Journal of Energy Technologies and Policy
ISSN 2224-3232 (Paper) ISSN 2225-0573 (Online)
Vol.6, No.8, 2016

Business Energy Needs in Ghana by 2020 and the Role of Solar Energy

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Abstract
The interest of this research is to explore business energy needs in Ghana by 2020. To readers, energy in this paper is referring to energy in the form of electricity. The main reason behind this study was to look at how businesses in Ghana can explore renewable sources available in meeting their energy needs since the demand for energy in Ghana is more than supply, and businesses have to rely on the use of generator sets as alternative. The scenario model developed by Peter Swartz (1991) was used to build three scenarios for solar. To complement the scenarios questionnaires were distributed to companies and individual consumers for their views on their energy needs. The study adopted the approach of scenario to build three scenarios for solar as the energy source that is sustainable, feasible, and reliable option for business in Ghana by 2020. The study identified solar as sustainable, reliable and feasible option for business in Ghana out of the renewable energy source available. The findings from the study revealed that solar has great potential for businesses and the country at large but little attentions has been given to renewable energy source in Ghana.
Keywords: Business, Solar Energy and Ghana

1.0 Introduction

The development of every country both developed and developing greatly depends on energy which drives the economy. Countries are making efforts in their energy sectors to serve as the backbone to drive developments. Some countries are looking for long term sustainability of energy, and various forms of producing efficient energy for development. Ghana is no exception, and especially when it wants to attain a middle income status by the year 2020. Undoubtedly, for Ghana to achieve such vision it needs a strong backbone of energy to propel such vision. However, little attentions are seen in the area of energy which is the drive for development. Instead, there are huge social infrastructural developments taking place in the country and several economic strategies been implemented by the government to reduce poverty, all in the direction of achieving a middle income economy by 2020. In recognition of the need to spur economic growth and reduce poverty, the Government of Ghana initiated the Ghana Poverty Reduction Strategy (GPRS) in year 2001 as a framework with the requisite strategies to achieve the twin objectives of poverty reduction and economic growth. In the medium to long term, the Government has launched a series of programmes to transform the country's economy from the low-income status of less than US $400 per capita in 2000 to a middle-income status with US $1,000 per capita by end of the next coming decade. On the priority list of government is the development of the private sector to facilitate the achievement of the vision of Ghana. Government introduced "golden age of business" to serve as the propellant from which economic growth is fuelled and thereby improving the worth of the people. In line with this, the Government has created a special Ministry called the Ministry of Private Sector Development, with a challenge to facilitate the development and growth of a competitive and vibrant private sector and also to help reduce the cost of doing business in Ghana. This move by the government was well received by multinationals and local companies, which saw the presence of multinationals in the telecommunication and financial sector. Also, some local companies expanding vigorously as a result of government support.

The rapid economic development agenda by the government requires the injection of large amounts of energy. There is empirical evidence from both developing and developed economies shows a close correlation between the rates of economic growth and energy demand. Other statistics exist that show however that the rate of energy demand growth in the developing economies especially in Africa with respect to economic growth rates are far higher than the norm. The energy commission in Ghana in July, 2006 indicates that the rate of growth of Ghana's Gross Domestic Product (GDP) since 1985 has been between 3.5 – 6 percent, yet over the same period, the demand for electricity had grown at the rate of 10 – 14 percent per annum

However, the population of Ghana is also on the increase. Based on data released by the Ghana Statistical Services, the corresponding number of households and urbanizations would rise from 3.7 million households and about 34 percent urban share in 2000 to about:

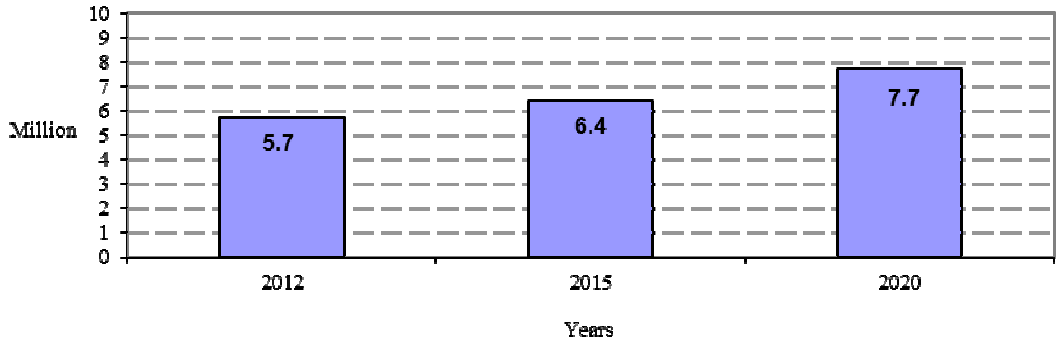

Figure: 1.1: Projection of households and urbanizations in Ghana
Source Ghana Statistical Service, 2006

