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# A REVIEW OF GHANA`S RENEWABLE ENERGY POLICY

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## ABSTRACT

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This thesis work describes Ghana`s renewable energy policies and the barriers the policy is facing. It further explains the various renewable energy policies used in the world and how Ghana can learn from those policies, especially the policies from Cape Verde.

The method used in this thesis work was a desktop research to come out with the various policies that Ghana can implement and an interview with one of the experts in renewable energy in the energy commission of Ghana.

The outcome of the study was that-Ghana has some policies in place such as feed in tariff, tax exemptions, biofuel and heat obligation, reduction in sales, renewable energy portfolio and public investments but it also faces some barriers in the renewable energy sector and those barriers are land access, structure of the energy sector, transmission access, lack of education and infrastructure, assistance from the government and banks.

Despite those barriers Ghana can still achieve their target in 2020 by learning from Cape Verde.

Key words (Renewable energy policy, barrier, incentives)

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## 1 INTRODUCTION

Today, energy has become one of the driving forces of the economy in the world and most developed countries in the world are doing well in their economic activities because their energy situation is very good. Nevertheless, energy being one of the driving force of the economy, most African countries are finding it difficult to improve upon their energy situation. In 2012 it was reported that about 1.3 billion people do not have access to electricity./13/

Most developed countries depend on fossil fuel for their energy, but unfortunately the fossil fuels are now becoming scarce and expensive to buy and coupled with the environmental issues the fossil fuels bring, countries are turning their attention to renewable energy barely in mind that they do not harm the environment. Countries are now developing policies that will include renewable energy in their energy production and Ghana is no exception.

Ghana is a sovereign state and unitary presidential constitutional republic located on the Gulf of Guinea in the Sub-Saharan Africa. Ghana has gained the fastest growth in Sub Saharan Africa with a GDP growth of 14.3 percent in 2011 and also a population of 25.37 million./12/. The country has ten regions and Accra is the capital city. Ghana's mainly depends on hydro power for their energy supply-but in 2008 the country experienced a great loss of water level of the biggest dam(Akosombo dam) which is the main source of the hydro power, thereby making the country to run load shielding exercise in the country. Ghana has been experiencing the load shielding exercise up to now (March 2014) which has made the electricity company of Ghana to announce a new timetable for load-shielding all over the country. Despite the huge potential in renewable energy sources and the national electrification project the country is undergoing, the country is experiencing load shielding. This situation has made industries to shut down their production thereby making the unemployment in the country worse. The country has implemented some measures to boost the energy situation bearing in mind that the country's population is increasing.

Despite all these measures in place, load shedding is still going on and this study is going to take a critical look at the various policies that the country is implementing and see if there is a need for a change of the policy or if there should be additional policies that will help the country get more energy. This in effect will help industry grow and thereby create more jobs in the country

### **1.1 Objective of the Study**

The purpose of the study is to review the renewable energy policy of Ghana, so as to know the challenges and the barriers the policy is facing- ,in order the country to reach the target that in 2020 10% of Ghana's energy mix comes from renewable energy.

### **1.2 The Research Question**

This research will critically look into the following questions to see what Ghana needs to do to achieve their target in the renewable energy sector.

What are the renewable energy policies in Ghana?

What are the barriers facing the implementation of the policies in Ghana?

### **1.3 Structure of the Study**

The various renewable energy forms and the main drivers of renewable energy will be discussed in Chapter 2, Chapter 3 will discuss the various renewable energy policies and the barriers renewable energy encounters.

Chapter 4 will compare the various policies used in three (Germany, Ghana and Cape Verde)

In Chapter 5 the analysis and recommendations are given and the conclusion is described in Chapter 6.

#### **1.4 Research Methods**

In this thesis, the method used was the qualitative method which was the desktop research and an interview with an expert in renewable energy at the Ghana energy commission. In using the desktop approach, information on the various renewable energy policies from Germany and Cape Verde was used to compare the policies that Ghana is implementing to see what Ghana needs to be done to achieve their target in 2020. Additional information was collected from the World Bank data and ECOWREX.

Germany was chosen in this research because it is considered as one of the best countries doing well in renewable energy and Cape Verde was also chosen because it is a West African country and also doing well in renewable energy.

The analysis of the three countries (Germany, Cape Verde and Ghana) will be given in Chapter 4

## **2 DRIVERS OF RENEWABLE ENERGY POLICIES**

This chapter presents an overview of the usage of renewable energy in the world and a review of the drivers of renewable energy policies.

Today, as the world population is estimated to be 7.138 billion by the United States Census Bureau (USCB) about 1.3 billion people are without access to electricity.<sup>/13/</sup> Coupled with the environmental challenges the non-renewable brings to the environment, countries are designing various policies of renewable energy to meet the demand of energy. The type of policy driver of a country will determine which policy to use and this chapter will discuss the drivers of renewable energy and the various renewable energy sources used in the world. The next section describes the different aspects of renewable energy.

### **2.1 Renewable Energy**

Renewable energy can be defined as energy derived from natural process that is replenished at a faster rate than they are consumed. Examples of renewable energies are solar, hydro, wind, biomass and geothermal.<sup>/13/</sup>

The IEA has predicted in their second annual medium-term renewable energy market report (MTRMR) that by 2016 power generation from hydro, wind and other renewable energy sources of energy worldwide will exceed that from gas and be twice as much as from nuclear energy. It is estimated that the 10 percent world consumption which is from renewable sources will be projected to rise to 14 percent in 2035.<sup>/13/</sup>

### **2.2 Sources of Renewable Energy Used In The World.**

Solar power

Solar power is one of the renewable energy sources that can play a role in reducing the carbon emissions and ensuring a sustainable energy in the world. It is obtained from the sun, and in 2011 the total capacity of installed solar power in the

world was 80.3GW./1/. Below is the installed capacity of solar in the various continents (see Table 1)

Table 1 the percentages of installed capacity of solar energy in the various continents./1/

<b>REGION</b>	<b>PERCENTAGE OF INSTALLED CAPACITY</b>
Middle East and North Africa	0.1
North America	8.4
Latin America and the Caribbean	0.1
South and Central Asia	1.4
Africa	1.1
Southeast Asia and Pacific	2.2
East Asia	13
Europe	73.6

### Wind Power

Wind is one of the renewable energy sources the world use most? The United States of America has the largest wind energy capacity installed which is over 25GW, Denmark has the highest capacity per capita at 3GW.In 2011, the total installed capacity of wind globally was 327GW./1/.Below is the percentage of installed capacity of wind in the various continents. (See table 2)

Table 2.The percentages of installed capacity of wind in the various continents./1/

<b>REGION</b>	<b>PERCENTAGES OF INSTALLED CAPACITY</b>
Middle East and North Africa	0.4
North America	22
Latin America and the Caribbean	0.9
South and Central Asia	6.6
Africa	0.1
Southeast Asia and Pacific	1.2
East Asia	28.6
Europe	40.1

### Hydropower

It is the most flexible and consistent of the renewable energy resources. For example, at the end of 2008 a total capacity of 874GW was built across 11,000 hydropower stations in 160 countries. China, Canada, Brazil and the USA respectively are the leaders in the generation of hydropower. Globally, a total of 1.31TW of hydro was installed in 2011./1/.Below is the percentage of installed capacity of hydro in the various continents. (See Table 3)

Table 3. The percentages of installed capacity of hydropower in the various continents./1/

<b>REGION</b>	<b>PERCENTAGES OF INSTALLED CAPACITY</b>
Middle East and North Africa	1.8
North America	17.5
Latin America and the Caribbean	14.8
South and Central Asia	6.6
Africa	1.5
Southeast Asia and Pacific	3.6
East Asia	29.9
Europe	24.3

### Geothermal Energy

Geothermal energy is gotten from the natural heat of the earth. Geothermal energy provides up to 8.3 percent of global electricity demand, and at least thirty-nine countries meet their electricity needs by geothermal energy .The total installed capacity of geothermal energy in 2011 was 15.5GW with United States being the leading producer of electricity from geothermal energy./1/.Below is the percentage of installed capacity of geothermal in the various continents. (See Table 4)

Table 4. The percentages of installed capacity of geothermal energy in various continents./1/

REGION	PERCENTAGES OF INSTALLED CAPACITY
North America	36.6
Latin America and the Caribbean	4.8
Africa	1.6
Southeast Asia and Pacific	36.3
East Asia	5.4
Europe	15.3

## Biomass

Biomass energy is the energy that is produced from agricultural, forestry and municipal wastes and residues and in 2011 biomass contributed to 10 percent of the global primary energy production, making it the largest global source of renewable energy used./1/

.

