

Robin Hood and Donkey Principles: renewable energy proposals for Ghana

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Abstract: This study proposes a reliable way of distribution and transfer of electricity cost to both the urban and rural consumers in Ghana. While the Robin Hood principles borrows the essence of the strategy used in this model by a British folklore character by the same name, in providing resources for the deprived and in this context an equitable demand and supply of electricity. The Donkey principle highlights the strategic billing policy used in Ghana, which suggests that urban communities should carry some of the cost burden of energy used by rural communities. The study aims at promoting strategies and educating the public on realistic solutions to the energy crisis. In Ghana, people in the rural communities lacks credit to afford almost any form of renewable energy system due to irregular source of income, although the bulk of consumables (agro based) are produced by them. Infrastructure in some rural communities is inadequate. In contrast, majority of the urban dwellers have access to credit and spend a reasonable amount of their earnings on electricity primarily focused on business and leisure. The study also addresses cost, motive, frequency and reasons for acquiring and using a secondary source of energy (SSE). The results of the study suggest a more just and equal system of distribution and billing of electricity cost.

Keywords: *Robin Hood, Donkey, Secondary Source of Energy (SSE), Distribution, Ghana*

1. Introduction

Rapid increase in population and increased material consumption always has its toll on the general resources of any given economy. Energy seen as the bedrock of every society is vital for a growing economy to flourish. In Ghana, many rural sectors do not have access to electricity^{1, 4, and 8}. The government often spread out the hope of embarking on an extensive electrification project. However, lack of capacity, quality planning and sound framework always turns up to become the “Achilles’ heel” in economic development and environmental sustainability. For those rural areas that are accessible to the national electricity grid, lack of technical and economic capacity undermines the efficiency and reliability of systems; these are plagued with unauthorized excessive power failures making it impossible for the citizens in these communities to be able to utilize the full potential of the energy to increase productivity.

Over the years, there have been advocacy for a solar home solution (SHS) for the rural communities of developing countries. As thoughtful as some of these arguments and proposed models might sound, they most often than not miss the point in their generalization of systematically unproven panacea for the entire energy situation in all rural communities in developing countries. These experts end up re-grouping at the *theory-formulation* table to either revise their theories or come up with newer perceived solutions convinced that it would work the next time round.

For instance, Srinivasan⁷ proposed pre-payment system as a way to curb SHS acquisition defaults as well as enhance the degree of acquisition in the rural communities. As laudable as the proposal is, it seems to ignore or did not anticipate some factors that have direct or indirect influence in such systems. To date, many energy service providers in developing countries have battled the complex nature of the process of prepayment and its collection system, thus meriting a careful scrutiny. It is noteworthy to examine some of the impacting

factors, which include but not limited to a country's infrastructure (*accessibility to internet and related mobile service that are essential support systems for pre-payment mode as well as reliable banking and financial institutions willing to provide credit for the needy*), economic and social configuration, per-capita income with special emphasis on individual/household income, the reliability of such income and its purchasing power as well as levels and classifications of such income and its determinants in developing countries. Moreover, administrative logistics and its bottlenecks which includes cost of personnel to inaccessible rural communities' makes pre-payment difficult and inaccessible for many people.

2. Definitions and Limitations

The social background of the principle: In most developing countries, the urban communities enjoy a relatively large percentage of the national cake in the forms of basic amenities and infrastructures like roads, access to good drinking water, affordable housing, and a reasonable access to modern health care unlike their rural counterparts. The situation compounds with an ongoing problem in that most of the rural communities have to contend and be content with an under-developed agro-based industry. This agro-based industry lacks proper incentives to help them add value to their produce. Inadequate infrastructure in the context of storage facilities as well as good transport network exposes these rural dwellers to opportunist intermediaries who offer to take their produce at less than the realistic market price. Consequently, rural economic development often stalls since they lack enough compensation for their hard work resulting in their inability to save some of their earnings – thus the typical cyclical nature of poverty.

The Robin Hood principle: This principle denotes taking from the rich and giving to the poor thus becoming a proposed model recommended by this study to help policy makers to resolve energy distribution for both urban and rural sectors of the Ghanaian economy^{2,3}. The concept of 'taking' in the principle denotes 1) weaning the urban dwellers off the main grid to help allocate the excess capacity to the rural areas. The urban dwellers are then encouraged to 2) adapt to renewable energy systems. Since there are few industrial activities in the rural areas and the need of the energy are simple, the benefits of this proposal become sound because the rural communities get the needed opportunity to develop the agro-base sector, creating jobs and mitigating the rural – urban migration influx. The Robin Hood principle also presumably suggests that most urban dwellers are in better position to afford renewable energy arguably due to access to credits and loans from financial institutions⁶.