As Ghana drive towards it developmental agenda, it is very important that it has a good energy plat form to drive these developments. According to the energy commission of Ghana the major sources of energy are hydro power (Electricity), oil, and biomass (firewood for domestic use). The business sector depends mainly on electricity for their energy supply. However, the main source of electricity supply is through hydro-power and thermal (Energy foundation, Ghana). There are currently two main dams (Akosombo and Kpong) built for the supply of electricity and an ongoing construction of the Bui-dam to support the existing once. Even though Ghana has potentials for other sources of energy, apart from the above listed the presence of the other sources of energy in terms of usage has not been felt within the economy.

The huge developments taking place from government, business and increase in population requires a strong energy back bone of the country to enhance growth. The question one may pose is how will businesses grow if the current energy shortage of energy supply continues?

The study is therefore interested in looking at how businesses in Ghana can meet its energy needs by 2020.

2.0 Problem Definition

In Ghana, over the last decades the demand for energy in the form of electricity has gone up more than supply. Ghana's energy challenge is manifested in her expanding economy. Other factors contributing to this are the growing population which is 23 million and is projected to reach about, 29 million in 2015, 31-32 million by 2020, expansion of business, the presence of multinational companies, and inefficiencies in the supply of energy. At present, the major sources of energy in Ghana are hydro-power (Electricity), thermal plants, oil, and biomass (firewood for domestic use). The business sector depends mainly on electricity for their energy supply. However, the main source of electricity supply is through hydro power. There are currently two main dams (Akosombo and Kpong) and an ongoing construction of the third dam to support the existing ones to supply electricity. Interestingly, the two main dams depend on one water source which is the Volta Lake. The ability of the two dams to generate hydro-power greatly depends on the inflow of water into the river at a maximum level. This requires increasing rainfall in the catchment areas of the Volta Lake to be able to generate electricity for the country. Meanwhile, with the issue of changing climate, Ghana's rain pattern of six months of rain and six months of sun has changed. Over the last decade, the six months of rain has changed to 3-4 months of rain. Causing decreasing levels of the Volta Lake and consequently limiting required hydro power for the country. On the other hand is the issue of maintenance. Since the commission of the Akosombo and Kpong dam in 1966 and 1982 respectively, major maintenance exercise was carried out in 1989 which was finished off in March 2006 (Volta River Authority). This attempt made a significant increase in the generating capacity output of hydro power from 912mw to 1020mw which is still not meeting the current electricity demand of the country. The Ghanaian economy has been experiencing shortage of electricity supply due to limited rainfall, incorrect water management, maintenance, etc. As a result, businesses have to rely on generator sets as an alternative to provide them with electricity. This has caused huge problems to companies, since they incur extra cost in fueling, and maintenance. This leaves those businesses who cannot afford to depend on the existing unreliable electricity supply which leads to most of them existing business.

3.0 Research Questions

The following questions are addressed by the study.

1. What are the various alternative energy sources available to Ghana, and how feasible are they in terms of it development, implementation cost, and commercialization?
2. Will other sources of energy help in complementing the existing sources or should Ghana concentrate

on the expansion of the existing sources?
3. Is there and what will be the markets for commercialization of other sources of energy?
4. What is the impact of electricity supply shortage on businesses?

4.0 Theoretical Framework

The main theoretical framework of the study was based on scenario planning model developed to help explore different alternative of which the future unfold. This gives the opportunity for strategic planning in meeting future issues. An energy scenario was created with a range of possible outcomes that are grounded within system dynamics of the energy system. Combining stories and models, the scenarios qualitatively explored diverse contexts of issues that having direct relationship with energy demand. The study adopted the model developed by Peter Swartz (1991) developing scenario as the main framework.

