 1995, the country's total installed and operating electricity generating capacity was about 42 MW with 13 power stations located all over the country using diesel engine generator units. Owing to the poor performance and the civil conflict, almost all the provincial thermal plants (except for Bonthe and Moyamba) have either deteriorated beyond sensible economic repair or have been completely destroyed. The current total installed capacity excluding auto-producers (from the mining, industrial and commercial sector) is about 41 MW with 33.14 MW in Freetown and the original capacities in Bo and Moyamba.

The national electricity production (by NPA and BKPS) between 2000 and 2007 was not satisfactory (see Figure 4). It peaked in 2002 with an annual generation of 142 GWh and drastically declined to 40 GWh in 2006 and 45 GWh in 2007. The peak generation in 2002 was due to the change in the NPA management in 2000 and the increased generating capacity (3 x 1.28 MW Caterpillar generating sets and the 6.3 MW Mirrless generating set). In 2003, another management was instituted, and due to its poor management there was a continuous decline in electricity generation between 2003 and 2007. Within this period, the use of imported petrol/diesel generators became the only alternative for households as well as private and public sector businesses. The estimated national private generation is in the order of 80 MW. The insecurity of power supply coupled with the inadequate distribution capacity of the NPA has forced most businesses to rely on an energy generation of their own in spite of its high costs. This has led to high production costs, which, among other reasons, has limited the competitiveness and growth of the manufacturing sector.

Figure 5 shows the electricity consumption pattern by the various sectors. The total consumption is less than the energy produced due to the high system losses, which are estimated at 30–38 %. In 2000, the per capita electrical energy consumption was 17 kWh. This increased to 30 kWh in 2002 and fell gradually to 7.7 kWh in 2006.This is far from being satisfactory, especially when compared to Ghana that had a per capita consumption of approximately 420 kWh in 2006.

FIGURE 4

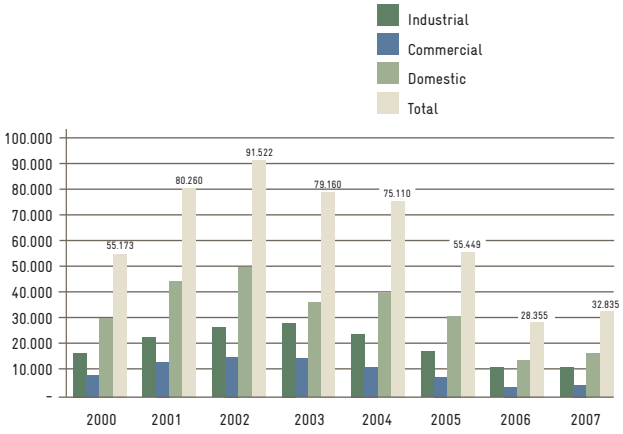
National Electricity Production (MWh; 2000–2007)



Source: National Power Authority (NPA) & Bo-Kenema Power Services (BKPS), as of 2008

FIGURE 5

Electricity Consumption Pattern by Sector



Source: NPA & BKPS, as of 2008

The electricity tariffs over the years 1996–2005 are given in Table 3 with the corresponding dollar exchange rates (as of 2000–2007) depicted in Table 4. Up to 2000 there was a difference in tariffs between state-run and private institutions. Presently there is no such distinction. The utility serves about 45,000 customers in the Western Area and about 10,000 in the BKPS region. The overall consumer base in Sierra Leone is about 7 % with the provincial towns and rural areas accounting for between 2–3 %. Due to the under-performance

of the NPA, the sale of imported generators[6] has become a very vibrant business in the country. The general cost is around 300 USD/kVA depending on the brand. There is a cheap brand of generators producing at a cost of about 100 USD/kVA, which has become very popular especially for consumers with essential needs on the low load level, such as for lighting.

There are a number of auto producers meeting their own demand. They include the mining companies, industrial, commercial and domestic consumers who continue to be customers of the NPA and BKPS. It is estimated that their self-generation capacity is over 40 MW.

TABLE 3

Electricity Tariffs (1996–2005)

TARIFF STRUCTURE	ENERGY CONSUMPTION LEVELS (UNITS[7])	ENERGY CHARGE (LE/KWH)				
		1996	1998	2000	2003	2005
Tariff 1	Domestic					
	0–30	90	117	205	287	373
	31–150	110	143	293	410	533
	Above 150	130	169	389	545	709
	Min. charge	2,500	3,250	6,143	8,600	11,180
Tariff 2	Non-domestic (commercial)					
	0–30	100	130	358	501	651
	31–150	120	156	429	601	781
	Above 150	130	169	465	651	846
	Min. charge	3,000	3,900	10,725	15,015	19,520
Tariff 3	State-run institutions					
	All units	100	130	429	601	781
	Min. charge	5,000	2,600	17,875	25,025	32,533
Tariff 3A	Others					
	All units	120	156			
	Min. charge	5,000	6,500			
Tariff 4	Industry					
	All units	150	195	517	724	941
	Min. charge	50,000	65,000	65,000	91,000	118,300
Tariff 5	Street lighting					
	All units	120	156	435	609	792
	Min. charge	7,500	9,750	796	20,475	26,618
Tariff 6	Temporary supplies					
	All units	200	260	-	700	910
	Min. charge	5,000	6,500	-	8,680	11,284
Tariff 7	Welders					
	All units	200	260	546	764	993
	Min. charge	10,000	13,000	19,500	27,300	35,490

Source: National Power Authority (NPA), as of 2006[8]

6 THESE GENERATORS ARE IMPORTED MAINLY FROM DUBAI AND EUROPEAN COUNTRIES.

7 THE UNIT OF ENERGY CONSUMED EQUALS 1 KWH.

8 1 EURO = 4,23301 LE

Petroleum Sector

Petroleum products (petrol, diesel and Marine Fuel Oil (MFO)) consumed in the country are imported in refined form. The annual average volume of imported petroleum products is about 200,000 metric tons, but this figure declined significantly during and after the war. Table 4 shows the volumes imported between 2000 and 2007.

The petroleum marketing and sales in the country are executed by Petro Leone, Sierra Leone National Petroleum Company (NP), Safecon, Total (formerly Mobil) and Leonoil. Though all companies import petroleum products, Petro Leone is the main importer and provider. Among the other four companies, NP dominates the market with 50 %, followed by Safecon (24 %), Total (23.5 %) and Leonoil (2.5 %). Prices for petroleum products are fixed due to an agreement that takes into consideration the trade price and the exchange rate (see Table 5). Allowances are made for various levies and distribution costs. The prices of the above mentioned petroleum products in the provinces vary due to varying transport distances from Freetown to the final destination. Due to the world market, the price of petrol, diesel and kerosene fluctuated between 14,000 Le and 16,500.00 Le (1 Euro = 4,233.01 Le) in 2008.

The industry is faced with a number of problems. Storage capacity is limited and this prevents huge quantities to be imported at any one given time. Also, foreign exchange is often not readily available and this has a far-reaching effect. The petroleum products are mainly imported from Côte d'Ivoire (Abidjan). Therefore, the oil companies experience some supply difficulties due to the unavailability of the products in Abidjan and bottlenecks in allocation or chartering of vessels. The procedures for procurement and delivery of products often cause long delays and unreliable supplies.

TABLE 4

Volumes of Petroleum Products Imported in Sierra Leone (2000–2007)

YEAR	PETROL (MT)	DIESEL (MT)	KEROSENE (MT)	JET A1 (MT)	MFO (MT)	NAPHTA (MT)	TOTAL (MT)
2000	29,874	39,561	39,981	-	15,607	-	125,023
2001	28,370	31,540	35,701	-	26,824	-	122,435
2002	36,524	49,462	54,786	-	26,433	-	167,205
2003	47,498	59,203	56,009	-	26,988	-	189,698
2004	54,880	68,663	21,480	31,132	34,432	-	210,587
2005	54,105	177,931	16,740	16,347	18,768	-	283,891
2006	59,317	160,902	14,503	13,586	18,825	3,524	270,657
2007	49,792	128,597	9,956	11,675	8,799	-	208,820

Source: Petroleum Unit–Sierra Leone, as of 2008

TABLE 5

Petroleum Product Pricing Formula (31st March 2005)

PRICE COMPONENT	PETROL	DIESEL	KEROSENE	MFO
Product Import–Platt FOB/USD/MT	512.92	449.93	535.23	237.77
Freight/USD/MT	33.26	40.00	30.00	35.00
C & F (Freetown)/USD/MT	546.18	489.93	565.23	272.77
Import duty 5 % C & F	27.31	24.50	28.26	13.64
Storage	4.70	4.70	4.70	4.70
Port charges	3.00	3.00	3.00	3.00
Demurrage	2.00	2.00	2.00	2.00
Freight levy	2.00	2.00	2.00	2.00
Other charges (transfer, agency fees etc.)	5.68	4.96	5.51	3.07
Landed cost–USD/MT	590.87	531.09	610.70	301.18
Conversion IG/MT	300.00	256.00	275.00	236.00
Landed cost–USD/IG	1.97	2.07	2.22	1.28
Exchange rate adjustment–Le/USD	2,950.00	2,950.00	2,950.00	2,950.00
Landed cost Le/IG	5,810.20	6,119.94	6,551.11	3,764.73
Distribution cost	1,311.63	1,217.70	1,358.85	596.33
Petroleum fund	15.00	15.00	15.00	–
Excise duty	1,613.17	1,397.36	575.04	238.98
Road user charge	750.00	750.00	–	–
Pump Price Le/IG (Freetown)	9,500.00	9,500.00	8,500.00	4,600.04

Source: Petroleum Unit–Sierra Leone, 2006

Liquified Petroleum Gas

This type of fuel is very important from an environmental point of view to phase out the production and use of wood and charcoal, but its use and hence its market is very small. Table 6 shows an estimate of the share of each energy source in household consumption. The percentage use of Liquefied Petroleum Gas (LPG) and electricity for cooking is almost negligible. The use of LPG in the near future will be zero if no policies are put in place to encourage its use. The LPG market is not well organized; individuals with the United Mission in Sierra Leone (UNAMSIL) import this energy source from neighboring countries. The National Petroleum Company and Shell did use to import LPG, but have almost stopped because of problems with availability, cost and the size of its market.