## 2.3 Main Drivers of Renewable Energy Policies

Despite the huge potential of renewable energy installed capacity in Africa, the continent is still having a lot of people without access to electricity. This may be due to the energy policies of the African countries. This section will describe the drivers of renewable energy policies

For countries to develop a renewable energy policy there are drivers or reasons why countries should implement policies for their renewable energy./11/. These are

- To improve upon their energy security
- To bring about economic development since with sufficient energy countries can develop well.
- To improve upon the climate change and the environmental impacts the fossil fuels brings.

For this reason when countries want to develop a long term renewable energy policy, it has to take into account which of the three reasons above best suits its objective.

### **2.3.1 Energy Security**

The International Energy Agency defines the energy security as the uninterrupted availability of energy sources at an affordable price. Energy security has basically two aspects which is the long –term energy security and the short-term security. The long term which deals with how the energy is supplied in line with economic developments and environmental needs with timely investments while the short-terms deals with how the energy system can react to sudden changes in the supply of energy demand./11/

#### **Energy availability**

Energy availability is the availability of sufficient energy supply to the final consumer at all times. For a country to supply sufficient energy to the final consumer at all times, the infrastructural system of the country as such the grid connections and the transport system of the country should be able to contain the primary resources to the final user. /11/

## Energy affordability

Energy affordability is the affordability of the energy at a reasonable price. Renewable energy is still considered as very expensive, but interestingly their cost of investment is changing rapidly because of the technology which is moving at a faster rate and this trend is bringing the price down very quickly. For example a solar photovoltaic panel is on the verge of reaching competitiveness with retail electricity prices in some markets. Also in locations where it is difficult to get access to the grid-connection, renewable energy applications are often more economically viable than other technologies and also it provides a sustainable environment.<sup>/11/</sup>. In energy affordability there are two aspects of affordability: the price volatility and the price uncertainty.<sup>/11/</sup>.

### Price Volatility

The economic effects of a country can be determined by the volatility of the fossil fuels. For example a loss of 0.5% in GDP was estimated by Awerbuch and Sauter due to a 10% price increase of oil for the United States of America and the European Union. The price of oil has been increased by approximately 45% which is roughly equal to the USD 774 billion or Netherlands GDP, therefore the development of renewable energy has a very key role in removing the attention of fossil fuel. <sup>/11/</sup>.

### Price Uncertainty

The price uncertainty of the fossil fuel has made countries to depend on the renewable energy for their energy mix. Over the years the price of the fossil fuels especially oil has not been stable thereby making various countries develop various policies to integrate renewable energy into their energy usage. The World Energy Outlook 2010 summarises that ``the era of cheap oil is over``.<sup>/11/</sup>.

### **2.3.2 The Economic Development**

Some countries include renewable energy in their energy mix because they want to improve their economy. These countries spend a lot of money on fossil fuel, therefore designing a policy that will help to improve the use of renewable energy is very important./11/. For example, in 2008 the United State spent about USD 410 billion in importing fossil fuel which represent more than 3 percent of the country`s GDP. This trend is similar in other OECD countries and in developing countries where the domestic fuels is not plenty, they spend even higher percent-age of GDP on the fossil fuels, thereby posing a serious fuel import bill on the country./11/

### **2.3.3 Environmental Benefits**

Some countries depend on renewable energy due to the amount of CO<sub>2</sub> the fossil fuel brings to the environment; therefore they put in policies that will save the environment from the emission of dangerous gases. Renewable energy technologies intend to reduce the amount of CO<sub>2</sub> released to the atmosphere and this reduces the greenhouse effect./11/.

In 2008, the generation of renewable energy power in 56 IEA countries alone saved 1.7Gt CO<sub>2</sub>./11/.Below is the CO<sub>2</sub> savings in 2008 of various country (see Table 5).

Table 5 CO<sub>2</sub> savings in the various region or countries./11/.

Country/region	CO <sub>2</sub> savings in 2008(Mt)
OECD Europe	297
OECD North America	428
OECD pacific	77
Brazil	138
Russia	3
India	121
China	563
South Africa	1
North Africa	7
Middle east	0.02
Other Latin America	30
Sub-Saharan Africa	2
Southeast Asia	51

The drivers of renewable energy policies, the GDP per capital and the renewable energy shares can be mapped together to see which policy to use. The next section will discuss the mapping of the drivers with GDP per capital and the renewable energy share.

#### **2.4 Mapping the Various Energy Drivers and the GDP Per Capital in Four Countries /Renewable Energy Shares**

The drivers of the renewable energy will determine which type of renewable energy policy a country will use. For example, countries that are considered by World Bank as higher income countries and either a net energy exporter/net energy importer will always put measures in place to cater for either their energy security or environmental issues, whereas countries with lower middle income either net energy exporter/net energy importer will also introduce policies that will enhance their poverty concern or economic development./11/.

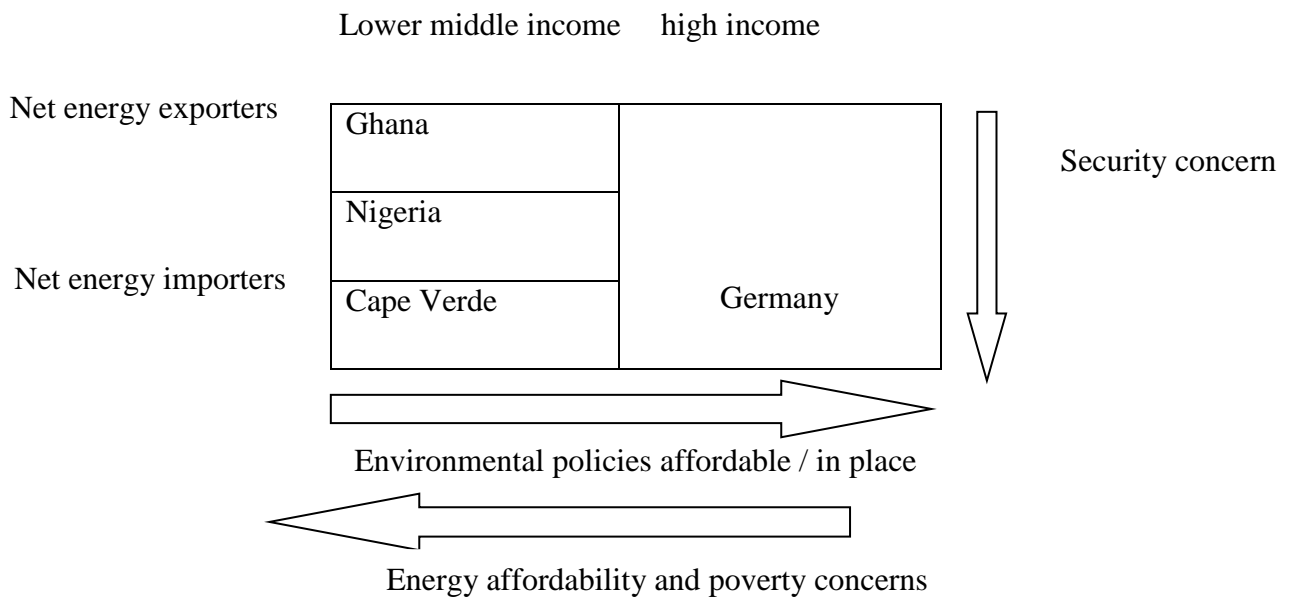


Figure 1. Energy drivers versus GDP

From Figure 1 above it can be deduced that, the income level of a country whether high or low and also whether the country is a net energy exporter or net energy importer will determine which kind of renewable energy policy to use. For example, it can be deduced that Germany as a high income country and net energy importer put in policies to ensure their security concern and also for their environmental concern, whereas the other three countries Ghana, Nigeria and Cape Verde, which are lower middle income countries and either a net importer of energy or exporter of energy put in policy to ensure energy affordability or for economic development. Figure 2 below shows the relationship between the renewable energy share and the GDP per capital of six West African countries namely (Benin, Cote d'Ivoire, Ghana, Nigeria, Senegal and Togo).