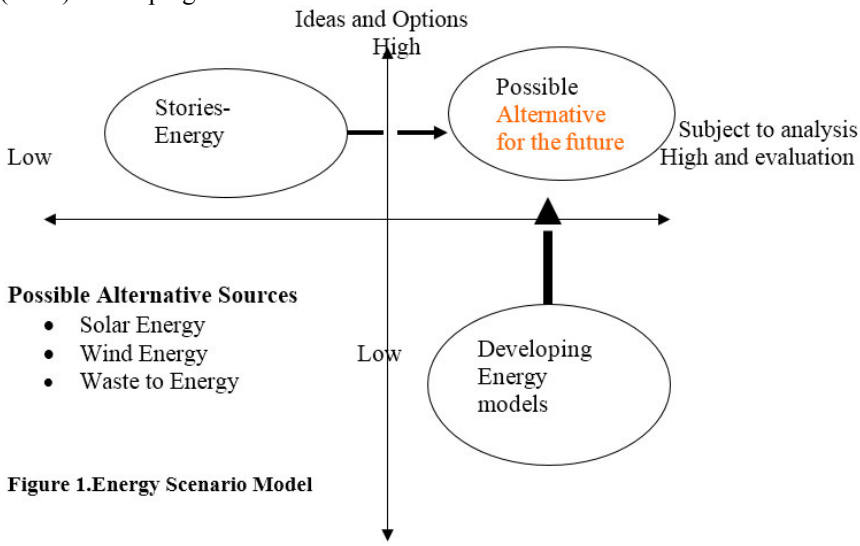

Figure 1.Energy Scenario Model

The research adopted the six- steps introduced by Peter Swartz, as the main frame work to develop scenarios for businesses energy needs in Ghana by 2015. The table below indicates the steps:

Table 1 Six steps of developing scenario

1. Defining a focal issue and strategic question
2. Listing important force in the environment, political, socio-economic and ecological environment
3. Evaluate forces by importance and uncertainty
4. Select scenario logic
5. Develop scenario around critical uncertainty
6. Evaluate the implication of the scenario

Source: Peter Swartz 1991

The model by Peter Swartz is not only meant for the development of energy future planning needs. The model also helps to trigger strategic thinking for managers to be able to prepare for the future. To enable managers not to be cut unaware, so the model makes managers aware of a broader critical development issues. Organizations that have installed scenarios practice into their deliberations include, the Royal Dutch/Shell Group, Pacific Gas and Electric, Motorola, and Global Business Network. These companies have managed to anticipate difficult times and opportunities that have caught managers of other organizations unawares. The main reason for working with scenario models is that it offers broader insight of strategic thinking issues. The beauty of scenarios is that it requires a lot of creativity to be able to tell the stories which are coherent and logical about the future.Also, emerging countries like China, and India, have applied this model successfully in planning for it energy needs. The study drew lots of knowledge from these countries and companies in building scenarios for business energy needs. Apart from this model other computerized decision support systems software have also been developed in addressing the long term view of energy planning for countries. The software was developed at the Stockholm Environment Institute – US called (LEAP) - Long range Energy Alternatives Planning. The LEAP is applied as the next step to scenarios which focus on conditions of implementation and developments. But for the purpose of this study, only the model by Peter Swartz model was adopted because the study was not focusing on implementation and development issues.

5.0 Literature Review

Role of Electricity in Business

There is a symbiotic relationship between electricity and business. Energy supplies have a significant impact on

economic activities (Velasquez and Pichler, 2010). This is because it is used for varied purposes ranging from production, storage, powering of office equipment and product display. Consequently, the use of electricity serves as input for production. This makes electricity an essential commodity for all industry types-manufacturing, service and distribution. Various sectors of the economy such as manufacturing and transport use enormous amounts of electricity (Haanes et al., 2011) for operation processes including storage, production. It is a critical resource needed to make products. In this respect, electricity as a "transformed unity" serves as a commodity. Consequently, suppliers of electricity have a strong influence on the buying organisation's ability to gain a competitive advantage and provide solutions to their clients. This is because operators of SMEs have a high dependency on electricity as a standardised input, without it they cannot produce to satisfy their customers. This dependency on suppliers therefore explains the value of electricity to SME operations along two trajectories namely: supply risk and reliability of supply (Haanes et al., 2011)

5.1.1 Supply Risk

The supply risk trajectory is a critical factor along the perception of electricity as a resource for the operation of SMEs (Halldorsson and Svanberg, 2013) In a report by UNIDO (2009), it was revealed that, in spite of the abundant resources Africa is endowed with, it still struggles with supply challenges in electricity. According to the UNIDO (2009) finding, only 26% of households have electricity making Africa the lowest in electricity penetration in all the continents. UNIDO (2009) reported that, an estimate of 547 million people in Africa lack access to electricity. Many reasons have been put forward by researchers and practitioners as the causes of such a predicament. For instance Mkhwanazi (2003) and Olumuyiwa and Mnse, (2008) have catalogued the following as the causes of poor access to electricity in Africa:

- Poor performance, resulting in poor quality of supply and service and an inability to meet growing electricity demand
- Insufficient managerial and technical skills to do the job Inability of the African country's government to fund expansion or refurbishment, or to attract private sector investment into the power sector
- Lack of maintenance of the existing facilities due to inadequate finance/technical leading to reliability problems
- Inappropriate tariffs, often resulting from political interference, with tariffs below marginal costs Poor governance or unstable governments due to regional and ethnic conflicts
- Poor economic status of African states especially south of the Sahara Inadequate revenue collection mechanisms, and therefore credit unworthy businesses
- Inadequate rainfall which causes power rationing

All these have culminated in poor supply of electricity with its attendant effects on the operations and performance of SMEs.

5.1.2 Reliability

Reliability of electricity supply is another trajectory that is closely linked to the supply risk trajectory. Reliability was catalogued as a dimension of service quality in the work of Parasuraman et al., (1988). It was then defined as the degree to which the retail service provides what was promised and when it was promised (Dabholkar et al., 1996). Electricity service providers have since measured system performance using reliability as an index (that is the proportion of uninterrupted customer hours provided per year out of a total number of customer hours provided per year) (Dabholkar et al., 1996). The deteriorating level of quality of electricity supply has since received a lot of researchers' attention. In Africa in general and Ghana in particular, there are problems with the quantum of electricity supplied. The problems have been compounded with fluctuations in the supply of power which tends to affect business operations negatively. The New York Times in 2001 surmised that some business especially ICT-related businesses have suffered significant losses resulting from vulnerable electricity supply. Electricity interruption frequencies, the duration of the interruptions and/or load curtailment have been known to cause a lot of difficulties for specific industries particularly those that use electricity as a resource. The electricity interruptions or fluctuations have had varying effects on businesses including but not limited to instantaneous damage to semi-finished goods, associated costs incurred in repairing equipment's and losses accrued from delayed or cancelled orders. Two types of interruptions have been identified. They are planned interruptions and unplanned interruptions.

- Planned interruptions have a mitigating effect on business operations because potential damage to semi-finished goods or materials can be minimised through the switch to alternative sources of electrical power such as generators and solar panels. Cost incurred due to delayed or cancelled orders or equipment repairs can also be avoided because production and delivery schedules can be adjusted ahead of time. However, the costs of alternate power sources such as power generators, as well as expenditure on overtime pay to staff and outsourcing service cannot be avoided (Wang, 2002).
- Unplanned interruptions, however, have unmitigated and sometimes unforeseeable effects on business operations. Often, there are damages that tend to affect product quality, semifinished goods and costs

incurred in repairing, and in delays in the delivery of orders. The cancelations in delivery are borne by businesses and that increases the operation and maintenance costs (Lai, Yik and Jones, 2008)

5.2 Alternative Sources of Energy Available in Ghana

Renewable energy can be particularly appropriate for developing countries including Ghana. According to a discussion at the renewable energy forum hosted by Australia Agency for International Development at Canberra (2000) rural areas, particularly in remote locations, transmission and distribution of energy generated from fossil fuels can be difficult and expensive. This means that attention must be given to renewable energy in most of our rural areas in Ghana where they are currently without electricity. The participants at the energy forum (2000) also indicated that, interest in renewable energies has increased recently due to environmental concerns about global warming and air quality, a decline in the cost of the technologies for renewable energy and improved efficiency and reliability.

The technologies for developing energy from renewable sources have increased. There are many different types of technology, appropriate for different locations and applications. According to the energy foundation, Ghana has the potential for electricity generation from renewable energy source such as solar, biomass, wind, and small hydro. However, these sources have not yet been exploited to any significant degree for electricity generation

5.3 Energy Resources in Ghana

In Ghana, according to the Energy foundation (2002) the country is endowed with several renewable energy sources like solar radiation, small hydro, biomass, and wind. Technologies to harness most of these resources except small hydro and wind have been demonstrated in Ghana. According to Akuffo (1998), Ghana receives good amounts of solar energy particularly in its northern regions with an average annual solar radiation of 16-29 MJ/m2. Conditions are therefore ideal throughout the country for the exploitation of solar energy. Technologies demonstrated to harness the solar energy resources in Ghana include solar water heaters (SWHS), solar crop dryers (SCD) solar water pump (SWP), solar refrigeration and solar lightning. Wind speeds in Ghana are low and therefore scope for development of wind energy is limited with current technology (Akuffo, 1998).