Table 7 shows the current prices for LPG in Freetown and in the provinces. LPG is sold in metal containers of different sizes. Affluent households, some hotels and restaurants and the marine industry use this energy source for cooking and heating.

Biomass Sector

Biomass has been a source of energy for centuries. Due to the recent increase of oil prices in the world market, bioenergy (in form of biofuels) has been seen as an alternative to deal with the oil supply constraint. Though it plays an important role in reducing greenhouse gas emission, the negative direct and indirect effects such as soil degradation, biodiversity loss, stress on water resources, trade-off with food supply etc. demand great attention. As far as Sierra Leone is concerned, little or almost nothing so far has been done in the direction of biofuel as an alternative to petroleum.

Fuel wood is the most widely used fuel in the country and is the most commonly used fuel for cooking and heating. Most households in the provinc es collect fuel wood from shrubs and forests, although a significant percentage (about 90 % of households in Freetown) have to buy it. According to Conteh (1997), 7,868 tons per annum of fuel wood reach Freetown (see Table 8). Charcoal and kerosene are also widely used, though far less than fuel wood.

The retail prices of fuel wood and charcoal vary throughout the country and according to the two seasons (meaning higher prices during rainy season). Fuel wood is sold in bundles with an average mass of 4 kg and charcoal is sold in 50 kg bags. In 2008, town prices of fuel wood ranged between 250–400 Le while farm gate and road prices range between 150–250 Le. Charcoal prices range between 11,000–15,000 Le in Freetown and other regions, roadside prices range between 6,000–8,000 Le.

TABLE 6

Petroleum Product Pricing Formula (31st March 2005)

FUEL WOOD	CHARCOAL	KEROSENE	LPG	ELECTRICITY
92.0 %	4.8 %	2.7 %	0.1 %	0.4 %

Source: National Energy Policy for Sierra Leone (final draft as of May 2004)

TABLE 7

LPG Prices for Different Containers

BOTTLE SIZE (LB)	4.41	14	28	33	50	86	120
PRICE (LE)	10,240	32,500	65,000	76,600	116,000	199,650	278,500

Source: market survey compiled by the author (as of 2004)[9]

TABLE 8

Estimations of Wood Products Consumption (1996–2002)

	1996	1997	1998	1999	2000	2001	2002
Fuel wood charcoal (m^3)	2,450,860	2,507,475	2,565,398	2,624,658	2,685,288	2,747,318	2,810,781
Fuel wood (m^3)	1,942,191	1,987,056	2,032,957	2,079,914	2,127,964	2,177,120	2,227,412
Wood for charcoal (m^3)	4,069,352	4,163,352	4,259,528	4,357,920	4,458,592	4,561,584	4,666,952
Charcoal (MT)	508,669	520,419	532,441	544,740	557,324	570,198	583,369

Source: Redwood-Sawyerr and Conteh, as of 2005

9 1EURO = 4,23301 LE, AS OF 2004; 5,66560, AS OF 2009

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The **Ministry of Energy and Power (MEP)** is the governmental authority responsible for the electricity and water sectors. Its mandate includes sector policy formulation, planning and coordination. Besides the electricity sub-sector, various other sub-sectors of the wider energy sector of the Sierra Leonean economy fall within the scope of responsibilities of various ministries. The MEP handles matters related to electric power supply, including hydroelectric schemes and, nominally, RE matters related to solar and wind energy. The **Ministry of Agriculture and Food Security (MAFS)** handles biomass issues (plant- and animal-derived matter), especially fuel wood. Petroleum marketing and sales are handled by the **Ministry of Trade and Industry (MTI)**; the **Ministry of Finance (MF)** also plays a significant role in the import and storage of petroleum products. Petroleum exploration and extraction is within the scope of responsibilities of a Presidential Petroleum Commission. The **Ministry of Mineral Resources (MMR)** deals with extraction of minerals, including energy related minerals.

It is interesting to note that the devolved functions of each ministry are listed in the 2004 Local Government Regulations. Only the rural water supply and community ownership of wells, bulk supply of water (except where privatized) and sanitation, however, are listed, however, for the MEP. There is no specific mention of energy and electricity provision for the local communities under the councils. This may, however, be subsumed under development issues counting as one the functions of the LCs.

Electricity Sector

The electricity industry in Sierra Leone is state owned and vertically integrated. It is operated by the NPA and the BKPS. The National Power Authority Act of 1982 established the NPA as the entity with the sole responsibility for carrying out power generation (including Hydro Power), transmission, distribution and supply in the country. The 2005 NPA (Amendment) Act stipulated additional governance duties for NPA.

BKPS was established in 1991 as a semi-autonomous body. It resulted from an agreement between the Danish International Development Agency (DANIDA), the GoSL and the NPA to operate with a certain degree of autonomy. It was formed as a result of an NPA Board decision and was subsequently established as an entity with its own Articles of Association. Formally, the BKPS is not an operating division of the NPA, but reports to the NPA Board through its Steering Committee.

The NPA is the sole supplier of electricity in the country. The BKPS, which is a semi-autonomous division of NPA, is responsible for the integrated supply of electricity for the townships of Bo and Kenema and their environs. The main legislative arrangements for the electricity sector are contained in the National Power Authority Act of 1982 and the National Power Authority (Amendment) Act of 2005.

The MEP is responsible for the entire electricity sector. This Ministry was created in 1974 for establishing and implementing the state policy for electricity and other energy related sub-sectors. Therefore, up until 2002, the electricity industry was sector regulated through the MEP. In 2002, the National Commission for Privatization (NCP) was created through an Act of Parliament. Its function, among others, is the privatization and reform of public enterprises with the NPA being part of the first schedule of public enterprises for divestiture. Therefore, operational oversight of NPA is now provided by a Board, which reports directly to the NCP in preparation for Private Sector Participation (PSP).

Though the ownership and supervisory role of the MEP for the NPA have been repealed and vested in the NCP, the MEP retains the overall responsibility for policy formulation, planning and coordination in the respect of the development and utilization of the country's energy resources. Currently, the lack of appropriate staff in the ministry is a major barrier in view of policy-making, planning, control and coordination.

The Project Implementation Unit (PIU) for the Bumbuna Hydroelectric Project (BHEP) reports to the MEP. The 1982 NPA Act defines the NPA's responsibilities and rights with respect to the development of hydroprojects in the country. The NPA forms part of the Steering Committee which supervises the PIU, it is, however, questionable if all duties can actually be performed.

Petroleum Sector

The Petroleum Unit (PU) was set up in June 1992 under GoSL's comprehensive Structural Adjustment Program for Macroeconomic Stabilization. This unit was meant to function as an independent coordinator between the GoSL, donor institutions and the petroleum industry in and outside of Sierra Leone. The PU is supervised by the MTI in close collaboration with the MF. The PU has been given a new mandate to serve as industry regulator/coordinator.

The petroleum exploration and production sector is regulated by the Petroleum Exploration and the Protection Act of 2001[10]. This act provides for the establishment of the Petroleum Resources Unit, which is under the authority of the President and headed by a general manager. This unit as the main administrative body was established to represent the state exclusively in negotiations with interested parties for the exploration, development or production of petroleum, to act on behalf of the state in petroleum agreements and to regulate the petroleum industry in Sierra Leone.

Biomass Sector

As to the supply of firewood to households in the country, no governance and/or regulatory authority exist to oversee the suppliers' activities. Producers and sellers of charcoal in the Western Area partially belong to the Coal Producers and Sellers Union, headquartered at Waterloo Street in the capital of Freetown. The union is registered with the Forestry Division of the MAFS. The Union is headed by a chairman, other members of the executive being the vice chairman, financial secretary, and secretary general. Membership in the Union is open to all coal producers and sellers for a minimal fee. The union pays annual taxes and dues to the Government.

10 LEXADIN/ THE WORLD LAW GUIDE, 2009

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

There used to be no policy instruments to address specific energy issues in Sierra Leone. Therefore, the United Nations Economic Commission for Africa (UNECA) provided funding to the GoSL in the first quarter of 2004 for a study leading to the formulation of a national energy policy for the country.

