

Diffusion of solar solution in developing countries – focus group study in Ghana

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Abstract

The role of renewable energy has gained considerable attention in modern trend of reversing the global energy crisis, especially in developing countries. While 'Greenness' of renewable energy plays a major role in developed countries making it a preferred choice, it is quite unclear if developing countries resort to renewable energy for the same purpose. A study on the energy system in Ghana shows that many consider solar as a preferred choice due to the un-reliable nature of the main sources of energy in the country. The related problems of the main energy sources (hydro and thermal power plants) identified in the study include: frequent outages and fluctuations leading to low-level of reliability. Results from the interview of sampled respondents selected from different regions of the country pointed out that many Ghanaians consider solar energy as the best alternative. However; it was a matter of affordability, financing and accessibility. Supplementary discussion into the benefits of resorting to 'greenness' of solar, which seems not to be of major concern to the potential users in Ghana is highlighted. Moreover, making solar energy accessible in Ghana and the related market-marketing conditions of the solutions are addressed. Based on the findings, a comprehensive examination of the reasons behind the slow adaptation of solar energy as an alternative is addressed. The alternative solar solutions identified include: standalone; backup and hybrid.

Keywords: *greenness, affordability, financing, accessibility, developing countries, Ghana*

Background of the study

A study on the energy system in Ghana shows that the demand of energy outweighs its supply, thus many would prefer an alternative source of energy (see also New African, 2007). These specific problems and many more have created a serious energy crisis, resulting in decades of high incidence of unauthorized and frequent power outages as well as regulated load shedding exercises - the rationing of electricity by geographic location, consumption capacity and density lasting between 12 – 48 hours. This particular phenomenon, amongst other factors, has resulted in low productivity; low development and slow growth of the country's economy (see also Dovi, 2007 and Mensah-Biney, 2007). The consequences of regular power rationing in Ghana has lead to many industries; commercial and domestic consumers opting for secondary sources of energy like generators which comes with its own, problem like environmental pollution and the high cost of fuel.

Research problem:

There is a need for an increase in the energy capacity of many developing countries. For instance, in Ghana, the Ministry of Energy explained in the *Policy Framework and Guide for Development of Independent Power Producer (PFGD-IPP)* that the demand for energy in Ghana has increased in the past 10 years by about 5% per year. This increment represents capacity addition requirements of about 50MW – 100MW. Since 2006 there have been promises from the government on measures that they intend to put in place to alleviate the energy crisis (New African, 2007).

The major sources of energy in Ghana are the hydro and the thermal plants. However, the country is confronted with two major problems related to energy: inadequacy of the energy sources and rampant erratic power outage (see also New African, 2007). The study therefore observes the viability of Solar Solution (SS) in developing countries and more specifically, Ghana as a reliable alternative. The questions therefore are: Would Ghanaians be able to afford an alternative solution and how would the solution be diffused?

Within the study, it became clear that there are numerous customers whose need of the solar solution varied. For this reason, the purpose of the solar as a solution is categorized into three main segments: *standalone users* – these are customers who perceive solar solution as solely an alternative energy source. This group falls within the segment of those who have no access to the national energy grid and for that reason; their only source of energy would be the solar solution. Furthermore, this category was identified as living farther from the urban areas. The next segment identified is

categorized as the *backup users* – these are customers who hope to use the renewable energy solution in case of a black or brown out. Such users may be within the reach of the national grid, but are confronted by erratic and insufficient energy. The final segment was identified as the *hybrid users* and within this group; appliances are categorized by the users into: low and high wattage capacity. Low wattage appliances may be connected to the solar solution while the higher wattage appliances are connected to the conventional energy source.

Definitions and limitation:

This study is a first attempt to educate and reposition solar solutions to Ghanaians as a means of attaining economic sustainability, development and growth (see also Holm 2005:13). Renewable energy systems are methods of harnessing energy for human consumption in a way that the source of such energy is not depleted over time as compared to fossil fuel which is currently threatened due to insatiable global consumption patterns (IEA, 2002).