In Ghana, the dominant source of energy with about 60% of the total national energy consumption being accounted for by biomass in either direct or processed form (Ghana energy foundation). It is used in the domestic sector for cooking and many other applications such as water heating. Wood-fuel us the dominant biomass form used in Ghana. The biomass technologies demonstrated in Ghana include improved cook-stoves, biomass fired dryers, sawdust briquette, improved charcoal production, and biogas. The forest resources in Ghana include open zone (savanna) covering an estimated area of 9.6 million hectares and closed zone (high forest). The closed forest zone covers a little more than a third of the country's total land area and has a size of about 8.2 million ha. 20% of which is demarcated either as forest reserves or fuel wood plantations (Akuffo, 1998).

Hydropower has been the main source of electric power in Ghana. Until early 1998, virtually all of Ghana's electricity was produced from two hydro dams at Akosombo and Kpong, which have a combined installed capacity of 1, 072MW (Volta Rive Authority). It is estimated that Ghana may have the potential for additional 2,000MW of hydropower. About 1,205MW of this total is expected to be produced from proven large hydro sources whiles the rest will come for medium to small hydro plants. About 70 small Hydro Power sites have been identified in Ghana (Akuffo, 1998).

6.0 Research Methodology

The methodology looked at the research type, data collection instruments and source, and data analysis method. The research applied both deductive and applied research in carrying out the research. Deductive in the sense that, the research deduce the understanding of the model by Peter Swartz by reviewing literatures and case examples like Shell, India, and China. It further evaluated how the model can be applied on the situation of business in Ghana. The study applied the model in developing three scenarios which looked at 2020 business energy needs in Ghana. The study selected 2020, because of the time frame required in implementing renewable energy option. To complement the scenarios a questionnaire was developed to for both individual and business consumers of electricity. The questions were qualitative, because the focus of the study was not on the development and implementation of renewable energy which requires quantitative data. The study employed both open-ended and closed ended questions. In all, 43 questions were developed, 22 questions to businesses and 21 to individuals.

7.0 Results and Discussion

Energy Resources in Ghana

Questions related to energy resources available to Ghana were administered to the selected companies to check

whether they are aware of existing resources of energy that Ghana can explore. Three questions were posed to respondents to answer in relation to the resources in Ghana. Respondents indicated that apart from the hydro power, they are aware of other sources such as wind, solar, thermal, waste and generators were some of the energy resources' available for them to compliment the hydro power for their business. Respondents also indicated that Ghana has enormous energy resources to be able to generate electricity from.

Energy Problem in Ghana

Respondents indicated that they have problem using the current electricity and categorized it as follows:

1. **Power surges**
2. **Low Current**
3. **Power Cuts**

Respondents also indicated that apart from the problems indicated above, the alternative which they are currently using which is mainly generator is also costly and not environmentally friendly.

Energy Delivery and Its Problems

This portion looked at the problems in delivery of electricity to business. Asked whether what might be the causes of the delivery, respondents indicated the high demand on the hydro, low level of water supply to the dam especially in the drying season, and technical problems as the causes of the delivery problems. Also, on the issue of uninterrupted supply, respondents indicated that in a week they are severally interrupted in a week.

Readiness and Plans to use Renewable energy in Ghana

Respondents indicated their preparedness to collaborate with others to produce electricity for their business. In terms of them seeing the potentials' in tapping the renewable source in Ghana, they share the view that Ghana has other potentials especially solar that they can tap from. Also, respondents undedicated that even though they are prepared to use other sources to complement their electricity supply, they were of the view that it is expensive for them to take the initiative, since they cannot produce on their own.

Scenario Logic-Is solar sustainable, reliable and feasible option for business in Ghana?

To develop the scenarios, the study developed scenario logic by asking a strategic question upon which the three scenarios were built. The strategic question "***Is solar sustainable, reliable and feasible option for business in Ghana?"***Three scenarios constructed for the period 2020 to help answer the strategic focal question. Three main scenario options for Ghana were considered namely:

- **Scenario 1- Economic growth**
- **Scenario 2- Draught**
- **Scenario 3- Oil exporting country**

The above scenarios were built around the under listed critical uncertainty which was indentified in the energy situation of Ghana in figure 3.14 above:

- **Economic growth**
- **Population**
- **Climate changes**
- **Rural-urban migration**
- **Energy sustainability**

The three scenarios are now discussed in turn.