CEMMATS, a local consultancy firm, was contracted to carry out an overview study. Based on an assessment of the existing institutional framework as well as energy demand and supply patterns, a document draft entitled "The Energy Policy for Sierra Leone" containing policy statements on specific energy issues was produced. This document was presented for validation in a consultative session of stakeholders from 29–30 June 2004. It was also presented to the MEP, but up till now this document has not been ratified by the Parliament and thus established as a working document. As defined in the energy policy draft document, the main policy target for electricity is to provide access for 35 % of the population by 2015. Hence, no contribution of Renewable Energy to electricity was mentioned.

The following policy statements, however, relate to the promotion of RE:

- Appropriate financial and administrative institutions will be set up to manage RE
- Consideration of tax reductions and incentives for RE equipment
- Manufacturing of RE equipment to actively encourage promotion and provision of investments
- Facilitation of adequate financing schemes for RE technologies by establishing sustainable financing mechanisms to make them more accessible
- Ensuring that RE producers and importers ascribe to certified performance and technical standards
- Encouragement of solar water heating in hospitals, clinics, boarding homes etc. for sterilization and hygiene purposes
- Taking measures to allay the fear of using solar cookers in rural areas because of cultural and traditional practices
- Encouragement of co-operatives and energy service companies in order to facilitate the financing mechanism for sustainable and transparent RETs
- Establishment of appropriate norms, codes of practice, guidelines and standards for RE thus creating an enabling environment for sustainable development
- Encouragement of local manufacturing of RE generator systems

According to the Sierra Leone first Poverty Reduction Strategy Paper (PRSP) for 2005–2007[11], the Government's objective in the energy sector was to expand the population's access to reliable modern energy services while improving supply reliability. In this regard, the planned strategy was to encourage both public and private investments, to promote an energy mix with focus on RE resources and to improve the supply and demand management of traditional fuels.

Owing to the pronouncement of His Excellency the President, electricity is the topmost priority of his Government aiming to restore electricity in the country. Thus, apart from other existing projects, the current thinking of the MEP for rural electrification is to exploit the country's small hydro potential.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Between 2006 and 2007, a number of offers by foreign private investors were made to the Government. A Memorandum of Understanding (MoU) was signed for some of these offers. Below is a list of some renewable energy related offers made to the Ministry:

- Elsfield Energy (Elsfield Holdings Ltd.), 28 Felipe Road Chafford Hundred Grays Essex, UK
- ENERGEON Inc., 2078 Willowbar Ct., Gold River, CA 95670, USA, by Prof. Balchandra, California: biomass power plant (medium- to long-term) of 100–500 MW capacity (biomass – such as tree branches, agricultural residues, municipal solid waste)
- Waste to Energy (energy production using residues) by Alternative Use plc
- 5.0 MW solar system of electricity generation by NAANOVO Energy Inc. (through Chief Gbondo)
- Biomass (Waste to Energy) project by Cinergex Solutions Ltd. (through David Donkor)
- Bikongo hydro project

None of the listed projects have been realized so far, while the energy situation (electricity in particular) has deteriorated drastically. Table 9 shows the current installed and available capacity of the generators at the Kingtom Power Station (KPS) in Freetown and their status. The rest of the country is almost completely without electricity except the Bo-Kenema region, where there is a mix of hydro and thermal plants.

Owing to the deplorable electricity situation towards the end of 2007, the current President – on assumption of office and in his first speech at the opening of Parliament – declared: "The utmost priority of my Government is the speedy provision of electricity supply." Hence, to actualize the presidential declaration, a presidential Energy Emergency Taskforce was created in order to develop a Strategic Plan/Road Map to address the energy crisis. This strategic plan is still being worked on. Due to the status of electricity in the country, the main policy goals of the MEP and the respective strategies are depicted below. The main objective is to encourage both public and private sector investments in the energy sector and to promote energy security through the encouragement of the sustainable exploitation of Sierra Leone's indigenous energy resources with focus on RE resources. The target areas to improve the current electricity supply are the Western Area and the provincial headquarter towns.

11 SIERRA LEONE PRSP, 2005-2007

TABLE 9

Installed and Available Generating Capacities at Kingtom Power Station–Freetown

GENERATOR	INSTALLED CAPACITY [MW]	AVAILABLE CAPACITY [MW]	REMARKS
Sulzer 4	9.2	-	Unavailable due to burnt alternator
Sulzer 5	9.2	7.5	Available
Mitsubishi	5.0	-	Unavailable due to crankshaft problem
Mirrlees 2	6.9	-	Unavailable due to cracks of cylinder heads
Mirrlees 3	6.3	-	Unavailable due to burst engine block
Caterpillar 1	1.28	-	Unavailable due to burst engine lock
Caterpillar 2	1.28	0.8	Available. Requires spare parts for overhauling as it has gone beyond the scheduled 9,000 hrs
Total	39.16	8.3	

Source: Ministry of Energy and Power, as of 2007

In order to deal with the declining power generation in Freetown (Western Area) towards the end of 2007, the Government engaged two Independent Power Producers (IPP): the Global Trading Group (GTG) and the Income Electrix Limited (IEL) for the provision of 15 MW and 25 MW respectively to salvage the electricity supply crisis. Currently, there is a slight improvement in the electricity supply in Freetown. In Addition to the emergency measures mentioned above, there are other projects in the pipeline for the improvement of electricity supply in Freetown. These are as follows:

- The repair of the Sulzer 4 (burnt alternator) and Mitsubishi (crankshaft problem) generators
- The implementation of the Arab Bank for Economic Development in Africa (BADEA) and the Saudi Development Fund (SDF) project for the installation of two 8.75 MW diesel generating units
- The implementation of the Japan International Cooperation Agency (JICA) project for the supply and installation of two 5 MW generating sets at the Kingtom Power Station with an expected commissioning by mid 2009

It is hoped that the completion of the Bumbuna hydroelectric project phase I (50 MW) will suffice for the supply of the Western Area and parts of the Northern Province. With the start of the Bumbuna hydroelectric project and the implementation of the other projects mentioned above, the available generating capacity is estimated at about 80 MW by 2010. The main challenge to receive and utilize such power is to install a transmission and distribution network. The current transport capacity of the network in Freetown is about 30 MW, but losses in the system are extremely high due to its age. Projects that are in progress for the expansion of the network are the Sierra Leone Power & Water Project (cr. 3945 – SL), the upgrading of the T&D network – 33 kV line as well as the construction of a sub-station at Regent by JICA with a 33 kV line from primary substation of Wilberforce toRegent and a 11 kV line from Kingtom Power Station to -Congo Cross Primary Substation and from there to Wilberforce. The Agency will also provide material for the 11 kV link between Falconbridge and Blackhall Road.

After the implementation of these projects, the transport capacity of the network will be strongly enhanced. Increased generation capacity in the Bo-Kenema region is the objective of the expansion of the Dodo Dam (Goma Hydro Power Station) and the repair of the thermal plant in Bo. Though the dam was upgraded from 4 MW to 6 MW by the Government of Sierra Leone in 2007, there is still room for a further upgrading of up to 12 MW. There are three generators with a total capacity of 5 MW installed at the Bo power station. Only one of them is functional with an available capacity of 0.7 MW. There is no further generation from the Bo power station due to lack of spares and fuel. Almost all other provincial electricity infrastructures are either in a state of disrepair or in an unsatisfactory state. Few towns, as for example Moyamba, Pujehun, Makeni, Bonthe, Koidu and Kabala, have rudimental, yet incomplete electricity infrastructure. Other towns, e.g. Kambia, Rokupr, Port Loko, Lunsar, Njala and Kailahun, have no electricity infrastructure at all. In order to address the supply of electricity in the provinces, the following strategic actions are being implemented:

- Connect towns along the Bumbuna transmission line (i.e. Magburaka, Makeni, Lunsar, Portloko and Masiaka) with the existing network
- Exploit the country's hydro potential with particular emphasis on small and mini hydro projects
- Explore the possibilities of alternative energy sources for power generation by engaging potential investors (IPPs) for biomass power, wind power and solar power
- Set up pilot/demonstration solar energy plants (Solar Home Systems – SHS) in selected rural areas

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The biomass resources comprise residues from existing forests and deforested or otherwise degraded lands on which so-called energy plantations can be cultivated. Of the residues, 656,400 tons of crop waste (rice husk, rice straw, cocoa husk etc.) are being produced annually, with a total annual energy potential of 2,706 GWh. Table 10 provides an overview of estimated biomass production figures.