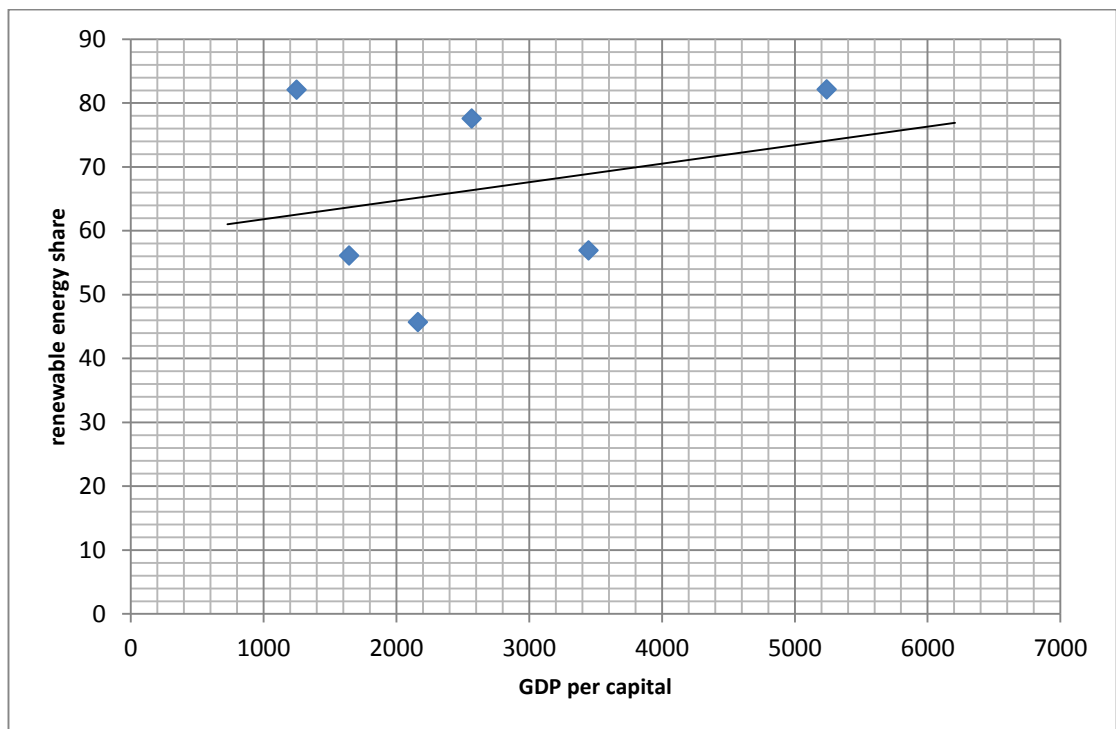


Figure 2. The GDP per capital and renewable energy share.

From Figure 2, it can be deduced that as the GDP per capital of the country increases, then the renewable energy shares of the country also increases thereby informing which type of policy to use.

### **3 A REVIEW OF RENEWABLE ENERGY POLICY**

This chapter will discuss the various kinds of renewable energy policies and the barriers renewable energy faces

#### **3.1 Energy Policy**

In 2010, according to a report by Bloomberg New Energy Finance indicates that barely US\$243 billion was invested in low-carbon energy worldwide representing a 23% increase over 2009 investments. This includes wind, solar biomass, geothermal and hydropower./2/

This has made many governments introduce some renewable energy policies to reduce the carbon emission and achieve energy security and many governments are turning to tax relief to promote renewable energy sources for power generation. These regulations can be classified as:

Regulatory policies: These are policies regulations that are put in place to encourage people to renewable energy source. This policies are the net metering, tradable renewable energy credit (REC), Heat obligation/mandate, biofuels obligation, feed-in tariff /premium payment, electric utility quota obligation/renewable portfolio standard (RPS) and renewable energy targets./2/

Fiscal incentives: These are incentives given to all those who are using the renewable energy. These incentives can be capital subsidy/rebate, investment and production tax and reductions in sales tax or energy tax, CO<sub>2</sub> taxes, VAT and other Tax./2/

Public Financing: This can be public investments, loans and grants, public competitive bidding/tendering./2/

The next section will briefly discuss the various renewable energy policies.

## **3.2 Theoretical Overview of Renewable Energy Support Instrument**

This section provides an overview of the different renewable energy support instruments.

### **3.2.1 Regulatory policies**

#### **Feed in tariff**

It is defined as a selling scheme based on fixed price system to sell the unit, such a scheme may focus on quantities or prices. This policy guarantees renewable energy generators to be at a fixed price. The feed in tariff policies were first introduced by the U.S Public Regulatory Policies Act (PURPA) in the 1970s. Denmark and Germany were the second to implement this policy in the mid-1990s, in which the government sets the price for renewable energy and the utilities were required to purchase at a specific price. The price of this policy was determined by government and the market determines the quantity, because it is considered as a political price model. Most of the European countries like Spain, Germany and Denmark have succeeded in using this type of policy, however since this mechanism is considered to be unpredictable it makes the number of investors unpredictable. Because even if the prices are fixed to the renewable energy generators, the market plays a role and decides the level of capacity and also reduces the investors risk because the generators guarantee a fixed price with a fixed duration. The wind power industry in California has been greatly supported by the feed in tariff, for example the total capacity of wind power increased from 41.7MW in 2001 to 17,630.9MW in 2011. The policy has also increased the use of biomass energy in China, with the country has reached an installed capacity of 5.5million KW in 2010 as compared with 1.4 million Kw in 2006.<sup>3</sup> When a country is designing relevant criteria for an effective feed-in tariff, the following should be taken into consideration:

- There should be feed in tariff for each of the renewable energy technology
- There should be legal security for the beneficiaries. That is the period in which the feed in tariff is guaranteed by law and it should at least cover the life span of the technology
- There should be preferential access to the grid.
- There should be a sufficient minimum feed in tariff and a cost reduction potential.

If a country wants to develop the feed in tariff well, then there should be a regulating authority giving or granting a good playing field for all the power producers and this will give investors confidence.<sup>/3/</sup>

#### Renewable Portfolio Standards (RPS) Mechanism

The Renewable Portfolio Standards (RPS) mechanism is a quota system which requires that a certain share of electricity used by the electricity suppliers should come from renewable energy. In this case the government passes a law which bids the electricity supply companies that a specific amount of electricity shall be from renewable energy source and companies who do not abide by the law will be forced to pay a penalty. This mechanism brings or creates a market competition between generators, which will result in the best lowest price for renewable electricity. Examples are the Renewable Portfolio Standards in 21 states in USA, the renewable energy obligation in the UK and as the national MRET in Australia. Carbon trading is also an example of the Renewable Portfolio Standards policy.<sup>/3/</sup>. When designing this policy, some important issues are to be taken into consideration.<sup>/4/</sup>. They are:

- Setting the right amount
- For the system to work well the right amount or quota needs should be widely used set and backed by law. In addition, the government should define a long-term target in consideration of continuity and certainly for expectations of investors.

- Eligible technologies
 

Governments should determine which types of renewable energy technologies are eligible in the market. Therefore technologies that are closer to the market may be suitable.
- Actors under obligation
 

There should be entities and it is very important. This may include the final consumer, the retail supplier, the generators, the grid companies or the distribution companies. This is mainly according to the electricity system in each country./4/
- Design to the (Tradable Green Certificate)
 

The green certificate should be designed very carefully. Each TGC represents a certain amount of electricity generated by renewable energy sources. The designing of the certificate can contain information, such as the date of production, the renewable energy type, and a unique number.
- The penalty
 

Penalty is a very necessary mechanism in the parts of the Renewable Portfolio Standard to achieve targets. The TGC will not work if there is no penalty for failing to meet the quota. The penalty collected could be used to set up support fund for renewable energy.
- Market organization
 

TGC price is affected by variety of factors, therefore accurate or reliable information is very important for investors to reduce risk and improve profits.
- Institutions involved
 

There should be authoritative administrative institutions that should be made or given the mandate to carry the above task depending on how the energy sector of a country is designed.

In Europe, the Netherlands has been a leader among the Renewable Portfolio Standard policy.