The Donkey principle: Donkeys have the potential of easily carrying 20 to 30 percent of their own body weight and thus suitable as beast of burden; other use of donkeys includes farming and transportation. Donkeys have the tendency to resist any form of force or intimidation if for whatever reason they consider submitting to such demand to be dangerous to them⁹. The Donkey principle is an allegory used in promoting the practicality and transparency required to ensure a fair billing system of electricity usage. The Donkey principle is coined from a billing policy in Ghana, where a government directive through levies makes it possible for corporate firms and urban communities to carry some of the cost burden of the electricity used by the poor rural communities. The same policy suggests that the extra cost paid by the urban citizens covers rural electrification projects as well as setting up streetlights at strategic locations across the country. Since the core idea is to promote social fairness, the noble assumption will be for the administrative aspects including methods for collecting, managing, monitoring and executing that the required projects are made public. On the contrary, everything concerning rural electrification and other related projects are usually activities initiated under cloak and dagger. Giving power to the people in essence should include some

measure of openness and this usually aims at building trust. The people paying these monies often feels cheated since there is no formal accountability from the authorities that are supposed to be in charge of providing this vital service for the nation. Thus, the donkey theorem recommend a clear-cut system, where an institution is set up to monitor and report all the monies accumulated from this strategic billing as well as give a clear framework and timeline as to how the monies are disbursed for the projects that they are collected for.

Social responsibility: The adoption of a photovoltaic system often reduces pollution. Thus photovoltaic system promises clean sources of energy especially the reduction of carbon emission. The conventional energy systems on the other hand, use other types of fuel (*gas, diesel, petroleum products and wood*) in generating energy, thus depleting the natural resources and causing environmental harm. For these reasons, adapting green energy sources promotes social responsibility.

For this study, the term **energy** refers to both conventional and renewable systems for generating or providing electricity.

Secondary source of energy from this point cited as SSE; is the sum total of all sources of energy and light generating systems readily available to end user both in the urban and rural communities. The list includes but not limited to candles, kerosene lamps, torch and flash lights, generators.

Distribution of photovoltaic energy identifies all the efforts made to deploy the technology to the end user. The processes involved in the distribution details down to where and how to make the photovoltaic technology available to the end user. These include profiling of end users energy needs, packaging, transportation and installation among others.⁶

Ghana is a West African country with a population of about 24 million with an approximately 1.9 percent population growth rate. Ghana's electricity production and consumption and exports as at the year 2007 were 6.7 billion kWh (kilowatt hours), 5.7 billion kWh and 2.49 billion kWh respectively. Since the demand of energy outweighs its supply, availability and accessibility to alternative sources of energy would be preferred by the over 9.2 million citizens in Ghana without electricity⁶.

This research does not take into consideration issues like the per-capita income of the rural-urban population. Nevertheless, it mentions the minimum income of the people in Ghana and figures out the percent of such income that goes to energy consumption. Furthermore, there were practically no individual volunteers ready to divulge their actual income as well as the percentage they spend on SSE. In addition, there proved to be virtually no relevant secondary sources of reference in relation to this parameter. Information gathered and used to develop the principles, is primarily based on covert questions asked under friendly atmosphere and mainly through acquaintance, which involves among others some speculative responds and pure approximations. Furthermore, omitted in this research, justifiably for future study, is the mechanism to map up a profitability ratio of how much savings is actually attainable from the use of renewable energy systems.

The study does not include any discussion on the potential of a feed in tariff system, since Ghana, as a developing country, has not yet implemented a full-scale de-regulated energy system. Feed in tariff would have required an economic system to have a pure privatization of its energy industry as well as market-regulated prices of energy. This study is designed to

serve as part of a series of proposals (1. *diffusion of photovoltaic technology for developing countries* and 2. *financing alternatives for renewable energy systems for renewable energy systems*) intended to act as a 'wake up call' and support for the energy regulatory bodies in Ghana (Ministry for Energy, Ghana Energy Commission, etc).

This paper attempts to answer the following questions:

How can the Robin Hood (RH) theorem be applied to disseminate energy to rural and urban communities and what benefits can be derived from it?

How can policy makers adopt and adapt the Donkey theorem; in helping reduce cost burden of especially low-income earners in the rural communities?

The primary objective of this study is to develop and justify a proposal on an efficient energy distribution protocol as well as flexible billing system, with the aim of helping especially the energy administrators of Ghana to re-structure the current energy policies and justify the proposed principles. Although the principles proposed would have their own specific set of limitations, the findings of this study could serve as a preliminary framework for further studies in addition to its potential for future replication in other developing economies faced with similar energy crisis.