It should be noted that the 2,706 GWh per year energy potential of crop residues (as calculated for 1996) correspond to the nation's highest generation of electricity of 142 GWh per year in fiscal 2002. This gives an indication of the potential of a single biomass resource (e.g. crop residues) to adequately satisfy the country's basic demand for electricity, which, assuming an average per capita requirement for basic human needs of 100 W, would turn out to be 4,800 GWh per year for a population of 5 million people using the power 24 hours a day throughout the year. Of the existing forests in Sierra Leone, the estimated incremental growth is between 770 and 1,500 m^3 per year for closed high forests, 260 m^3 per year for secondary forests and between 7,700 and 11,000 m^3 per year for forest re-growth. Savannah woodland, coastal woodland and plantations account for the rest of the estimated 9,260–15,010 m^3 of wood obtained from the forested area of the country (i.e., 730–2,250 m^3 per year). Leaving out high and secondary forests, the rest of the forest types mentioned above can provide feedstock to biomass conversion technologies. Removal of the forest overgrowth in particular can increase the yields of the remaining high-quality wood. Deforestation in the country is estimated at 3,000 hectares per year. Deforested land can, however, be restored to productive use through the cultivation of energy crops. These energy plantations can also be established on the available savannah and coastal woodlands. It should be noted that for all three biomass resources mentioned in the foregoing (residues, existing forests and deforested or otherwise desolated land), an exhaustive quantitative assessment is a prerequisite to ensure an accurate overall assessment of their energy potential and a sustainable form of cultivation/forestation. Fuel wood and charcoal are the major renewable biomass energy forms used in Sierra Leone's households for cooking. About 87 % of the total energy demand in Sierra Leone are met by traditional energy resources. At the current deforestation rate and with 65 % of the population living in the rural areas, the harvesting of these traditional fuels can lead to serious environmental degradation entailing harmful health effects and other serious social impacts.

4.2 SOLAR ENERGY

The country experiences sunshine for most part of the year hence solar energy is available in abundance. A recent study estimated the average solar radiation at 1,460 to 1,800 kWh/m^2/y, which points out the huge potential for solar power of the country. These data need revision since calculations were made from temperature and humidity measurements carried out at only eight different sites across the country in 1996. The potential and economic feasibility of photovoltaic (PV) electricity generating costs needs to be further explored. Table 11 indicates figures before the civil war in Sierra Leone; now however, most of these PV installations are stolen or destroyed. Less than a quarter of these figures is based on information from the remote sites. The potential of redesigned installations can be estimated at a total power output of 20.1 kW and more – considering that currently diesel generators are being used to power some of the stations instead of PV facilities.

Exemplary solar lighting systems were presented in 4 hinterland villages by the Competence Centre for Renewable Energy at Allen Town, Freetown. The most recent solar power facility installed by Prof. J.A.S. Redwood-Sawyerr, Deputy Vice Chancellor of the University of Sierra Leone, at Tombo Village was commissioned by the Minister of Energy and Power, Haja Afsatu E. O. Kabba. Before the civil war, PV was used extensively in the telecommunication industry at repeater stations. Currently, repeater stations and cell sites are using diesel generators. Few SHS are used for lighting and entertainment, and one institution is using it for water pumping. The current installed capacity of solar PV in the country is about 25 kW with 60–80 % of this capacity being installed by the RCD Solar Company. It provides 120 W/4 kW solar systems for hospitals, secondary schools, domestic and commercial use. Significant work has also been done by the Environmental Foundation for Africa (EFA)[12].

TABLE 10

Estimation of Annual Biomass Production

	WASTE PRODUCED (1000 T/YR)	TOTAL ENERGY POTENTIAL (GWH/YR)
Rice husk	181.0	640
Rice straw	210.0	788
Cocoa husk	8.7	34
Coffee husk	30.5	130
Peanut shell	10.1	43
Palm kernel shell	75.9	346
Palm fruit fiber	47.5	306
Woody remains of palm fruit bunches	72.5	367
Bagasse	20.2	52
Total	656.4	2,706

Source: Swaray S.M and Keili A, as of August 2004

TABLE 11

PV Installations in Sierra Leone

APPLICATIONS	INSTALLATIONS	CAPACITY (KW)	OPERATING HOURS
Telecommunications only	38	13.36	24
Telecommunications and lighting	4	6.24	24
Lighting only	19	0.9	12
Lighting and refrigeration	3	1.2	24
Refrigeration only	10	2.0	24
Miscellaneous	7	1.5	-
Total	81	25.2	108

Source: Redwood-Sawyerr and Sillah, as of 1999

12 EFA, AS OF 2009

4.3 WIND POWER

Data on wind speeds across the country are rare. The existing data on wind velocities indicate a countrywide average speed of 3–5 m/s. However, wind speeds of up to 12 m/s seem to be possible in some areas of the country. Should this in fact be the case, wind power may offer very promising opportunities for the overall energy sector of Sierra Leone. The MEP is currently encouraging studies of sites around the country that may hold potential as economically exploitable resource bases. With wind turbines operated with low wind speed now on the market, there is a strong potential for these systems in the rural areas, especially the North of the country. There is currently no known wind energy system applied in Sierra Leone.

4.4 HYDRO POWER

The estimated hydroelectric potential of Sierra Leone is 1,513 MW from about 27 different sites. Nearly all of them, however, suffer from the enormous flow variation between the wet and dry seasons. According to the Lahmeyer International report (1996)[13], only two of the 27 sites studied in the Master Plan are deemed to provide Hydro Power at attractive costs and with annual flow regulation. Yiben II, Benkogor III, Kambatibo, Betmai III, Yiben I and Bumbuna Falls are the most promising plants in terms of generation cost. Presently, Sierra Leone has built two hydroelectric plants. These are the 2.4 MW Guma plant, installed in 1967 in the Western Area, which has been out of service since 1982 due to electrical and mechanical damages, and the only operational 6 MW run of the river type located in the Eastern Province, some 380 km from Freetown and 69 km from the headquarter town of Kenema. This plant is operated by the BKPS consortium and is connected to a regional grid linking thermal power plants in Bo and Kenema. The consortium is made up of Danish experts from DANIDA and a regional committee appointed by the Government.

One hydroelectric power plant has been under construction since 1990, i.e. the 50 MW Bumbuna Hydroelectric Power Plant. The Bumbuna HEP has been suffering from a protracted construction process and was further compounded by the political upheavals in the country. The source of generation is the Rokel Seli River. Transmission lines, transformers etc. had already been installed before the war, which resulted in the damage of some of the pylons and transmission lines. The 161 kV transmission lines pass through a number of towns including Binkolo, Makeni, Lunsar, Masiaka and Waterloo. The sub-station at Kingtom, which has already been constructed, is intended to be used for distribution. The Bumbuna HEP is about 95 % completed and is expected to generate 47.5 MW during the rainy season and less than 30 MW during the dry season. According to the NPA (Amendment) Act of 2005, a Special Purpose Company has been formed and registered to run the facility. It is also meant to form the backbone network for a national grid. The HEP's total potential is about 305 MW and plans are in progress to develop the second phase of the project.

Many of the rivers investigated suffice for only small to medium hydro systems (i.e. 1–100 MW) and there is also a potential for pico to mini hydro systems (5 kW to 1 MW). The Master Plan, however, neglects potential resources under 2 MW. Hydro Power is expected to be an area of huge potential for Public Private Partnerships (PPP) and wider investment by the private sector. Due to the lack of data from small capacities, the MEP (in collaboration with GTZ Sierra Leone) planned a basic study between 2006 and 2007 aimed at gathering hydrological data to feed into the design of small hydro projects with capacities of up to 1 MW. This study is yet to be executed. There exists a well-advanced plan for the construction of one Small Hydro Power Plant (1 MW) in Port Loko. The design has been completed and the project implementation will start soon. It is a project funded by the Chinese Government, UNIDO and GoSL.

5 MARKET RISKS AND BARRIERS

The lack of an energy sector policy as well as a legal and regulatory framework is a significant barrier to private sector entry in the electricity supply chain. As mentioned above, there is no legalized energy policy that creates a healthy environment for private sector investments in the energy sector and RE in particular. This creates some uncertainties for investors regarding the commitment of the Government to liberalize the power sector. Relevant issues for the development of entrepreneurship in rural electricity supply in general and grid connected projects in particular remain unclear.

The current financial situation in the power sector is very unsatisfactory. NPA's present tariffs for households are below production cost, and about 20 % of the consumption is not being paid for. Illegal connections and the lack of a proper customer census are some of the factors contributing to this situation. Though corruption is generally not very common, the amount of tips ensuring a smooth and successful business registration process is significant. Bureaucratic bottlenecks increase the cost of doing business e.g. in dealing with construction permits and registering property (see table 12).

The major risk of solar appliances for a private business is the slow pace of the buying, installation and maintenance process. This is mainly due to the high costs involved resulting from high import tariffs. Import tariffs for solar appliances are between 40–50 % of their cost. Adding the necessary shipping costs, solar appliances can easily cost about two to three times as much as in Europe or America. The cost of a good quality CFL, for instance, is around 4.5 USD, a DC CFL is approximately 17 USD, a solar lantern is about 75 USD, a 600 W power inverter is about 250 USD and an 80 Wp polycrystalline solar module is about 700 USD.

The main thrust of the Government's investment promotion policy is to eliminate the structural and physical difficulties potential investors are currently facing. One of the key strategies is the simplification of business registrations and transactions through the consolidation of the role of the Sierra Leone Export Development and Investment Corporation (SLEDIC) as a 'one stop shop'. Any investor, whether domestic or foreign, may invest in any legitimate form of enterprise and

13 LAHMEYER, 1996

obtains a business name registration certificate, certificate of incorporation, business registration certificate and business license certificate. Thus, any person who wishes to invest in a business enterprise in the country shall, on request, be assisted by SLEDIC to obtain the above documents.