The term '*greenness*' used in the study denotes environmental friendliness and a responsible way of using energy. Although the term '*greenness*' is highly used in responsible business, the study rather addresses the positive impact of solar on the environment. The details are limited as respect to the same purpose of greenness in developed countries compared to developing countries. It is evident that, most consumers in developed countries resort to solar energy mainly due to its positive impact on the environment. For this reason, government subsidies and grants on '*green*' energy or environmental friendly sources of energy is high in developed countries (ESTIF, 2008; see also Zittel 2002). The opposite appears to be the case in developing countries like Ghana.

As identified earlier, the primary need of solar energy in Ghana is considered to be an '*alternative solution*' instead of green issues. For this reason, '*greenness*' of alternative sources of energy becomes the sole responsibility of the government to initiate a sound framework that encompasses the introduction and the dissemination of an alternative source of energy.

The term *affordability* is considered purely on individual's ability to pay for the solar solution. Financing explains how financial and credit organizations can facilitate the payment of solar energy on behalf of prospective clients. More so, the term financing is also connected to the individual's payment-package for any specific solar solution. The term payment-package denotes the various payment plans offered to individuals,

households and organization by the sales agents. Making the solar solution accessible to the prospective customers details down to *where* and *how* to make the solar available to the customers.

Ghana was known as Gold Coast and was the first African nation to achieve independence from United Kingdom in 1957. Ghana shares a common border with Côte d' Ivoire to the west; Burkina Fasso to the north and Togo to the east. The inhabitants of the country speak some 250 languages and dialects, although English is the official language which pre-dominates government and business affairs in the country. The country has a current population of about 23 million with an approximately 1.9% population growth rate (CIA World Fact book, 2008).

The term *developing countries or economies* is sometimes used interchangeably with the term emerging economies or developing nations especially after the breakdown of the communist economies (except China and North Korea). As much as the term is conveniently used in that context, it does not in any way give explicit implications that the countries in context are all experiencing similar economic development and growth or for that fact intended to imply that other economies have reached a preferred or final stage of economic development (Cavusgil, Ghauri and Agarwal, 2002: 4, 5).

According to Cavusgil et al (2002: 3), the classical notion for developing countries prior to 2000 is as follows:

- High risk to foreign business;
- Economically and technologically backward;
- Consumers had poor purchasing power;
- It gives few opportunities for business.

However, for purpose of the study, the term developing countries is used specifically in the context of the Ghanaian market rather than in a general sense.

It is noteworthy to mention that, although there are various sources of energy including: wind, biogas, hydro and solar, this study, as a limitation focused on the diffusion of solar as an alternative source to energy and solution to the current energy crisis in Ghana. One of the primary limitations of the study is the inability to reach major rural areas. The sample framework and the respondents for the survey were selected from only the urban centers, due to the difficulties involved in accessing the respondents far from the urban centers. It is believed that these findings would be integrated in the future to serve as a parameter in developing a generalized framework that can handle the rural sectors as well. Other reasons that hindered the integration of

the rural communities in the survey included lack of better access of roads and communication networks.

Time and funding also appeared to be a major impediment. A considerable amount of time was needed to either personally travel to or invite the sample respondents from various rural communities in Ghana. The funding involved in inviting these groups which include compensating their travelling and living expenses appeared to be very high. Although it may be assumed that the rural areas lack purchasing power to afford an alternative energy solution, it is merely an unapproved assumption and research is needed to establish this fact. For this reason, excluding the rural area respondents is not because they cannot afford an alternative energy solution. A supplementary research would be needed in the future to help draw an accurate conclusion.