### Net Metering

Net metering is another policy mechanism that is used to promote renewable energy in the world. This is a policy that allows consumers own renewable energy facilities to use electricity whenever needed while contributing their production to the grid. This type of policy puts the burden on the consumers who do not have the bargaining power when negotiating with utilities. The policy varies from country to country, countries like Kenya and Brazil are using this type of policy to promote their renewable energy./6/

### 3.2.2 Fiscal Incentives

#### Tax credit mechanism

Fiscal instruments have been used to promote renewable energy sources there by lowering the rate given to renewable energy system. These tax incentives are normally provided by the government to promote investment in renewable energy. Tax incentives can be capital or VAT reduction on renewable energy sources or technologies. For example, India's market in the 1990s was driven by different tax incentives thereby given 100 percent redemption of wind equipment used and another is the 5-year tax holiday. Countries like China have used tax exemption and VAT on electricity generated from wind./3/

#### Public Benefits Funds

This policy is mostly used in the United States where funds for renewable energy are raised through a system called System Benefits Charge (SBC), which is a per-kWh levy on electric power consumption. Some analysts in the energy sector have suggested that this is one of the more effective ways of promoting renewable energy development in United States./5/

## Direct Subsidies and Rebates

Direct subsidies and rebates are also one mechanism used to promote renewable energy. China has used this type of policy to boost their renewable energy. For example, in 2009 the Chinese Ministry of Finance brought out two photovoltaic power subsidy programs to boost the domestic demand. And also the solar roof program gave a 50 percent of the bidding price for the supply of critical components. Another was the subsidy program for the Golden sun demonstration which provided 50 percent of the total cost for on-grid systems and 70 percent for off-grid systems in the rural areas. In 2012 alone 5.5/W RMB was received for on-grid system and 7.00/W RMB on off-grid. Also countries like Japan, Germany and the United States subsidize capital cost of solar PV as part of their market transformation program. For example, the Japanese sunshine program provided capital subsidies and net metering for rooftop PV system.<sup>/7/</sup>. Between 1994 and 2000, the Government of Japan invested 86billion yen (\$725 million USD) which resulted in about 58,000 system installations and over 220 MW of PV capacities. In 1994 subsidies began at 900,000 yen/peak-kW (US\$5/Peak-watt) to 120,000 yen/peak-Kw (US\$1/Peak-watt) in 2001. New York and New Jersey also had a subsidy offering up to \$5/peak-watt subsidies.<sup>/5/</sup>

### 3.2.3 Public Financing

#### Grants

Some countries use grants to promote renewable energy technology. For example, Denmark in the beginning of 1979 provided rebates or grants of up to 30 percent of capital cost for wind and other renewable energy technology.<sup>/5/</sup>. This practice is also used in the United States. Countries can also give rebates or acts as loan guarantees for project developers who do not have a proven track-record because they may find it difficult to get loans from commercial banks at reasonable conditions.<sup>/6/</sup>

## Loans

Some countries give loans to promote the renewable energy usage. In the United States; loans are available to all sectors such as residential, commercial, industrial, transportation and public. The repayment schedules vary with terms of up to 10 years common. The interest rate is normally 1 percent or higher than those for conventional power. Also in developing countries such as India, China and Sri Lanka, World Bank have provided financing for renewable energy, usually in conjunction or collaboration with commercial lending. One example of the commercial lending in India is the India Renewable Energy Development Agency (IRE-DA), which in 2011 had disbursed more than US\$400 million in loans for renewable energy projects in India giving more than 1600MW of renewable power./5/

## Competitively-Bid Renewable Source Obligation

This mechanism was tried by the United Kingdom during the 1990s under its non-fossil fuel obligation (NFFO), in which power producers bid on providing a fixed quantity of renewable power, with the lowest-price bidder winning the contract. For example, wind power contract prices declined from 10p/kWh in 1990 under NFFO-1 to 4.5p/kWh in 1997 under the NFFO-4. From the experience in UK it can be said that the price for renewable energy rapidly declined./5/

There has been some negative effects of this type of mechanism in a sense that since some contracts are bid under low price, the results of the one who won the contract are unable to meet the terms of the bid and do not translate into projects on the ground. It made the UK abandon the mechanism in the fourth round of bidding in 1997. Countries like Australia (under the renewable energy commercialization), Ireland (under the alternative energy requirement program) and France (under the EOLE) have used it to promote the renewable energy./5/

### 3.2.3 Other Renewable Energy Policy Instruments

#### Site prospecting, Review and Permitting

This type of policy used to promote renewable energy is mainly used to reduce the barriers in renewable energy through resource, transmission, zoning and permitting assessments. This policy has helped the promotion of wind energy in California and India. For example, India has a large wind assessment program with more than 600 stations in 25 states providing information to project developers on the best sites which is suitable for the developing of wind.<sup>5/</sup>

#### Accelerated Depreciation

This type of mechanism to promote renewable energy allows investors to receive tax benefits sooner than under standard depreciation rules. This type of mechanism can be found in the United States where businessmen or investors recover their investments in solar, wind or any other renewable energy by depreciating then over a period of 5 years rather than the 15 or 20 years. In India the accelerated depreciation policy allows 100 percent depreciation in the first year of operation and has led to large investment in the renewable energy sectors.<sup>5/</sup>

Despite the various policies to promote the renewable energy, there are barriers facing renewable energy. The next section will discuss the various barriers in renewable energy.

### 3.3 Main Barriers in Renewable Energy

The failure of policies to support renewable energy is often attributed to a variety of barriers or conditions that prevent investors from investing into the renewable energy sector. The barriers can be categorized into three main sections.

- Costs and Pricing
- Legal and Regulatory and
- Market Performance

#### 3.3.1 Costs and Pricing

Under This type of barriers include the following will be subsidies for competing fuels, high initial capital cost, unfavorable power pricing rules and environmental externalities.

##### Subsidies for Competing Fuels

The large subsidies that non-renewable energy gets has significantly lower final energy prices, thereby putting the renewable energy at a very competitive disadvantages. For example organizations like the World Bank and the International Energy Agency put global annual subsidies for fossil fuels in the range of \$100billion to \$200billion./5/

##### High Initial capital cost

The initial cost of the renewable source of energy has deterred people from investing in renewable energy. The renewable energy technologies sometimes face high taxes and imports, and this also contributes to the high initial cost. /5/

##### Unfavorable Power pricing rules

Renewable energy sources that are fed into the electric grid do not receive full credit for the value of their power. This is because the renewable energy often has an intermittent source whose output levels will depend on the resources that is sun

or wind and therefore cannot be controlled. This may lower the price at a given time. The lower prices are in two forms: The utility only pays for the energy value that is a zero price paid for the capacity of the generation and any average price paid at peak times when power is more reliable./5/

#### Environmental Externalities

The impacts of the fossil fuels to the environment often results in a real cost to the society, in terms of human health. These environmental impacts are associated in dollar costs and are involved or included in the economic comparisons between renewable and conventional energy, investors rarely include such environmental costs in the bottom line used to make decisions./5/

### **3.3.2 Legal and Regulatory**

These barriers, refer to the lack of legal framework for independent power producers, restrictions on siting and construction, transmission access and liability insurance requirement

#### Lack of legal framework for independent power producers

In most countries power utilities still control a monopoly on electricity production and distribution. If this continues and there is no proper legal framework, the independent power producers may not be able to invest in the renewable energy facilities./5/

#### Restrictions on siting and construction

Some renewable energy sources, such as wind, solar power may face building restrictions based on height, noise or safety particularly in the urban areas and also some environmental concerns, especially the protection of birds. In some cases one needs to go through a series of authorities before permission is granted./5/

### Transmission Access

Some renewable energy resources like windy sites and biomass fuels may be located far from population, therefore a transmission access is needed. Transmission and distribution access is also necessary for direct third –party sales between the renewable energy producer and the final consumer./5/.

### 3.3.3 Market Performance

This type of barriers refers to the lack of access to credit, perceived technology performance uncertainty and risk and lack of technical or commercial skills and information.

#### Lack of Access to Credit

Investors may not be able to invest into renewable energy because of lack of collateral, poor creditworthiness or distorted capital markets. Sometimes the loan terms or payment may be short relative to equipment or investment lifetime. Some power project developers in certain countries find it difficult to obtain bank financing because of uncertainty as to whether utilities will continue to honor long-term power purchase agreements to buy power./5/.