According to the Investment Promotion Act of August 2004, remittance of profits after taxes earned by a foreign investor from a business enterprise is guaranteed and international transactions involving payments abroad shall be allowed without restriction. The Act also guarantees capital repatriation and loan remittance. No export license is required for the export of locally produced goods except gold, diamonds and selected other goods to be specified from time to time. A business enterprise requiring foreign labor should apply to the Ministry of Labor, Industrial Relations and Social Security (MLIRSS) for consideration in accordance with any enactment relating to labor matters. Foreign personnel with work permits are allowed to make remittances abroad through their commercial banks, as long as they pay their tax obligations as defined the Income Tax Act 2000[14].

In the case of a dispute between an investor and the state in respect of an investment business, the parties are obliged to settle their differences in accordance with the rules of procedure for arbitration of the United Nation Commission on International Trade Laws. If a dispute between an investor and a non-governmental body cannot not settled amicably, the matter shall be referred to the relevant legal authority within Sierra Leone in accordance with the law binding the transaction. Any person who, in the course of his official duties, transfers proprietary information obtained from an investor to any person to whom he is not authorized by any enactment commits an offence and is liable on conviction to a fine or imprisonment or both.

Apart from the hydroelectric projects, which the Government is implementing through the MEP, not many investments have been made in this sector. Few institutions and individuals are showing interest in the exploitation of RE in the country, but funding and collaboration is their main challenge. If any individual or institution intends to invest in this sector after registration of a company or NGO, the MEP helps to facilitate the implementation of any RE project. Since the Government intends to restore the electricity supply in the country, the MEP can intervene to facilitate the waiving of custom duties on imported machineries for electrification depending on the MoU signed between the investor and MEP.

In spite of a strong record of economic reforms, including those to promote private investment, Sierra Leone ranks low (at 163 out of 181 countries – as compared to Ghana at 82, Nigeria at 114, Gambia at 128 and Liberia at 167) on the World Bank's 2008 Ease of Doing Business Survey (see Table 12). However, the country ranks high (49) on protecting investors and satisfactory (94) on starting business.

TABLE 12

Sierra Leone–Ease of Doing Business 2008 Rankings

Ease of doing business	163
Starting a business	94
Dealing with construction permits	171
Employing workers	173
Registering property	175
Getting credit	141
Protecting investors	49
Paying taxes	154
Trading across borders	133
Enforcing contracts	139
Closing a business	144

Source: Ease of Doing Business, World Bank, as of 2008

14 THE PRESIDENT OF SIERRA LEONE, 2000

6 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

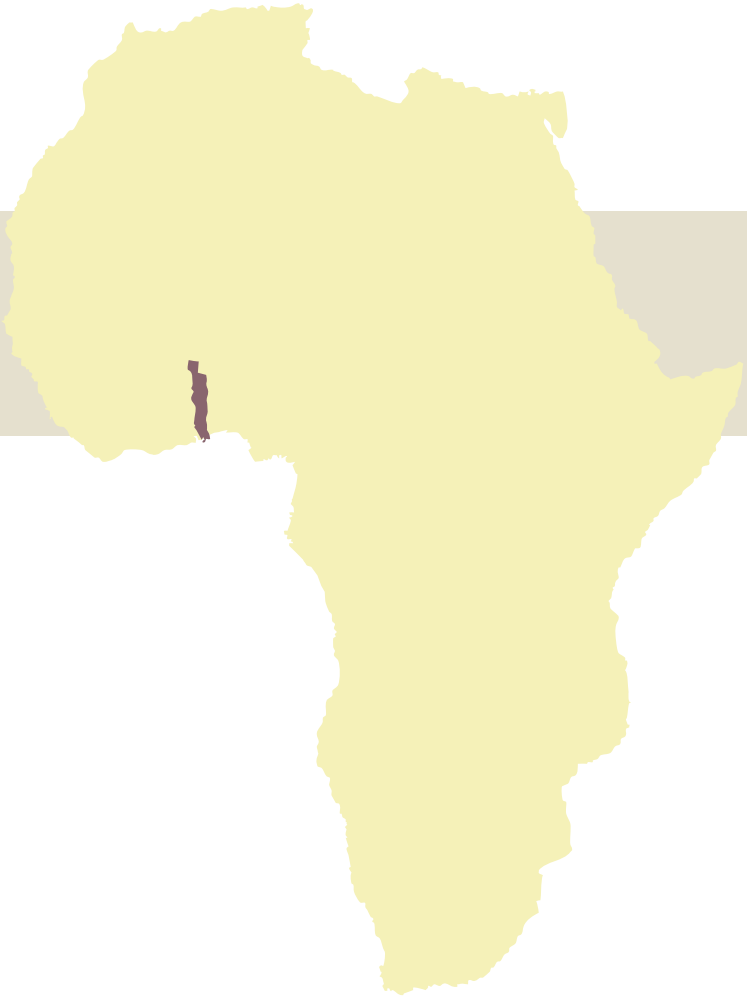
TABLE 13

Business Partners in Sierra Leone

INSTITUTION	ADDRESS	PROFILE
Ministry of Energy and Power (MEP)	4th Floor–Electricity House, 36 Siaka Stevens Street, Freetown Phone: +232 222 265 66 info@mep.gov.sl	Governmental authority responsible for the electricity and water sectors
Fourah Bay College, University of Sierra Leone	Fourah Bay College, Mount Aureol, University of Sierra Leone Phone:+232 302 070 65	College established in 1927
RCD Solar Company	64 Circular Road, Freetown General Manager, Mr Crispin Gray. Phone: +232 766 178 83	Company catering for the sustainable energy supply systems or as back-up system for institutions, commercial enterprises, rural communities and domestic or home set up. It is an outlet for the sale of solar equipment.
The Environmental Foundation for Africa (EFA)	1 Beach Road, Lakka, Freetown Peninsula, PMB 34 Phone: +232 766 114 10 info@efasl.org.uk	NGO aiming to protect and restore the environment in West Africa. For over 15 years, it has led environmental education and awareness raising campaigns, restored degraded lands and conserved pristine forests, minimized the impacts of civil war on the environment and its inhabitants, and equipped thousands of people with sustainable livelihood skills such as agro-forestry. In 2007, solar initiative is EFA's largest scale project; installing solar power systems in medical clinics, schools, visitor centers and training willing students and volunteers in the installation and maintenance of solar technologies.
Competence Centre for Renewable Energy	38 Safer Future Drive, Lower Allen Town, Freetown Phone: +232 766 079 90	NGO aiming to positively change the lives of young people. It is training young people in various trades including PV applications and had solar electrified four rural villages and also established a rural Electronic workshop at Safer Future farm.
Sonako International Services Limited	7 Percival Street, Freetown Phone +232 767 135 89	CDM Project Development

7 BIBLIOGRAPHY

- CEMMATS Group Ltd. (2004): Study on the Formulation of a National Energy Policy (Draft). On behalf of the Ministry of Energy and Power, Government of Sierra Leone
- Central Intelligence Agency – CIA (2008): World Fact Book – Sierra Leone (www.cia.gov/library/publications/the-world-factbook/geos/sl.html)
- Government of Sierra Leone (2005–2007): Sierra Leone Poverty Reduction Strategy Paper – PRSP (2005–2007): A National Program for Food Security, Job Creation and Good Governance
- Government of Sierra Leone (2005): The National Power Authority Amendment Act
- Government of Sierra Leone (2004): The Investment Promotion Act
- Government of Sierra Leone (2004): The Local Government Act
- Government of Sierra Leone (2002): The National Commission for Privatization Act
- The Environmental Foundation for Africa - EFA (2009): Novel and Practical Conservation Strategies Following Mining in Sierra Leone
- (www.efasl.org.uk/4_projects/mining.htm)
- Government of Sierra Leone (2001): The Petroleum Exploration and Production Act
- Government of Sierra Leone (1982): The National Power Authority Act
- Lahmeyer International (February 1996): Power Sector Master Plan – Sierra Leone. Appendix B, Vol. 1, Annex 10.2 (www.lahmeyer.de/en)
- Lexadin/The World Law Guide (2009): Legislation Sierra Leone (www.lexadin.nl/wlg/legis/nofr/oeur/lxwesle.htm)
- Massaquoi, J. G. M. Biomass Resource Assessment: A survey of Sierra Leone's Energy potential from Agricultural and Forestry wastes
- Redwood-Sawyerr J. A. S. and Conteh M. A. (2005): Sierra Leone's Country Report on Access to Energy Services for Rural and Peri-urban Population for the Achievement of the Millennium Development Goals
- Redwood-Sawyerr J. A. S. and Silla S. M. (1999): Distributed Electricity Services in Africa: The Sierra Leone Perspective, Forum on DES, Cape Town, South Africa, 1–5 June 1999
- Statistics Sierra Leone (2001): Annual Statistics Digest
- Statistics Sierra Leone (2005): Provisional Results, 2004 Population and Housing Census
- Swaray S. M. and Keili A. (August 2004): Sierra Leone Energy Sector Review; Poverty Alleviation Strategy Coordinating Office, African Development Bank, Final Report
- The President of Sierra Leone (2000): The Truth and ReconciliationCommission Act 2000 (http:// www.sierra-leone.org/Laws/2000-8s.pdf)
- UNDP (2007/2008): Human Development Report. Fighting Climate Change: Human Solidarity in a Divided World (http://hdr.undp.org/en/reports/global/hdr2007–2008)
- World Bank (2008): Ease of Doing Business (www.doingbusiness.org, viewed 18th Sept. 2008)