Stories around critical uncertainties

Scenario 1-Economic growth

Ghana's attainment of a middle income status in 2015 has changed the fortune of the country considerably. There is currently a wave of more business activities taking places throughout the entire country. The private and public sector is expanding vigorously in most remote part of the country. Most of the basic facilities which were lacking in most of the rural communities such as clinic, schools, roads, etc have been put in place. The current situation puts less stress on people in terms feeding their families. People are able to afford three square meals a day, when some years back this was not the case. There is now free flow of people from one location to the other without any difficulty. This is because most of the road network systems connecting each other have been improved with major highways linking the ten regional capitals in the country. Apart from that, the introduction of bus systems that shuttle between towns has made life comfortable and has brought cities closer to the village and vice versa.

In addition, the current development in the telecommunication industry has brought the country closer to one other than before. The telecommunication industry has created so many jobs for the youth in the rural

areas as well as in the cities. In every corner of the country you will see people selling re-chargeable units for mobile phones of various kinds from various providers, call centers; movable phone-to-phone kiosk, transfer units, etc. The providers give these products to dealers on credit sales which have employed more youth who were not employed and are able to cater for the daily needs. Now it does not matter where you are in the country you can be still be reached. Now I can reach my old lady in the village any time which was not possible some years back. The introduction of cheap and affordable mobile phones by the numerous telecommunication providers has provided almost every home with a telephone. Apart from the individual benefits derived from telecommunication providers, banks are also using their services to reach their customers. It is now possible for one to transfer money to his or her parent in the village through mobile phone. This before 2020, you have to be physical present almost every time just to remit your parent or family in the village. The business environment is now competitive with local and multinationals competing for customers, by opening up several branches throughout the entire country to cater for the needs of their customers. The expansion exercise by businesses has seen most people employed. This has increase the purchasing power of most people which has placed high demand on electric appliance products such as television, fridge, etc and most families now use such products.

Ghana has also enjoyed favorable weather conditions, since the country has enjoyed more rains than previous. This is not only good for our hydro-power generation, but for our agricultural sector. There is abundant of food stuff from our famers and also increase the agricultural export of the countries. The lives of many farmers have been improved because of the favorable weather conditions. Farming in Ghana predominantly depends on rain fall, so when the rains are not coming then it puts farmers and the country at large in a critical condition in terms of food.

There are currently all kinds of family education programs by health officials on how to plan for your family and birth related issues. Even though, Ghana's population will continue to increase, it will not be significant as previous because of the increasing awareness of family education. Furthermore, most of our teenage girls are now into income generation jobs to meet their basic needs. The non-reliance on men for their livelihood which most a times end up in pregnancy has been reduced. Most women are also now competing for managerial positions with men, and focusing more on career than given birth. The perception, which has engulf people mostly in the rural areas regarding given birth to so many kids in the hope that in old age you will be taken care of by at least one of them is gradually shifting. This mentality was because of the high poverty levels people find themselves, however, now people are able to make money and further save some for future needs. These empowerments are gradually changing people's mind set and people are now focusing on managing a sizeable family and giving them a better life. There has been a mass exodus of people from the rural areas to the urban areas and cities in search of livelihood over the years. The year 2020, this trend has changed; people now do not see the urban and the cities as the ultimate place of opportunities any more. The reason is that most people are now able to get some employment and engage in a business that will earn them income irrespective of their location in country.

Scenario 2-Draught

The long standing draught in the country has affected the development of Ghana tremendously. The agricultural sector which provides the country with foodstuff has been hit by the draught. Famers in Ghana predominantly depend on rains for faming because farmers do not have money to construct canals to irrigate their farms during drying seasons. The draught has caused huge loss of farm products especially in the northern parts of the country where the country's main agricultural products comes from. This has brought a lot hardship to farmers and their families as well as the country at large. The situation has caused high food prices and agricultural products shortage for the nation. Life is becoming unbearable to most people in the country since people cannot afford to feed on tree square meal a day because of the high prices of agricultural products. The most deprived are farmers, since their source of income which is mainly through farming has been taken away from them by the draught. The hardship from the draught is increasing child birth among teenage girls who are vulnerable to people who acts as their source of livelihood because most of them are idle. Population in rural areas is also on the increase because these areas are deprived of economic activities. These people are seeing childbirth as a way of salvaging themselves from poverty in the future. Since they believe in times of old age their kids will definitely look after them.