#### Perceived Technology performance uncertainty and Risk

Since the cost-effective technologies, it may be perceived as a risk if there is a little or no experience in the technology. The lack of visible installations and familiarity with renewable energy can lead to perceptions of greater technical risk than for conventional energy sources./5/

#### Lack of technical or commercial skills and information

Project developers may lack the information or do not have adequate skills and knowledge in the renewable energy technology and this may increase perceived uncertainties and block decisions./5/.

### Liability insurance requirements

Power generators particularly home photovoltaic systems feeding into the utility grid, may face excessive requirements for liability insurance. For example, when a self-generator continues to feed power into the grid and there is no power flow from the central utility source, this can cause injury or death of the utility repair crews./5/.

Market Actors in the renewable energy sector that is the generators that generate the power, the transmitters that transmit the power and the distributors that distribute the power to the final consumers also has an impact in the developing of the renewable energy policies.

In summary, the framework for the drivers of renewable energy policies is presented in the Figure 3 below. This framework would be used for analyzing the energy policies in Ghana.

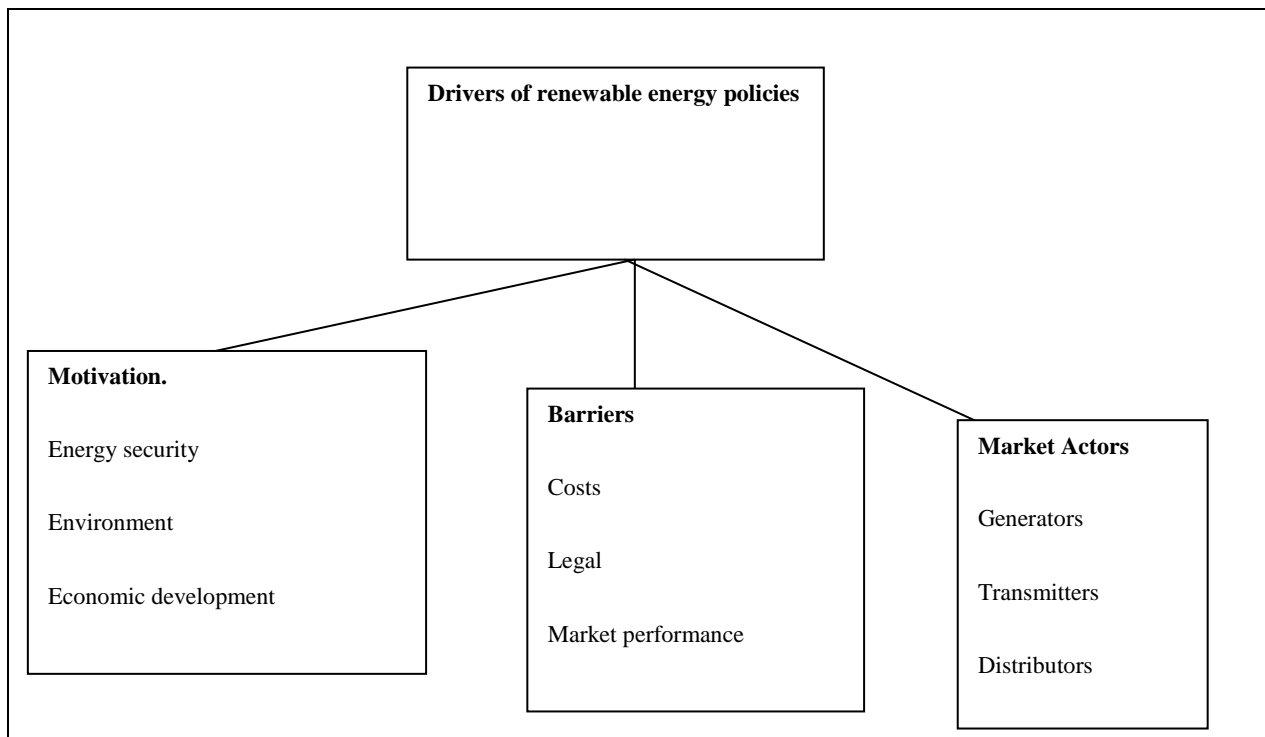


Figure 3 .Renewable energy policy framework used in this stud

## 4 COUNTRY ANALYSIS

This chapter will basically describe and compare some policies used by Germany, Cape Verde and Ghana. The policies of Germany and Cape Verde will be used to compare to Ghana to see what Ghana needs to be done.

### 4.1 Overview of the Energy Situation in Germany

The Federal Republic of Germany, as it is officially called, has a population of about 81.89 million in 2012 and covers an area of 357,021 square kilometers. The country consists of 16 states and Berlin is the capital, with a GDP growth of 0.7%, GDP \$3.428 trillion and an inflation of 2% in 2012 according to world bank./12/.

In September 2010 Germany adopted the energy concept, a comprehensive new strategy for a long-term energy pathway to 2050, following the 2011 March accident of Fukushima Daiichi Nuclear. This accident made Germany decide to phase-out the nuclear power by 2022, thereby making an immediate closure of the eight oldest nuclear plants. This decision has resulted in adoption of a suitable new policy measures and determining renewable energy as the cornerstone of the future energy of Germany. Although feed-in tariffs are expected to be cut down and the other reduction in incentives is expected to be reduced, Germany still remains one of the countries that are doing well in renewable energy policies. Currently it is the aim of the German government to use 30% of their energy from the renewable energy source in 2020, with renewable energy contributing over 17% to the electricity consumption./13/.

Wind energy is the highest share of the renewable source of energy used in Germany and it takes an over 6% share of the total renewable used. Germany has been a great success in the development of renewable energy with a 9% share of green electricity in 2002, becoming world leaders in terms of capacity of wind installed in October 2003. This was about 13,312MW, which is almost 40% of the global capacity of wind energy./13/.

## **4.2 Market actors and regulation structures in Germany**

Germany as a higher income country is implementing renewable energy policies to ensure their energy security and also their environmental concern./11/.The Federal Ministry of Economy and technology is responsible for formulating and implantation of energy policies in Germany. The operation and the expansion of the grid are normally organized by the private sector with four transmission grid operators and over eight hundred (800) distribution grid operators work to transport electricity from the electricity producers to consumers. The grid operators are all subjected to the state regulations. In order to cover for the costs of the grid expansion, the operators charge their electricity consumers a grid utilization fee. The grid utilization fees are the payments that the consumers that the electricity pay to the grid operators to cover for the cost of the grid expansion incurred by the grid operators. The fees are normally based on the amount of electricity taken from the grid (energy charge per kilowatt hour) and the total load profile of the consumer./8/.The operators of the grid will give or provide the following services for the grid utilization fees:

- The usage and provision of the grid infrastructure
- Service system for reliable grid operation
- The balancing of loss of electricity during transportation

There is also an incentive regulation system which makes sure that the grid operators run the electricity network in a safe reliable and most competitive manner in the interest of the grid users./8/

## **4.3 Policy Framework for Renewable Energy in Germany**

The Government of Germany has introduced some incentives so that they can achieve their renewable energy target in 2020.The following are some of the policy instruments used by Germany to promote renewable energy sector.

### The Feed in Tariff (FIT, Standard offer contract)

It is a policy mechanism designed to improve the usage of renewable energy technologies in the country. This is usually done by offering long-term contracts to renewable energy producers based on the cost of generation of renewable energy technology being used. Under this type of policy, a set price which is guaranteed is set by the government for different types of renewable energy power produced so as to accommodate the producers of the renewable energy power the high cost of producing the energy. In effect this policy subsidizes the renewable energy sources in order to promote its usages and this makes it cost-competitive with the fossil –fuel based technology. In the early 1990s Germany made up a policy that will promote the usage of renewable energy to produce electricity. The FIT came into force in 1991 through the Germany's renewable energy act (EEG) making the renewable energy producers sell their electricity to utilities at a fixed percentage of the retail electricity price. The FIT contracts are set in 20 years contracts to cover the cost of renewable energy. This also made the producers of the energy from renewable sources guarantee access to the grid and the operators of the grid were obligated by law to buy the power which has resulted in an increase of the renewable energy production. For example, in 1990 the percentage growth of total renewable energy production was 3% but had increased from 3 to 20% in the mid - 2011, while in 2009 the electricity generation which was supported by FIT grew from 38.5TWH in 2004 to 75TWH. In view of how the FIT policy has increased the use of the renewable energy in Germany, it has now added a new FIT option which allows producers of the renewable energy receive a variable adder premium in place of fixed price tariff when they sell electricity at the market price. This new addition is to make the producers become more comfortable with the electricity markets and ultimately increase their participation in the wholesale market place./14/. The Act was based on the following core principles:

- Priority access for renewable energy to the grid.
- Priority transmission and distribution.