COUNTRY CHAPTER: TOGO

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ACRONYMS AND ABBREVIATIONS

TOGO

ADB	African Development Bank
ARSE	Autorité de Réglementation du Secteur de l'Électricité (Regulation Authority of the Electricity Sector)
AU	African Union
CDM	Clean Development Mechanism
CEB	Communauté Électrique du Bénin (Electric Community of Benin)
CEET	Compagnie Énergie Électrique du Togo (Electric Energy Company of Togo)
DGE	Direction Générale de l'Énergie (General Directory for Energy)
CGD	Customs General Department
ECM	mechanical construction company operating in Togo
ECOWAS/CEDEAO	Economic Community of West African States (Communauté Économique Des États de l ,Afrique de l'Ouest)
CFAF	Franc de la Communauté Financière d'Afrique (1 Euro = 655,957 CFAF)
GDP	Gross Domestic Product
HDI	Human Development Index
IMF	International Monetary Fund
OAPI	Organisation Africaine de la Propriété Intellectuelle (African Organization of Intellectual Property)
OHADA	Organisation Pour l'Harmonisation en Afrique du Droit des Affaires (Organization for Harmonization of Business Rights in Africa)
PAIP	Priorities Actions Interim Program
PCHD	Poor Countries Heavily in Debt
PRSP-I	Poverty Reduction Strategy Paper Interim
PV	Photovoltaic
RE	Renewable Energy
STE	storage company operating in Togo
STSL	Société Togolaise de Stockage de Lomé (Togo Storage Company of Lomé)
UN	United Nations
WAEMU/UEMOA	West African Economic and Monetary Union (Union Économique et Monétaire Ouest Africaine)
WTO	World Trade Organization

MEASUREMENTS

€	Euro
GWh	gigawatt hour (1 GWh = 1,000,000 kilowatt hours (kWh))
kg	kilogram
km²	square kilometer
kVA	kilovolt ampere
kWh	kilowatt hour
m/s	meters per second
m²	square meter
m³	cubic meter
mm	millimeter
MT	million tons
MW	megawatt (1 MW = 1,000 kW)
MWh	megawatt hour
°C	degree Celsius
t	ton
toe	tons of oil equivalent
W	Watt
Wp	Watt-peak
yr	year

SUMMARY

The Country Study of Togo is to provide an overview of the country's energy market and to support decision-making for private investments for the Renewable Energy (RE) sector in Togo. The study is structured as follows:

Chapter one provides **Background Information on Togo**. This includes an overview of geographical and climatic conditions, as well as the most important facts in view of political, economic and socio-economic conditions of Togo.

Chapter two summarizes facts and figures of **Togo's Energy Market** including stakeholders and market actors involved as well as sector related regulations.

Chapter three presents the currently existing **Political Framework for Renewable Energies** in Togo. This includes an overview of support mechanisms for photovoltaic (PV) as well as already existing regulations, incentives and legislative framework conditions concerning other RE technologies.

Chapter four provides a brief overview of the **Status Quo and Potential for Renewable Energies** in Togo.

Chapter five summarizes the existing and potential **Market Risks and Barriers** in general with focus on RE.

Chapter six presents a compilation of the most relevant **Renewable Energy Business Information and Contacts** of Togo.

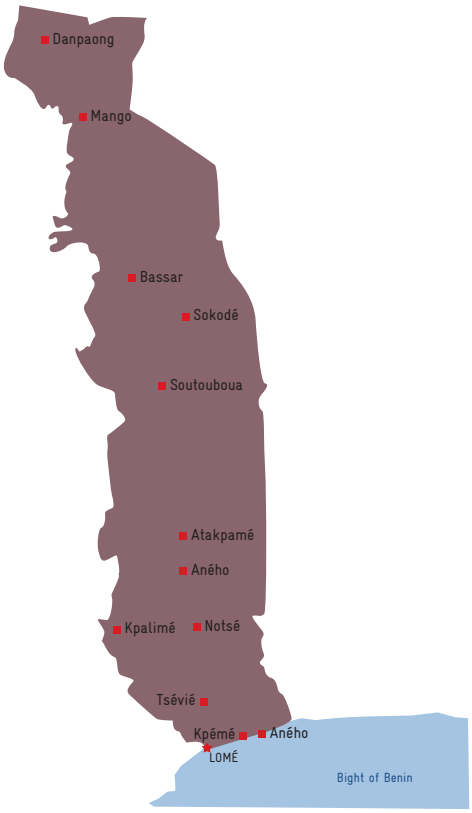
1 COUNTRY INTRODUCTION

1.1 GEOGRAPHY AND CLIMATIC CONDITIONS

Located in the southern part of West Africa, the Republic of Togo covers 56,600 km². Direction-wise it stretches for almost 600 km to the North, 55 km along the seaside on the Guinea Gulf and has a maximum width of 120 km from East to West. With a longitudinal stripe form, Togo is limited by Ghana to the West, by Benin to the East, in the North by Burkina Faso and in the South by the Atlantic Ocean. Togo is located in the northern hemisphere in West Africa between latitudes 6 ° and 11 ° North and longitudes 0 ° 30' and 1 ° 30' East.

Togo is divided into five economic regions: the Savannah Region, the Kara Region, the Central Region, the Plateau Region and the Seaside Region. These regions are divided into 31 prefectures and four sub-prefectures. Country towns of prefectures are considered as urban commons.

FIGURE 1
Map of Togo



As to the climatic situation, Togo has a tropical climate, characterized by very different climatic zones and seasons. The South has four seasons (two dry seasons and two rainy seasons) with annual rainfalls between 800 and 1,500 mm. The North has one dry and one rainy season and is characterized by annual rainfalls of 1,000–1,500 mm. The medium temperatures in Togo vary from 22 °C to 28 °C.

1.2 POLITICAL, ECONOMIC AND SOCIO-ECONOMIC CONDITIONS

According to estimations of the general statistic department, the total population of Togo has reached 5,590,000 inhabitants in 2008 at an average population growth rate of about 2.4 %. The gross of the population is living in the rural areas of Togo (66 %). In Togo, the distribution of population is very unbalanced. A high population concentration exists in the South of the country, mainly in the Plateau Region.

Togo received its independence on 27 April 1960. Since 1992, the political system has been characterized by democratic elections. Togo is a member of many international, regional and sub-regional organizations such as the United Nations (UN), the African Union (AU), the World Trade Organization (WTO), the Organization for Harmonization of Business Rights in Africa, the African Organization of Intellectual Property, the Economic Community of West African States (ECOWAS/Communauté Économique Des États de l ‚Afrique de l'Ouest – CEDEAO), the West African Economic and Monetary Union (WAEMU/Union Économique et Monétaire Ouest Africaine – UEMOA) and the Electric Community of Benin (CEB).

The economic and social development of Togo is mainly based on the primary sector that represents about 40 % of the country's Gross Domestic Product. The economic growth rate reached 2.9 % during the period 2000–2004. The inflation rate of Togo corresponds with the average 3 % of the WAEMU countries, except in 2005 when the prices of basic products increased to about 6.7 %. Other important sectors such as the industry sector, electricity sector, water and gas sector or the building sector represent another 19 % of the GDP. The service sector contributes with about 26 %, the trade sector with 11.6 % to the GDP.

The socio-political crisis (1990–2005) has greatly affected public investment activities, which have decreased from 13.8 % of the GDP in 1990 to 3.3 % in 2005. It also affected the annual growth average of the GDP which has not exceeded 1.1 % since 1991. In 2006, Togo was classified as a less developed country and in 2008 as one of the Poor Countries Heavily in Debt (PCHD). Today, Togo ranks at 147 out of 177 countries in the Human Development Index (HDI).

As for the revenues, the rate of the fiscal pressure remains low at 14 % of GDP which is three points under the standard of 17 % fixed by the mechanism of multilateral supervision of the WAEMU in 2005. Public debt is split into 72.4 % of engagements towards the World Bank, the International Monetary Fund (IMF) and the African Development Bank (ADB) and 27.6 % of bilateral debts. The current external debts are estimated at 783 billion CFAF of which near one third are overdue payments (2006–2007). In 2006, the weight of the total debt with regard to the GDP reached 96 % as opposed to 70 % in 1992.

2 ENERGY MARKET IN TOGO

2.1 OVERVIEW OF THE ENERGY SITUATION

Togo mainly relies on the utilization of energy from biomass. In 2006, up to 75 % of the total energy consumption was covered by biomass energy. Due to the fact that Togo has no proven reserves, the total consumption of petrol products is covered by imports. The overall energy consumption per inhabitant was estimated at 0.27 toe in 2006, which is significantly less than the average of West African countries (0.45 toe).

2.2 ENERGY CAPACITIES, PRODUCTION, CONSUMPTION AND PRICES

Electricity Sector

The overall electricity production of Togo reached 221 GWh in 2006. The national production capacity includes thermal and Hydro Power installations under the management of the CEB, the Electric Energy Company of Togo (CEET) and some independent producers. The electricity production units of CEET include 17 thermal electric plants and one mini Hydro Power plant. The total amount of produced electricity reached 71 GWh in 2007. The second electricity producer CEB operates several gas turbines with an overall production of approximately 53 GWh (as of 2006). Furthermore, three mini Hydro Power plants contributed another 150 GWh to the electricity consumption. The overall contribution of small producers (mostly self-sufficient electricity generation in the industry sector) was estimated at 8 GWh in 2006. Additional imports of electricity origin from Ghana, Côte d'Ivoire and Nigeria. Overall electricity imports are estimated at 505 GWh at a total consumption of 726 GWh in 2005. Table 1 presents the prices of imported electricity while the current electricity tariffs are presented in Table 2.