The current situation has seen the exodus of most people from these parts of the country to the cities in search for greener pasture. The rural-urban drift has become a serious issue in the country and had made most of the cities especially the capital (Accra) choked with many sleeping at market places and on the streets. In addition to the above problems posed by the draught, the country is experiencing electricity load shedding, interrupted electricity supply, and unannounced cuts in electricity. The main reason is that the two main dams which supply the country with electricity also depend on rain. The presence of rain in the catchment areas is so crucial to the survival of the dams since water flows from these areas into the dams. However, these areas are also dried up because of the draught.

The business sector is also encountering huge problems because of the shortage of electricity supply. Most businesses and institutions depends mainly on electricity for their operations, for instance clinics, hospitals, and schools need reliable source of electricity to be able to provide improved services. The situation has caused many deaths in our hospitals and clinics in the country. As a result of power cut, most people are dying in our hospitals and clinics in the process of surgery. The situation is now becoming frightening with more reported cases almost every month in the country. In the era of information age, the country is been held far away from the rest of the world. Internet correspondence is really difficult, since most internet providers do not have frequent supply of electricity to enable access. It takes hours for a file to down load from the internet in areas with electricity. This situation is mostly blame on power fluctuation and low current. The situation is increasing the gap between Ghana and the rest of the world in terms of information communication. The current situation is putting a lot of pressure on the existing source of electricity supply. The current situation requires drastic measures to be taken to address the energy issues since the impact is becoming unbearable.

The current situation requires an alternative that is reliable and cost effective. Generators used by businesses are not cost effective and environmental unfriendly. Looking at the various options of renewable energy sources available in Ghana, the best option will be from solar. The current draught is perfect for solar as option. The northern parts and rural areas where the impact of the draught is greatly felt, solar farming can be used to support their families. Solar panels can be installed by these communities to tap solar energy which can be sold to the existing power supply for income. Businesses can also install solar panels to provide their own energy needs since once installed it will last for twenty five years which will provides reliable and cost effective option.

Scenario 3-Oil Exporting Country

The current exploration of the oil in the country has helped transformed the economy of Ghana tremendously. Now Ghana export oil to it neighboring African countries for foreign exchange. The proceeds from the oil is been invested in most institutions and infrastructures like school, clinics, hospitals, roads, etc. The proceeds from oil have generated a lot of job opportunities for people in the country. New cities and towns have been created at the various areas where the oil exploration is taking place with all kinds of businesses ranging from banking, insurances, schools, hospitals, real estates, hotels etc to cater for the needs of the people. The Oil producing companies are contributing to increase energy requirement place on the country to meet these demand. This is because these companies use machines and equipment which depend on high voltage of electricity for their operations. On the other hand, these foreign companies are working with expatriate workers with high energy consumption because of the kinds of items they use. For instance most of the expatriates are using items such as air-conditions, washing machines, fridge etc. which requires electricity. Existing businesses have also expanded to these new area and new businesses have been created offering people the opportunity to work. Jobs created in these areas ranges from unskilled to skilled labour.

As a result of the opportunities these oil producing companies and the towns and cities around offers, there is exodus of people into such area in such of jobs. This has increase the population of these areas because people can find some jobs to do. People have also been transferred to such areas because of the most businesses have opened branches and people have to relocate. The situation has deprived our rural areas with active business and economic activities since most the youths have moved leaving the old folks.

The creation of these towns and cities has contributed to the increase in the country's population. Most of the youths who were unskilled and were not employed but as a result of the job opportunities offered by the oil producing companies most people are now employed. People who could not afford to raise families are now raising families and child birth is increasing among these people. Since these people can now earn some income and will be able to take care of their basic needs. The birth rate is on the increase in these areas. This is contributing to the increasing population of the country at the moment. The development occurring in the oil producing catchment areas is also manifested in other parts of the country. People are able to remit their families who are in the rural areas on monthly bases for their up keep. Most people working with these oil producing companies have also opened shops in their villages for their families to run. This is boosting economic activities in most rural communities.