- Obligation of grid operators to produce the electricity produced from renewable energy
- Fixed price(tariff) for energy kilowatt-hour produced from renewable energy for 20 years
- Tariffs are differentiated by source and size of the plant.

Below is the feed in tariff rate of the various renewable energy technologies (see Table 6)

Table 6 the feed in tariff rates of the various renewable energy in Germany./2/

Type of renewable energy	Rate
Hydro	Depending on nominal generation capacity of the individual plant:
	Up to 5MW:ct6.3/kWh-ct12.7/kWh
	More than 5MW:ct3.4/kWh-ct5.5/kWh
	Degression:1 percent p.a
Geothermal	Ct2.40/kwh
	Degression: five percent p.a
Wind(onshore)	Wind turbine commissioned in 2012:ct4.87/kWh
	First five years:basic increased feed in tariff of ct8.93/kWh
Wind(Offshore)	Basic 3.50ct/KWh
	First 12 years:ct15/kWh(extended depending on water depth and distance from shore)
	Degression:0 percent p.a until 2017,7 percent p.a from 2018 onwards
Solar	Depending on the amount of nominal generation capacity:ct11.02/kWh to ct15.92/kWh as of April 2013

#### Sales tax/energy tax/

The sales tax is another renewable energy policy used by the Germans. This policy aids in reducing the related consumption taxes(value added tax or the energy tax),thereby making investors and individuals invest in the renewable energy since doing so the tax benefit of depreciation can be maximized by the equity provider./6/

### Capital subsidy/grants or rebates

Another policy used by Germany to boost their renewable energy. The repayment period of loans and interest rate of the overall cost of renewable energy is very expensive and therefore has huge impacts on the project. Some projects without track proven record often have difficulties in getting commercial loans at favorable conditions, therefore the government of Germany offer capital subsidies, rebates and low interest loan. This can be provided by the state-owned banks or through subsidies to commercial banks./2/.

### Heat obligation mandate

Another policy that the Germans have introduced is the heat obligation mandate. This policy allows home owners obliged to cover parts of their heat demand by renewable energy in their new buildings. It can be all the forms of the renewable or combination of them, but if one decides not to use renewable energy, one can take other climate changes mitigation measures, thereby improving the insulation of their buildings, or obtain heat from district heating system or use the heat from a combined heat and power generation (CHP)./14/.The share of the renewable energy can be covered depending on the energy source used, namely:

- ✓ Solar radiation must cover at least 15%.
- ✓ Biogas must cover at least 30%.
- ✓ At least 50% for all other renewable.

Germany also has introduced the following renewable energy policies to boost their energy situation: Investment or production credits, public investment, biofuel obligation and reduction sales./18/

## 4.4 Overview of the Energy Situation in Cape Verde

Cape Verde is located between the equator and the tropic of cancer at 15°02 north and 23°34./9/.It has a population of 494,400 people as at 2012 with a GDP growth of \$1.827 billion./12/.

The primary energy resources for Cape Verde is wood, but it is insufficient due to the poor rainfall and the poor quality of soil. The country gets its energy supply mainly from four sources, which are the petroleum products, butane gas, firewood and wind. Fire wood accounts for 57% of household energy needs. Each island in Cape Verde operating on its own local power station and electric grid. In 2010 alone, the access to electricity attained a rapid growth which made the nation achieved a percentage of 95 national coverage and since the 90s, Cape Verde has been extending their electric grid through the rural electrification programme to most of the remote areas and these has covered almost 100% of the urban area. The country has the largest power station located at the capital city with an installed capacity of 31MW, followed by an installed capacity of 18.3MW and then 9MW. The country is mainly depending on the imported petroleum products and diesel for power generation and this has made electricity production in the country remain deficient. Cape Verde has a high electricity tariff, about 0.25euro per KWH and this is affecting the economic development in the country./10/.

As in 2010, the total installed capacity of energy was 116MW with diesel fuel taking 72%, wind 22% and solar power 6%. In view of these, the country has launched a plan to reduce the dependence on imported fossil fuel for energy production, thereby increasing the energy production from renewable sources. The country intend to achieve a target of 50% of renewable energy in their mix by 2020 through policies and government support program./10/.

#### **4.5 Market Actors and Regulation Structures in Cape Verde**

Cape Verde as a lower middle income country is implementing the renewable energy policies to ensure their energy affordability and for poverty concerns./11/.

Cape Verde wants to achieve a 50% of renewable energy in their energy mix by 2020 and in view to achieve this objective, the country has defined a strategic plan (Cape Verde Energy Policy) for the energy to implement it the coming year with the following objectives: /17/.

- To centralize the power generation in each island (that is one power station for each island)
- To reinforce the electric grid and cut technical and non-technical losses from 30% in 2008 to 24% in 2010 and 20% in 2012
- Promote the private sector participation in electricity generation.
- To promote the development of renewable energy projects in Cape Verde, to achieve 25% renewable energy penetration in 2011 and 50% in 2015 , and for one island(Brava) 100% penetration in 2020 and also
- Restructure ELECTRA to become technically and financially viable to be able to meet the shareholders obligation.

The table below summarizes the responsibility of the various actors in the energy sector in Cape Verde.

Table 7 Summary of the various actors in energy sector of Cape Verde

<b>Institution</b>	<b>Responsibilities</b>
General direction of industry and energy	Formulating and implementation of policies
Agency for economic regulation	For regulating
National electricity and water company	Production and distribution

#### **4.6 Policy Framework for Renewable Energy in Cape Verde**

For Cape Verde to achieve their target of reducing their dependence on imported fossil fuel for energy production and also to reach their renewable energy target by 2020, the following policies has been adopted by the Government.

#### Tax exemptions/capital subsidy

The article 16 of Cape Verde law number 20/VII/2007 gives or allows the import of renewable energy equipment, such as solar panels, wind generators with tax exemptions. The purpose of this policy is to increase the participation of the private sector in the energy sector./9/

#### Capacity building

The Government of Cape Verde is using capacity building to increase awareness or usage of renewable energy through the University of Cape Verde to increase national capabilities. Through capacity building individuals are getting to know the relevant of renewable energy. /9/.

#### Credit/production credit or loans

Cape Verde is using loan and credit to develop their renewable energy sector .For example, the solar photovoltaic project at Santiago and Sal which are 5MW power and 2.5MW respectively, was financed by a credit loan from Portugal./10/.It is expected that the annual production will be 8.120MWh from Santiago and 3.960MWh from Sal./9/.Also through loans from Portugal there has been micro-generation of solar photovoltaic at public buildings installing at 150KW power./10/

#### Public –Private Partnership (PPP)/competitive bidding

Through this type of arrangement with the private sector such as InfraCo and the Government of Cape Verde, the wind power project at Santiago, Sao Vicent, Sal and Boavista have been installed giving about 25.5MW of power. It is estimated that between 80-110Gwh/year will be the annual generation of the project which represents about 25% of electricity production from 2001-2015, which will also save the country from importing about 20000 tons/year of fuel and 20000 tons/year of CO<sub>2</sub> emission will be avoided./10/

### Renewable energy assessment plan/site prospecting

The government has used this type of policy to develop the energy sector. For instance, through this policy, the assessment for wind, solar, hydro and geothermal power for the five main islands in Cape Verde (Santiago, Sao Vicente, Sal, Sao Antao and Fogo) has been made, making it easy for the government to identify the best location for each renewable energy source so as to boost investors' confidence. Those areas will be reserved as a renewable energy development zone (ZDER) by law. Through the renewable energy plan for Cape Verde, it has identified some high potential of renewable energy sources such as wind which can generate 220 MW, solar with an estimation of 4,7GWh/year, geothermal generating 22, 3 Gwh/year at Fogo island, and waves and tides energy generating 14,2Gwh/year./10/.

Cape Verde has introduced the following renewable energy policies to also boost the sector: Net metering, reductions in sales and energy production payment./18/.