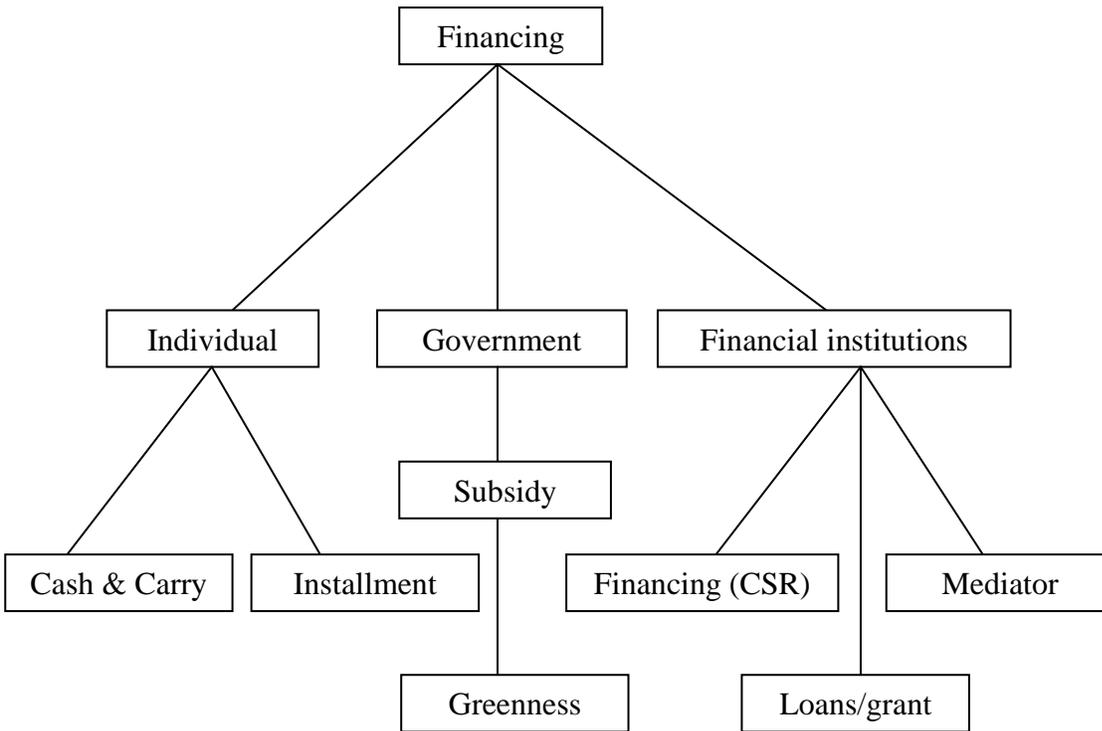
Framework of the study

The framework for the study is deduced from the implications of solar solution in Ghana. The primary focus of the study is the economic implications of the diffusion of solar solution whilst the minor study focuses on the environment implications. The economic framework touches issues pertaining to affordability, financing, and accessibility. On the other hand, the minor study addresses the environmental impact of solar solution in Ghana.

1. The Economic Implications

- a. **Affordability:** As explained earlier, affordability as an economic condition denotes the purchasing power of the customers. The findings help us to establish the degree to which Ghanaians are willing and able to patronize the solar solution.
- b. **Financing of the solar solution:** Within this framework three broad categories of models can be drawn. Firstly, the individual as a financier, secondary the financial institutions and finally, the government.

The framework is illustrated below:



i. Individual: The available options within this part of the framework comprises of the cash and carry system where the individual goes to the distribution point to buy the product personally. The other option, payment by installment is when the individual negotiates with the sales agent on a payment plan either on monthly or quarterly bases. This option is flexibly arrived at on an equitable agreement between the parties involved.

ii. Government: Serving as a financier, the government plays an important role in both the promotion as well as subsidizing the solar solution with the motive of encouraging the diffusion of green energy. The provision of subsidies by the government involves, incentives made available to the manufacturers by reducing taxes, allocating suitable manufacturing sites and reducing import tariffs.

iii. Financial institutions: The role of the financial institutions include: incorporating the financing of solar on the community and the needy as part of their corporate responsibility programs. Furthermore, these organizations can serve as 'mediators' between the end users and the sales agents. In this program, the individual opens an account with the respective banks (financiers). The banks in turn pay the sales agents who have supplied the solar solution to the end user. The objective of this system is believed to promote and ensure security within the payment plan.