The use of proceeds from the oil is been put into productive use by the Government. The entire senior high schools in the country are now upgraded with facilities such as computers, internet and library to facilitate learning and teaching. Upgrading of these schools has increased the demand for energy. This was funded by energy fund set aside by the Government. The year 2015 has not seen any significant change in our climatic conditions. The pattern of 3-4 months of rain is still the case without any change. The country at the moment is enjoying more sun then the country's six months of rain and six month of sun.

The creation of cities and towns in the oil exploration areas has increased the energy needs tremendously. The current hydro power cannot provide the increasing demand of the energy under the current situation. It is very important these areas provide their own energy needs, looking at the location of these areas

the available option that can readily be tapped is solar. These areas can depend entirely on solar for their energy needs, so that they will be off the national grid, which at the moment is not reliable. These areas need constant and reliable energy because of the 24 hours business activities. The rest of the country can depend on the existing hydro power whiles the new areas created as a result of the oil depend on the solar for their energy needs.

The role of solar in the scenarios

The above scenarios stories crafted, is undoubted that the energy needs of Ghana will continue to increase and alternative options needs to be explored. Under the three scenarios created, the study find solar as a perfect energy needs for business and institutions in the country. Under the three scenarios, solar among the various options of renewable is the most sustainable, reliable and feasible option which can be explored by businesses and country. The current hydro power will not be able to meet the needs of the country looking at the increasing need of business, institutions and individuals within the country. Climatic conditions are certainly not going to improve over night because of the mass destruction of bio-diversity by human activities in the catchment areas of the dams. The continuous reliance on the hydro power will put the country's energy needs in a serious problem for business if alternative options which are reliable and cost effective are explored to meet the increasing demand of energy.

To be able to sustain the economic growth describe under scenarios above, Ghana need energy source which is reliable without interruption which businesses can depend on. There is competition now between businesses and individuals on the consumption of energy. Solar can serve the needs of both individuals as well as businesses. Individuals can install solar panel on their roofs to supply their home energy needs. There is no need for huge infrastructure developments before the use of solar. The panels can be purchased from solar manufactures and be installed. What is important is for Ghana to train people in the areas of technology usage, maintenance, and monitoring of the system. This will also create a lot of employment for people as well. In terms of cost, business can collaborate with each other to purchase the panels and set up a solar system where they can share. Solar provides a perfect opportunity for institutions such hospitals, universities, senior high school and clinics which will allow them to be self-reliance and manage their own energy. The various energy sources available to Ghana, solar does not require long project development process since the panels are been produced by solar panel producing companies. The development of other sources for instance hydro power needs lots of project development processes which is time consuming and takes year to construct a dam. With solar, business will not spend time in developing the technology, since the technology is already available and can be purchase.

The current 6 to 8 months of sun present a better opportunity for the usage of solar in Ghana. The northern part of the country has vase idle lands which can be turn into solar farms to provide the northern parts with electricity. The installation of solar will cut down the cost businesses incur and will offer businesses better planning of their energy needs since there is no interruption in solar energy supply once installed. The reason is that since the reliability is assured with solar, machines and equipment such as computers, printers, photocopiers etc will not be at the mercy of frequent power cuts, low currents, and power fluctuation. This will minimize the damage on equipment and machines so businesses will not spend extra money for repairs. The use of the solar in Ghana will offer businesses with the reliability that is required, and can be sustained by business because they manage their own energy. There is no doubt at all on the possibility on the use of energy in Ghana, since there technology is already been used.

8.0 Conclusion and Recommendations

The study concludes that solar is sustainable, reliable and feasible option for business energy needs by 2020. Therefore, Government has a key role in making sure that the energy needs of businesses are met by 2020 through the use of alternatives such as solar as identified as the sustainable, reliable, and feasible option for business energy needs in Ghana by 2020. The study is of the view that the situation requires a policy issue with strong support from the government. The study will therefore make the following recommendations for consideration by Government policy makers, and businesses in Ghana: The private participation in the provision of energy should be allowed by Government as seen in the telecommunication, and the financial sector to create competition and allow for options of buying electricity from different sources. The study recommend that it is time the monopoly enjoyed by the current producer and supply be removed to encourage other private hands to compete. All Government institutions such as clinics, hospitals, universities, etc should be allowed to run on solar for their energy needs. These institutions should be made self-reliance by using solar to provide their energy needs. There should be awareness on the potentials of solar in providing electricity needs of people. Business should start collaborating with each other and start providing their own electricity through the use of solar. There should be encouragement by the Government by given tax exemptions and subsidies for business that will and are now using solar to provide their own electricity.

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