### **4.7 Overview of the energy situation in Ghana**

Ghana currently has an energy supply need of around 2200 MW. The country relies heavily on the Akosombo power energy which supplies about 1,020MW of energy, followed by Bui Dam, Aboadze thermal plant and Takoradi thermal power plant which produce 400MW, 360MW and 330MW respectively. There is also a thermal plant in Kpong which produces 160MW of power. Some independent power producers like Sunon Asogli and CENT producing 200MW and 126MW power respectively. Ghana's first solar plant at Punga in the Upper East Region of Ghana supplies 2MW of power to the national grid giving a total of 2,272MW of combined electricity supply./15/

### **4.8 Market Actors and Regulation Structures in Ghana**

Ghana as a lower middle income country implements the renewable energy policies to ensure their energy affordability and poverty concerns./11/.

The Ghana national energy policy of 2010 and the strategic national energy plan 2006-2020 are the two important frameworks policies in Ghana to develop support for the renewable energy technologies. The strategic national energy plan 2006-2020 was aim at contributing to the development of a well-functioning energy market and to create a pathway for the sector until 2020 and also considered the renewable energy as an important pillar in Ghana's energy mix. The Ghana national energy policy of 2010 is the most recent policy framework which is forecast on renewable energy development. In that policy it suggested that the country should focus more on mini hydro because they have identify more than twenty site where mini hydropower can be built. The renewable energy service program (RESPRO) and the Ghana Energy Development and Access Project (GEDAP) are programs that the Ghanaian Government in cooperation with international organizations have develop this program with the aim of installing small PV appliances in households and public buildings./6/.In 2020, Ghana wants to achieve their policy target of 10% renewable energy usage in their total amount of energy used. The table below shows the various actors and their role or responsibility in the energy sector in Ghana.

Table 8.The various actors in Ghana's energy sector and their roles

<b>Institution</b>	<b>Responsibility</b>
Ministry of energy and petroleum	Formulate, implement ,monitor and evaluate energy sector policies
Volta river authority and Bui power authority ,IPPs	Power generation
Ghana grid company(GRIDCo)	Power transmission
Electricity company of Ghana	Power distribution(southern sector)
Northern electricity company(NEDCo)	Power distribution(northern sector)
Energy commission of Ghana	Licensing, policy advisor
Public utilities regulatory commission	Setting of tariffs, quality monitoring consumer protection

#### 4.9 Policy framework for Renewable Energy in Ghana

In order for Ghana to achieve their renewable energy policy target in 2020, the government has introduced some policies or measures to reach that target. Below some policies introduced by Ghana are introduced.

##### Feed in tariff

The Renewable Energy Act 2011 introduces the feed in- tariff and also provides an establishment of renewable energy fund. This fund will be used to develop renewable energy sources and is also used to pay for promotion of renewable energy. With the extensive hydropower and biomass generation capacity this act is intended to stimulate a significant increase in the country solar, biomass and wind installed capacity. The feed -in tariff policy was introduced in Ghana on Septem-

ber 1<sup>st</sup> 2013 after being approved on August 28 in accordance with the country's Renewable Energy Act 2011. This act imposes some form of minimum amount of renewable energy purchase quotas on the distribution companies. /6/

The utility service in Ghana is to be regulated by the public utilities regulatory commission (PURC) which was set up by the Act of Parliament, Act 1997 (Act 538). The PURC is an independent body which currently regulates the tariff and it has responsibility to set the utility tariffs in Ghana. The Renewable Energy Act 2011, Act 823, which gives the regulatory body PURC the responsibility to set the fee in tariff (FIT) as the pricing mechanism for renewable energy technology in Ghana. The FIT scheme consists of the RE purchase obligation I and II, the rate of feed in tariff and a connection to transmission and distribution system. /16/

Under the renewable energy purchase obligation I, the bulk customer or the electricity distribution utility shall acquire a specified percentage of its total purchase of electricity from RES and that percentage shall be determined by PURC in consultation with the energy commission of Ghana whereas the obligation II the PURC takes also into account the following. /16/.

- Which technology is being used to generate power for renewable energy sources.
- The assurance of the financial integrity of the public utilities and
- The cost of the net effect of the renewable energy on the end-user tariff.

Under the feed-in tariff rate settings the section 5 of the Act 832 gives the to approve

- The grid connection charges
- The rates chargeable for wheeling of electricity from RES and
- Rates chargeable for the purchase of electricity from RES by public utilities.

But when the rate has been set by the PURC, they should take into consideration the following objectives under the Act.

- The interest of the customer
- The interest of the investor
- The competition between the utility companies
- The country economic development
- The best use of the natural resources
- There should be a reasonable cost of production of the service
- A rate of return which is reasonable
- Where the generation facility is located

As per the renewable energy Act, the FIT rate fixed for the electricity will last for a period of 10 years and it is subjected to review for every two years./16/

Table 9. FIT rate for the various renewable energy technologies./16/

Renewable energy technology	FIT effective 1 <sup>st</sup> September 2013 (GHp/Kwh)
Wind	32.1085
Solar	40.2100
Hydro $\leq$ 10MW	26.5574
Hydro(10MW $\leq$ 100MW)	22.7436
Landfill gas	31.4696
Sewage gas	31.4696
Biomass	31.4696

### Tax exemption

Ghana has introduced these fiscal incentives to all renewable energy equipment. Investors or individuals are not to pay tax on any renewable energy equipment in Ghana. This intends to boost the confident of investors and individuals how have the mentality that renewable energy technologies are very expensive. Ghana has also introduced the following policies to boost the renewable energy sector: biofuel obligation, heat obligation, public investment, renewable energy portfolio, tradable REC, heat obligation and reduction in sales./18/.Below is the summary of the various renewable energy policies of the three countries with the energy drivers.

Table 10. The type of policies the three countries have and their policy drivers

COUNTRIES	Motivation for renewable energy	POLICY
GERMANY	<i>Energy security concerns and environmental concern</i>	<ul style="list-style-type: none"> <li>➤ Feed in tariff</li> <li>➤ Investment or production tax credit</li> <li>➤ Capital subsidy, grants or rebate</li> <li>➤ Heat obligation mandate</li> <li>➤ Biofuel obligation mandate</li> <li>➤ Public investment or loans</li> <li>➤ Energy production payment</li> <li>➤ Reduction in sales, energy ,VAT</li> </ul>
CAPE VERDE	<i>Economic developing and energy affordability</i>	<ul style="list-style-type: none"> <li>➤ Tax exemption/capital subsidy</li> <li>➤ Capacity building</li> <li>➤ Production credit/loans</li> <li>➤ Public-private partnership/competitive bidding</li> <li>➤ Renewable energy assessment plan</li> <li>➤ Net metering</li> <li>➤ Energy production payment</li> <li>➤ Reduction in sales</li> </ul>
GHANA	Economic developing and energy affordability	<ul style="list-style-type: none"> <li>➤ Feed in tariff</li> <li>➤ Tax exemption/capital subsidy</li> <li>➤ Biofuels obligation</li> <li>➤ Public investment</li> <li>➤ Renewable energy portfolio</li> <li>➤ Tradable REC</li> <li>➤ Heat obligation</li> <li>➤ Reduction in sales</li> </ul>

As seen in the table above Ghana has some policies which are also implemented by Germany even though they have different drivers. Those policies are the feed-in tariff, capital subsidy, biofuels obligation, public investment, reduction in sales and heat obligation.

Similarly, Ghana and Cape Verde have two common policies that they are both implementing: capital subsidy and reduction in sales even though they have the same drivers. Also it can be deduced that Germany and Cape Verde also have three common policies that they are implementing: production tax credit, energy production payment and reduction in sales. The next section of the study will discuss the various barriers facing Ghana.

#### **4.10 Barriers Facing Ghana in the Renewable Energy sector.**

The barriers discussed here are based on an interview conducted by the researchers with one of the experts in renewable energy at the Ghana Energy Commission.

##### **Renewable expensive and expensive exchange rate fluctuation**

The initial capital to set up renewable is expensive and the exchange rate is very expensive therefore most investors do not want to invest their money into renewable energy. This has made the renewable energy sector in Ghana not growing.