Petroleum Sector

Togo is not a producer of petroleum products and therefore has to meet the final consumption by imports. In 2006, the overall import was estimated at 276,000 toe equaling 12 % of the total energy mix.

All imports are subject to be certified by the Ministry of Commerce and Transport. As far as hydrocarbons are concerned, Togo has total storage capacity of 255.315 m³, shared between the Togo Storage Company (STE) and the Togo Storage Company of Lomé (STSL). The price for petroleum products is presented in Table 3.

Biomass Sector

In Togo, biomass energy comprises charcoal, wood and agricultural waste. The total biomass energy production was estimated at 2,031,000 toe in 2006. Traditional biomass is the most prominent source of energy for cooking and heating purposes in Togo. About 75 % of all households (mainly in rural areas) utilize wood energy, which causes an annual consumption of 347 kg per capita. Charcoal is the most prominent combustible of urban households with an annual consumption of 59 kg per capita. The annual consumption for household energy needs is estimated at about 1.63 million tons of wood and about 0.27 million tons of charcoal.

TABLE 1

Price of Imported Electric Energy and National Energy Production by Type

ORIGIN	CÔTE D'IVOIRE	GHANA	NIGERIA	TOGO				
				Hydro Power	Thermal	Gas Turbines	CEET Purchase	CEET Purchase and Sale
€/kWh	0.050	0.040	0.034	0.038	0.170	0.210	0.076	0.082 to 0.140

Source:CEB, as of 2008

TABLE 2

Price of Electric Energy by Type of Use

TYPE OF USE	PRICE (€/kWh)
Professional Use	
slack period	0.08
full period	0.09
peak period	0.11
uni tariff	0.10
Public lighting	0.14
Free zone companies	0.08
Domestic Use	0.10 (‹ 40 kWh) 0.11 (40–300 kWh) 0.14 (› 300 kWh)

Source: Conceded electricity service rule to Togo Électricité, as of 2002

TABLE 3

Price of Petroleum Products

TYPE OF ENERGY	CHARCOAL €/KG	WOOD €/KG	KEROSENE €/KG	BUTANE €/L	GASOLINE €/L	DIESEL €/L
Price	0.04	0.13	0.82	0.43	0.66	0.71

Source: Ministry of Commerce, as of 2009

2.3 MARKET ACTORS AND REGULATION STRUCTURES

The energy sector of Togo is very complex due to numerous institutions involved in the sector. The Ministry of Mines, Energy and Water develops and implements policies for the overall energy sector.[1] Moreover, it directs and coordinates relevant initiatives. The Ministry of Environmental and Forestry Resources develops and implements policies and regulations, monitors and controls the exploitation of forests and the production and supply of wood and charcoal. Many other institutions and organizations from private and public sector also participate in the overall management of this sector . This includes the CEB, the CEET and the Regulation Authority of the Electricity Sector (ARSE) as well as the STE and the STSL.

3 POLICY FRAMEWORK FOR RENEWABLE ENERGIES

3.1 POLICIES, STRATEGIES AND PROGRAMS FOR RENEWABLE ENERGY PROMOTION

In Togo, there are currently no dedicated policies for Renewable Energies. According to the Togo Poverty Reduction Strategy Paper Interim (PRSP-I) for 2006–2008, however, the Government pursues several objectives in the energy sector. This includes the implementation of policies for the promotion of RE, the increase of electricity supply of rural areas and the implementation of regulatory institutions.

3.2 REGULATIONS, INCENTIVES AND LEGISLATIVE FRAMEWORK CONDITIONS

Based on a feasibility study on rural electrification, the implementation of a rural electrification master plan was recently initiated. In the framework of the Priorities Actions Interim Program (PAIP) and the PRSP-I, several priorities were formulated.

The first priority concerns institutional reforms and the regulation of the energy sector and schedules three actions: (i) strategic review and elaboration of reviewed energy policies, (ii) regulation and reduction of state electricity consumption by introducing energy-saving/-efficient measures in public buildings in accordance with Clean Development Mechanism (CDM) and (iii) capacity building by the general department of energy.

The second priority focuses on the rapid improvement of production capacities in order to end the energy crisis in a short time. Furthermore, capacity building in the electric energy production sector aims to promote the implementation of gas turbines and Hydro Power installations in different regions of the country.

The third priority proposes a framework for rural electrification and prepares an investment program likely to alleviate the high energy dependency of Togo. The restricted access to modern energy services forces the elaboration of the master plan of rural electrification that will fix realistic objectives for 2010 and 2015. It is planned to develop and implement goal-directed strategies with focus on institutional, technological and financial issues.

The fourth priority aims at activities in the field of RE and the hydrocarbon sector. This includes the implementation of legislative, institutional and regulation framework conditions, allowing the substitution of traditional energy sources. This should be done with tax exemptions for RE equipment, the definition of standards for rural electrification and the reduction of relevant costs.

In order to help the population through the energy crisis and to promote RE on a large scale, the Ministers' Council authorized the Customs General Department (CGD) on 8 April 1998 to issue a memorandum on import tax and VAT exemptions for generators and other energy equipment. This measure is in force till now.

4 STATUS AND POTENTIAL FOR RENEWABLE ENERGIES

4.1 BIOMASS/BIOGAS

The biomass potential of Togo is estimated at 2.6 million toe and mainly consists of wood, charcoal, and vegetable waste. Table 4 provides an overview of the biomass consumption by region.

With regard to the production and utilization of biogas, there are significant resources available, mainly from agricultural waste (cotton, maize stem etc.) and livestock. Due to the lack of technology and knowledge, there are no existing biogas production sites in Togo up to now.

4.2 SOLAR ENERGY

The available solar radiation is between 4.4 and 4.5 kWh/m²/day.[2] Up to now, there are already some experiences with thermal solar energy and photovoltaic (PV) energy available. This includes solar water heating, solar cooking and PV systems for telecommunication services, water pumping, railway stations and some other small scale applications. In order to improve the access to modern energy services in rural areas of Togo, there is still a significant need to promote the utilization of solar energy.

4.4 HYDRO POWER

Togo has more than 50 rivers and waterfalls that offer abundant potential for mini- and micro-scale production of electricity. About 40 sites, located at the rivers of Mono and Oti, offer a potential overall production capacity of 224 MW. Up to now, however, there are only very few Hydro Power installations available for electricity generation. Table 5 presents an overview of the available Hydro Power potential of Togo.

1 SEE ALSO INSTITUTIONS MENTIONED IN CHAPTER 2.2

2 AS MEASURED BY LOMÉ UNIVERSITY AND THE NATIONAL METEOROLOGY DEPARTMENT

TABLE 4

Biomass Consumption by Region

REGION	TYPE	WOOD		CHARCOAL		VEGETABLE WASTE	
		Number of Households	%	Number of Households	%	Number of Households	%
Seaside	Whole	409	38.47	840	79,20	125	1.75
	Urban	65	10.20	586	91,70	21	3.30
	Rural	344	81.00	254	59,80	104	24.50
Plateau	Whole	578	77.79	379	51,00	83	11.17
	Urban	64	47.70	113	84,07	05	3.60
	Rural	514	84.40	266	43,06	78	12.80
Central	Whole	192	82.40	146	62,66	12	5.15
	Urban	42	57.40	59	81,90	n/a	n/a
	Rural	150	93.40	87	53,70	12	7.40
Kara	Whole	214	83.59	169	66,01	84	32.81
	Urban	66	62.20	103	96,70	15	14.40
	Rural	148	99.20	66	44,40	69	46.00
Savanna	Whole	253	94.75	164	61,42	95	35.58
	Urban	42	81.40	47	93,00	13	25.60
	Rural	211	97.80	117	54,40	82	84.10
Total	Whole	1,646	64.24	1,698	66,27	399	15.57
	Urban	279	27.81	908	90,52	54	5.38
	Rural	1,367	87.68	790	50,67	345	22.12

Source: DEF, as of 2008

TABLE 5

Available Hydro Power Potential

SITE NAME	RIVER	POWER (MW)
Djédrame	Danyi	3.000
Daye Konda Daye Konda Amou Oblo	Gban Hou1 Gban Hou2 Amou	5.000 10.000 3.000
Tététou	Mono	60.000
Nangbéto en aval du site	Mono	20.000
Sérégbané (Kougnohou)	Koroon	9.000
Bassar	Cascade Sika	1.000
Kpessi	Ogou	8.000
Dotékopé	Mono	9.000
Gboamoa	Amou	2.000
Gougou	Ogou	7.000
Ezimé (Cascade)	Koulassou	2.500
Langabou	Assou Koko	5.000
Tomégbé	Domi	8.000
Tomégbé	Sin sin	1.600
Soukourou	Souroukou	5.000
Sagada/Kpététa	Mono	8.000
Fazao	Kpaza	2.500
Bongoulou	Bassar	1.250
Bangan (Bassar)	Mô	6.000
Koueda	Kpaza	9.000
Landa-pozanda	Collège milit. Kara	17.000
Landa-pozanda	Kara	0.200
Tihaléa	Kara	9.000
Namon	Kara	n.a.
Titira	Kéran	12.000
Mongo-Kantè (Atigbé)	Kéran	5.000
Alokoegbé	Sio	0.125
Wonougba	Sio	0.165
Légouazeladè	Mô	0.100
Aklowa	Cascade	800.000
Landa-pozanda	Kara (Kpizindè)	0–110.000

Source: DGE, as of 2006

4 MARKET RISKS AND BARRIERS

The major obstacle within the RE market development is the lack of appropriate policies. Furthermore, there is a significant lack of regulatory instruments for private investments to the sector. Up to now, there are no mechanisms or incentives that are suitable to attract investors from the private sector. The regulation institution ARSE has no master plan in the field of RE. On top of that, Togo has no independent agency that is in charge of the RE sector including the rural electrification.