Moreover, loan packages for individual customers who patronize the solar solution are made available by the financial institutions. The loan is made available for the purchase of a complete solar package by the users. Moreover, the banks can choose to pay for the cost of the solution directly to the sales agent on behalf of the end user.

c. **Accessibility of solar solution:** This involves making the solar component available to the end user. Within this framework, two main issues arise these involve *where* and *how* the solar solution can be made available to the customers? In this case *where* denotes the sources from which the solar components can be purchased whereas *how* denotes the distribution as well as other marketing channels designed to reach the customers.

2. Environmental implications

The environmental implications of the solar solution within the study are denoted by the term 'greenness'. The government on the other hand is seen as the agent who is responsible for the promotion of the concept. The aspect of *green* within the framework is linked to the efforts of the government to promote and embark on a comprehensive campaign strategies. The purpose of these strategies is imprinting the positive effects of solar as environmentally friendly but not merely as an alternative energy source in the minds of Ghanaians.

Methodology and data collection methods

This study seeks a deeper understanding of the underlying issues of energy and the possible solutions available to Ghana. The main research questions are summarized as follows:

RQ1. What is the current energy situation in Ghana?

RQ2. Would Ghanaians be able to afford an alternative solution?

Questionnaires used in the study

The questionnaires used in the study were carefully selected to help unearth the general overview of the problem related to the current energy situation in Ghana. The objective are summarized as: the depth of the nature of the current problem, the cost of the current energy service, the real applications of the energy both in the industry and residential level, the expectation of a new alternative solution and the marketing or the deployment of this new solution.

Sample of the questionnaire used is shown in the table below:

FOCUS GROUP QUESTIONNAIRE
How do you use electricity at work/home?
What appliances does the electricity power at work/home?
How many hours do you use electricity per day at work/home
How much do you pay for electricity on the average at work/home
How reliable is the electricity? Would you want an alternative energy solution?
Why have you not used any alternative
How would you like to finance the purchase of solar solution?
What do you know about solar energy?
What is involved in the generating of solar energy? (<i>by respondents</i>)

How do you use electricity at work and or home?

It was clear that most Ghanaians rely on electricity for both domestic and industrial activities. For all equipments: Industrial – 11hrs, Telecommunication – 24hrs, Public Service – 8hrs, Entrepreneur – 8hrs, Lighting - 11hrs, Fridge/Freezers – 24hrs

What appliances does the electricity power at Work or Home?

Industries: Telecommunication companies and health providers are high consumers of energy. They use high powered equipments - Servers, Masts, Hospital Equipment, Industrial machines, Lighting, PC's, Printers, Photocopiers, Heavy duty equipments for industrial workers etc. Home use: Hot Water, Microwave, TV.

Home usage: Domestic consumption is not high depending on equipment in use - Air-conditions, lighting, fridge/freezers, hot water, ironing, charging of phones, TV/Radio, microwave, air-condition – lesser extent, electrical fans

How many hours do you use electricity per day at work or at home?

Entrepreneur – 10hrs, Industrial – 11hrs, Telecommunication – 24hrs, Public Service – 10hrs, Hospitals – 24hrs, Lighting - 5hrs, Fridge/Freezers – 24hrs, TV – 6hrs, Radio – 5hrs - The number of hours varied depending on services rendered. Telecommunication, Industrial and Health service providers need 24hrs energy to power equipments in use. The situation is compounded where there is frequent power outage and generators are in use. The cost of running these generators is expensive.

How much do you pay for electricity on the average?

Telecommunication/Industrial organizations: The cost of running equipment for these industries is very high compounding the situation is the frequent power outages calling for the purchase of fuel to run generators at a very high cost.

- House owners = GHC60 (600,000 Cedis)
- Tenants = GHC50 (500,000 Cedis)
- Semidetached apartments = GHC200 (200,000 Cedis)

How reliable is the electricity? Would you want an alternative energy solution?

Low level reliability, frequent outages and fluctuations resulting in damaged equipment and appliances. It was clear that Industries, Home owners, Entrepreneurs, and all would appreciate an alternative energy – Solar.

