

COUNTRY CHAPTER: GHANA

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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

TABLE 4:
Trend in Electricity Generation (GWh) 2000–2007¹

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.

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 (m³)

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 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.

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

TABLE 6

Overview of Electricity Tariffs and Prices³

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%

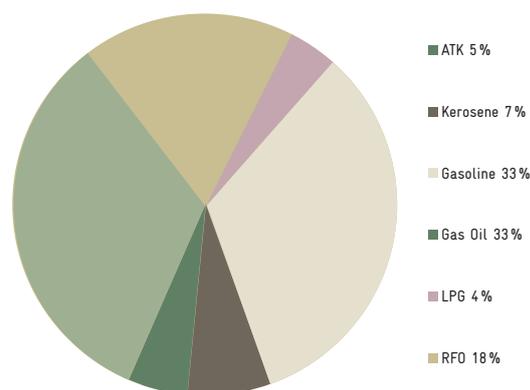
Source: NPA, as of 2008

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 PER 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 Prices⁴ 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 bio-energy 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/m². 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 lighting 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 coastal 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 un-

der 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@dengttd.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



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