Since 2000, Togo has been applying uniformed acts of the African Harmonization Affairs Law Organization (OHADA). This is part of the overall liberalization process intended to implement codes, principles and comminatory rules of ECOWAS/WAMEU. The regional harmonization process was implemented by ECOWAS/WAMEU in September 2005 and has been in force since January 2006. The national legislation regulating competition has been replaced in 2003 by a comminatory legislation that includes the objectives of ECOWAS/WAMEU. The national commission for competition and consumption has been in operation since 2006.

Law 99-011 regulates the overall competition in Togo and aims at establishing successful and self-regulatory markets. Within this, the establishment of appropriate prices, properties and services should help to prevent market distortions and discriminatory practices. According to the PRST-I, the Government intends to elaborate national policies against corruption and towards equitable and transparent markets.

5 RENEWABLE ENERGY BUSINESS INFORMATION AND CONTACTS

TABLE 6

Local Partners

INSTITUTION	ADDRESS	PROFIL
Solaire Ingenierie	Phone: +228 320 63 82 Fax: +228 221 35 18 solaire.ingenierie@yahoo.fr	PV technology
Mechanic Construction Company (ECM)	P.O Box. 31277, Lomé Phone: +228 925 21 04 ecmpompes@yahoo.fr	Solar equipment and service provider
ESTN	Phone: +228 923 33 08	Solar equipment
Direction Générale de l'Energie (GE)	P.O Box 335, Lomé Phone: +228 223 14 39 Fax.+228 220 86 46	Stately institution
Action Communautaire pour le Développement Intégral et Solaire (ACDI SOLAR)	07 BP 128606, Lomé Phone: +228 966 25 67 Email: www.acdisolar06.blog.co.uk (www.riaed.net/IMG/pdf/ONG_ACDI_Solar_au_Togo_0507.pdf)	NGO for the promotion of solar energy
UL/ ENSI	P.O. Box. 1515, Lomé Phone: +228 902 86 07	Electric equipment
Lomé University Solar Energy Laboratory	P.O Box 1515, Lomé Phone: +228 901 25 18 www.ub.tg	Solar energy research
CFIT	Phone: + 228 999 88 65	Solar equipment and training
JVE Volunteers Youth for Environment	P.O Box 88236, Lomé Phone: +228 913 48 21	NGO
ENERGIA SOLAIRE	Phone: + 228 939 35 13	Solar equipment
Ministry of Mines, Energy and Water (Ministère des Mines et de l Energie)	P.O Box 4227, Lomé Phone: +228 220 07 62 Fax: +228 220 08 05 energie@laposte.tg	Regulatory institution
Ministry of Economy and Finance, (Ministère de l'Economie et des Finances)	P.O Box 387, Lomé Phone: +228 221 09 05	Regulatory institution
Ministry of Environment and Forestry Resources (Ministère de l Environnement et des Ressources forestière)	P.O Box 48235, Lomé Phone: +228 221 30 78 www.merf.tg	Regulatory institution

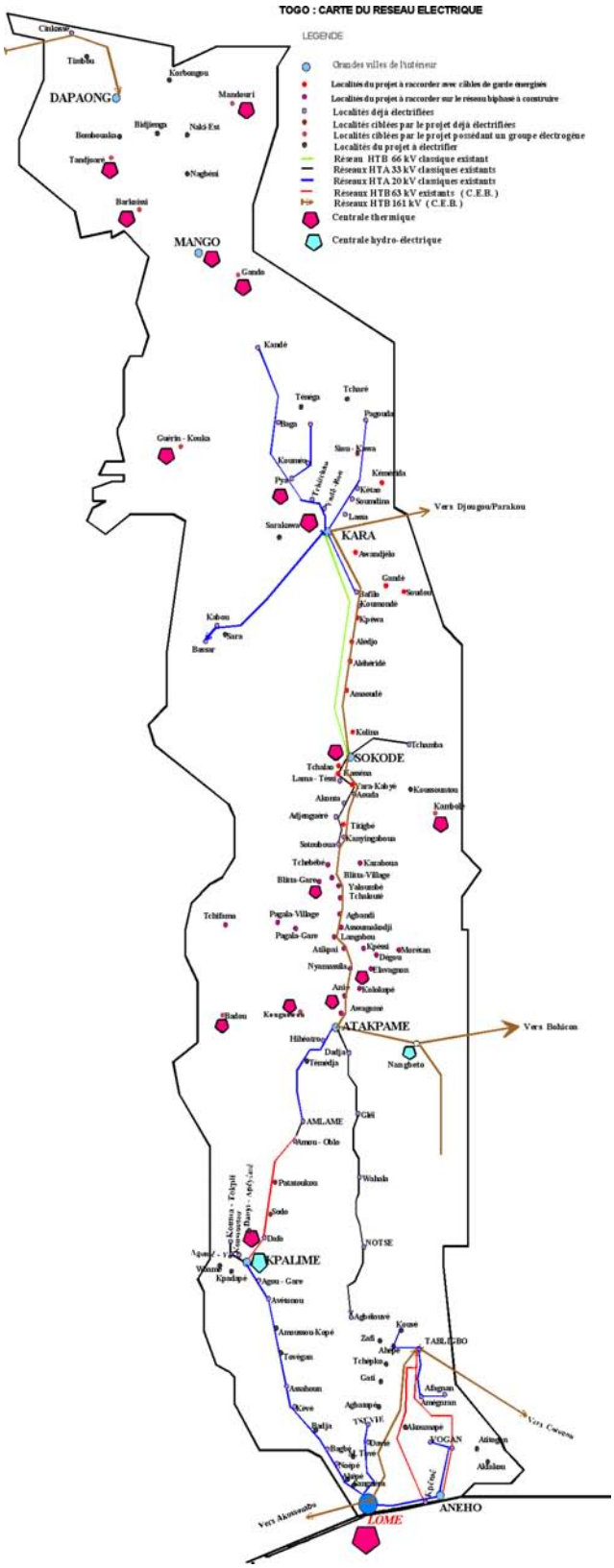
6 BIBLIOGRAPHY

- DEF (2008): Biomass Consumption by Economic Region
- Ministry of Trade (2007): Commercial Activities Paper
- CEB/CEET (2002): Decree Nº 2002–075/PR on Energy Sale and Price Fixation in Togo
- Ministry of Economy and Finances (2007): Duties in Togo
- DGE (2007): Electric Energy Sector in Togo
- DGE (2008): Energy sector policies and projects/ current and future programs
- N. N. (2004): Ethic, Energy and Sustainable Development of LIAISON Energy-francophone Nº 62–1fs term
- DGE, CEET, STSL, SIE (2008): Final Consumption Share by Source of Energy
- DGE (2008): Government Projects at PIAP
- DGE, STSL, SIE (2006): Households' Energy Consumption
- DGSCN (2006): Households' Percentage According to type of Energy Use
- DGE (2007): Infrastructures Access in Energy Service – Atlas Energy Togo
- AOIP Togo (2007): Intellectual Property Paper in Togo
- N. N. (2003): International Forum on Energy Market and the Role of Energy in Fight Against Poverty
- SIE (2007): Investigation Report Paper on Domestic Energy Consumption in Togo
- National Assembly (1999): Law on Competition Organization in Togo
- N. N. (without year): National Rapport on MDGs
- N. N. (2007): Interim Poverty Reduction Strategy Paper of 2007
- ARSE Office (2006): Relatives to Electricity Sector and its Application Decree
- African bulletin (2006): Poverty Reduction: Renewable Energies Can Truly Contribute
- University of Lomé (2006): Private Renewable Energies Fitting in Togo
- DGE (2007): Sustainable Development World Summit in 2002
- General Direction of Tax (2008): Tax Conditions in Togo
- Ministry of Plane (2008): Temporaries Programs Paper of Priorities Actions (PATP)
- UNDP (2007): UNDP Paper on Profile of Poverty and Vulnerability in Togo
- PNAE (2002): Wood Demand Growing in Togo – Biological Diversity Document
- LIAISON energy-francophone (2004): World's Solar Program of Nº 46-1fs term

7 ANNEX

FIGURE 6

Electricity Network Map of Togo



Source: CEET, as of 2008