Why have you not used any alternative reliable source of energy?

Facts indicate that there are no known reliable alternatives available on the Ghanaian market. Moreover, there are no incentives to invest in reliable solutions.

How would you like to finance the purchase of solar solution?

Most people would like to make payment in installments or be supported by loans.

What do you know about Solar Energy?

Most Ghanaians have little or no knowledge about solar energy

What is involved in the generating of solar energy? (*By respondents*)

This is the generating of electricity through a combination of solar panels, batteries, charge controllers and inverters. The solar panels charge the batteries which stores power for use.

Results and analysis

Results from the focus group session of sampled respondents selected from different regions of Ghana revealed that many consider solar energy as best alternative due to the degree of awareness created during the interviewing session. However; the problem was identified to be a matter of accessibility and financing. For those who claimed that they could afford, it was a matter of 'accessibility' of the solar products on the market. This raises the need for further study in ascertaining the right segments for the diffusion of solar solution. Identified segments include: *standalone* (the sole use of renewable energy solution, especially for people without access to any form of conventional energy), *backup* (the use of renewable energy solution in case of a black or brown out) or a *hybrid system* (where specific household or corporate systems/facilities could be connected to a renewable energy system). The finding pointed out that, the solar solution would be of much help to both industries and domestic use.

Meanwhile, an attempt to establish the financing options available to users pointed out that, financing as a problem was insignificant. The main problem lies in having a viable economic framework from which financial institutions will design a realistic pay-back time. Existing financial structure identified in Ghana includes: individual and corporate loan systems for investments, like cars, housing and start-up businesses. This system makes it possible for financing of alternative solar solutions.

Meanwhile, the study pointed out that solar solution as an alternative source of energy was hardly identified as viable option due to lack of adequate knowledge and information. It was observed further that, the public seem to hardly understand the real components that make up a complete solar-solution. A complete solar solution include: panels, charge controllers, battery and in some case inverters. It was further established in the study that, solar panels are also perceived to be monstrous and bulky making potential customers wonder if their properties would not be defaced.

Conclusion and Recommendations

It becomes evident that solar solution to Ghana and developing countries at large would be a preferred choice. Moreover, for this to be materialized, it would require a well-developed marketing strategies and joint-efforts of various actors. These actors involve marketers, investors, the government and the efforts of Ghanaians at large. Making the solar solution accessible will involve creating a viable business model which includes an efficient network of sales and distribution programs. This will be effective especially when every regional capital has at least one sales point where a solar solution can be purchased or be ordered.

The financiers need to combine their efforts with the manufacturers, service providers and the end-users and to help draft effective plans for training, diffusion, servicing and maintenance as well as financing the program. A comprehensive training program is necessary. In this sense, the manufacturers and the government join their efforts to recruit and educate students on renewable energy courses to help them become competent enough to handle renewable energy diffusion and implementation within the Ghanaian communities.

The role of the government within this program would include more emphases on education of the solar solution. More focus on 'green' issues within its educational programs and the responsible use of energy would be an added advantage. Various forms of education to be used include: seminars, workshops, posters, televised demonstrations, radio and phone-in programs, classroom lectures amongst others. Most government structures and facilities could use solar as an example to demonstrate its positive environmental impact of to the public.

Energy users on the other hand must give critical consideration to the various options of the solar solution identified within the study which include: standalone, backup and the hybrid system. Such consideration involves mapping their right energy requirement against the specific segment. To be successful in this effort, heavy users of energy may consider hybrid as an appropriate solution while light users give attention to the standalone or back-up system.

Further research in the areas of conservation and 'smart' usage of energy can be conducted in the future. The term 'smart' usage denotes the situation where the available power wattage is conserved and distributed evenly between the appliances as to when and how one needs it. For example, a solution doesn't have to necessarily power all the appliances at once but only when an appliance is needed. It can also be explained further that listening to the radio and watching television cannot be combined. In a practical sense, it denotes the 'waste' of energy and lack of responsible-use of energy.

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