##### **Transmission access or connection**

Although Ghana has an electrification project which intends to boost the transmission access to the grid, there still is a lot of deficit on the transmission access. Due to this, most investors are not willing to invest in the renewable energy sector since they will incur more money to transmit their power to the nearest transmission grid and that will result in more power lost and very expensive power to the customer or end user. Currently Ghana does not know how much the whole grid can take, and therefore makes it difficult for investors who want to construct huge renewable energy project to come and invest.

##### **Lack of education on renewable energy**

Ghana does not promote the benefits that renewable energy can bring to the country power sector even though the country has a potential in renewable energy sources, such as solar and biomass. Ghana mostly base its energy resource on fos-

sil fuels and people do not have confidence in renewable energy technology that it will work as well as the fossil fuel. This has made investors find it difficult to invest into the renewable energy sector since investing in it will not give them any profit.

#### Land Access

Land access in Ghana has become one of the major headaches of investors in the renewable energy sector. Investors do not have access to land and therefore will have to negotiate with land owners on land where the project can be built. Most of the lands is agricultural lands and therefore securing it becomes very hectic work. Therefore some investors negotiate for land only after getting the license to operate the renewable energy in Ghana.

#### The structure of the energy sector

Another major problem facing Ghana is how the energy sector is structured. Ghana has only one institution that transmits electricity to about 25 million Ghanaians and two distribution institutions and three power generation companies. This in effects does not bring competitions among the various institutions since they are not plenty. It also brings much burden on those institutions since they do not have the capacity to do the work very well.

#### Lack of infrastructure

One of the problems facing Ghana is the lack of infrastructure. In view of the deficit Ghana has, it is very difficult for investors to invest in renewable energy, especially biomass and wind. For instance, when an investor wants to invest in the wind project, one needs to know the road infrastructure or the quality of road network since a good road network is needed to transport the equipment to the site. The next chapter will discuss briefly the analysis of the various renewable energy policies that Germany and Cape Verde are implementing and those in the world are compared to Ghana`s policies.

### Assistance from Government

The Government of Ghana is more interested in the non-renewable energy sources, and therefore does not focus much on the renewable energy. This is also an impediment in finding investors for renewable energy. Because of these barriers investors find it difficult to invest since the government does not put much interest in the renewable energy. Also although Ghana has passed the law on tax incentive for all renewable energy items but the government institution responsible to ensure that people do not collect tax on renewable energy items are not doing their job therefore investors end up paying taxes on renewable energy items.

### Assistance from various banks

Securing loans from various banks for a renewable energy project is difficult to and even if you manage in it, the interest rate is too high for individuals to bear and therefore do not want to go in for renewable energy.

## 5 ANALYSIS OF RENEWABLE ENERGY POLICIES OF GERMANY AND CAPE VERDE AGAINST GHANA

This chapter will analyze the various renewable energy policies in the world and compare that of Germany and Cape Verde against Ghana and give recommendations.

Table 11. The various renewable energy policies against the three countries./2/.

POLICIES	COUNTRIES		
	CAPE VERDE	GHANA	GERMANY
FEED IN TARIFF	x	✓	✓
RENEWABLE PORTFOLIO STANDARD	X	✓	X
NET METERING	✓	X	X
BIOFUELS OBLIGATION	X	✓	✓
HEAT OBLIGATION	X	✓	✓
RENEWABLE ACCESS PLAN/SITE PROSPECTING	✓	X	X
CAPITAL SUBSIDY OR TAX EXEMPTION	✓	✓	✓
INVESTMENT,OR PRODUCTION TAX CREDIT	✓	X	✓
REDUCTIONS IN SALES,VAT	✓	✓	✓
ENERGY PRODUCTION PAYMENT	✓	X	X
ACCELERATED DEPRECIATION	X	X	X
PUBLIC COMPETITIVE BIDDING/PPP	✓	X	X
Capacity building	✓	X	X
Public investment	X	✓	✓

### **5.1 The Analysis of Germany`s Policy against Ghana`s Policy**

Germany as a higher income country has introduced some renewable energy policies which will help them to deal with the environmental issues that the fossil fuels bring to the country and also to give them energy security. Therefore all the renewable energy policies are geared towards that concern. It can be seen from Table 11 above that Germany and Ghana have lots of common policies even though both countries have different reasons for implementing the renewable energy policies. These policies that are common to both Germany and Ghana are: feed-in tariff, heat and biofuel obligation, public investment, capital subsidy and reduction in sales. Although both countries are implementing the feed-in tariff, the policy duration are not the same, in Germany it is for 20 years, in Ghana`s for 10 years and is subjected to be reviewed every two years according to the law.

### **5.2 The Analysis of Cape Verde`s Policy against Ghana`s Policy**

Cape Verde as a lower middle income country has implemented some renewable energy policies which will help them deal with their economic development. Ghana on the other hand, is also implementing renewable energy policies that will help their economic development but unfortunately Cape Verde and Ghana has only two common policies even though both countries are considered as lower middle income country and also have the same purpose of implementing the renewable energy policies. Those policies are capital subsidy and reduction in sales.

From the study, it was found out that Cape Verde is implementing some major policies that Ghana can take a clue from that. For example the renewable energy access plan policy is one policy that Ghana can learn. This type of policy gives investors confident because the country has all the site location suitable for various kinds of the renewable energy sources. Since land access has been one of the major problems the investors are facing, it would be better for Ghana to take a closer look at this type of policy so that the country can have the entire site suitable for the different kind of the renewable energy sources.

Again Cape Verde as a lower middle income country is implementing net metering, competitive bidding, capacity building, production tax credit and energy production payment are all policies that Cape Verde are implementing while as Ghana as a lower middle income country and with the same purpose of implementing the renewable energy policies do not have those policies. Ghana can also take a clue from those policies and see if Ghana can implement those policies.

Accelerated depreciation is the only policy that none of the three countries are implementing from the table above.

### **5.3 Recommendation**

Ghana as a lower middle income country has eight renewable energy policies as the same Cape Verde which is also a lower middle income country, but the two countries have only two common policies. Ghana should also be considering implementing those policies that are not implemented by the country but Cape Verde are implementing. Those policies are renewable energy access plan, net metering, competitive bidding, capacity building, production tax credit and energy production payment.

One of the barriers facing Ghana is the lack of access to land. Therefore Ghana should be considering implementing the renewable energy access plan. This will give investors some relief on which site is suitable for the various renewable energy sources and also the Government will have the authority on the land suitable for the renewable energy sources. Again, there should be education on renewable energy so as to make people aware the benefits of renewable energy. The Government should start using renewable energy as a source of power at the various government schools and this will also help to educate the students on the benefits of renewable energy. Investors should also be thinking of investing into the transmission access of the country since the Government alone cannot do that. When the GDP of the a country increases the renewable energy shares also increase, therefore Ghana should also be thinking of increasing the GDP so as to

improve the renewable energy. The Government institution responsible should see to it that those who produce their renewable energy are exempted from taxes to encourage investments.

## 6 CONCLUSION

During the study it was found out that Ghana is implementing some renewable energy policies such as feed in tariff, biofuel obligation tax exemption, heat obligation, public investment, renewable energy portfolio, tradable REC and reduction in sales but it was also found out that if Ghana wants to achieve the target of 10% of renewable energy in their energy mix then they have to take a clue from what Cape Verde is doing in their renewable energy sector. Cape Verde is considered as a lower middle income country the same as Ghana is and also has the same purpose of implementing the policies. The policies that Ghana can learn from Cape Verde are the net metering, renewable energy access plan, capacity building, production credit, competitive bidding and energy production payment. Although Ghana and Germany do not have the same reason for implementing the renewable energy policies, they are both implementing the feed- in tariff but Ghana can increase their duration to twenty years instead of ten years so as to give investors confidence of getting their investment back. Again from the study it was found out that Ghana is facing some major barriers and if these barriers are not looked at it will affect the country's chance of reaching the target in 2020. These barriers are transmission access ,no education on renewable energy, land access, the structure of the energy sector and lack of infrastructure. If Ghana wants to improve upon the usage of renewable energy then the Government should make it a point to let some of the state institutions especially schools, hospitals and other institution to start using renewable energy as their source of energy.

During the study, only one person was interviewed at the Ghana Energy Commission but due to lack of resources, it was not possible to interview other major stakeholders in the energy sector in Ghana to see what their problems were. This could had an impacted on the results. Nevertheless, one could also make it a point to consider interviewing the other major stakeholders in the energy sector in Ghana. This can intend affect the result of this study.

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