3. Methodology

To help promote and justify the adoption of the Robin Hood and Donkey principles, this paper discusses types of SSE available and in use. Knowledge about the cost, purpose, frequency and reasons for purchasing and using a particular SSE by both rural and urban communities would help address a realistic payment plan for renewable energy systems such as photovoltaic or SHS. It is noteworthy that, the idea of availability, affordability and reliability of the renewable energy systems was part of the focus group discussion that helped generate simple questions for the interview⁶. For each of the SSE under consideration, a random sample size of 5 - 10 retail outlets at different towns in different regions (*Accra municipalities and Tema all in the Greater Accra region, Cape Coast, Apam, Winneba all in the Central region, Takoradi in the Western region and Kumasi in the Ashanti region*) responded favorably to the interview. The questions used to derive at the objective were simple and given in the local language - Akan, similar questions were used for the different form of secondary energy source. The questions were as follows:

1. What type of SSE do you prefer and why?
2. What triggers the purchase of a SSE?
3. How often is the purchase of an SSE made?
4. What are the main uses of any specific SSE?

4. Results

Table 1 below, represents a summary result of the study. When the question on an individual or household preference of a SSE was asked, the answers varied greatly. Two main reasons were identified - *the household income* and *the purpose for which the secondary energy is needed*. In Ghana, the current minimum income effective February 2010 is 3.11 Ghana cedis, a 17 percent increment from the previous level of 2.65 Ghana cedis⁵. The assumption is that, a household had to carefully consider their net income and consider as to how much of such income could be set aside for such emergencies related to power outages very prominent in the life of a Ghanaian. Although the purpose was clear and easy to understand, the issue of

household income proved to be very difficult to ascertain. This is due to the fact that, most Ghanaians are reluctant to reveal how much they actually earn for two main reasons: reluctance to expose themselves to rigorous scrutiny if found to be hiding some other source of household income as well as fear of being over taxed. Furthermore, Ghana's gross domestic product (GDP) as at January, 2011 is estimated at \$ 38.24 billion with an average per capita income of \$ 1,600. It is important to mention that, GDP is not the only viable index to adeptly measure the collective household's decision on energy consumption^{6,10}. The household income of the urban dwellers in Ghana varied heavily based on academic qualification and the nature of work under consideration. Meanwhile, an extrapolation of the lowest to the highest income levels based on the minimum wage is considered. The monthly income level within the urban dwellers ranged from as low as 50 euro to about 2,000 euro per month (approx. 100 - 4000 GHc). Upon this finding, one can easily assume the type of SSE affordable to the people. Based on this premise the conclusion is that, the higher the income the more expensive the type of SSE considered.

Nevertheless, the frequency of power outages per location would also easily affect the type of SSE adopted despite the price factor. A typical situation in the urban communities of Ghana is found in numerous high and low capacity generators and rechargeable lamps in contrast with those living in the poorer communities using candles, kerosene lamps, flash light, low priced rechargeable lamps as well as low capacity car batteries. Future field studies aims at unraveling aspects of the aforementioned points to help present a model for calculating the percentage of household income used on any specific secondary source of energy.

As to the reasons for the need of a SSE, the findings revealed yet two more underlining motives: *what triggered the purchase and why the particular purchase*. The finding concludes that *regular power outage, brownout and inaccessibility to grid* were the main triggers. Power outage affects both rural and urban dwellers that have access to the national grid. For this reason, lack of electricity supply appears to be the major cause for the need of a SSE. Moreover, there are situations whereby there is power, yet with insufficient voltage (brownout) to power basic devices like TV and refrigerators among others. For the aforementioned reasons, the need of a reliable SSE increases at such times. At the extreme end of the situation are sections of both the urban and rural dwellers that do not have power at all due to inaccessibility to the national grid. The situation leads such citizens without any other choice than a SSE, thus the need of these sources becomes a daily concern. There are so many people who are into petty trading especially at night selling almost anything from a home cooked meal to simple household items like toilet tissues.

Apparently, these household and petty traders' resort to the purchase of specific types of secondary energy source most suitable for varied needs. Popular among such purchase includes candles, portable flashlights and generator to take care of immediate household needs or to power such facilities used for petty trading, thus answering the underlining motive on why a particular secondary source of energy is purchased. The positive aspect of this is that the energy is sometimes acquired and used for productive activities that generates income other than merely using it for relaxation or recreational activities like watching television or listening to the radio. Nonetheless, these two underlining reasons are applicable to both urban and rural people.

A probe into the uses of a SSE also varies greatly based on the type of SSE available to the user. Candles are primary needed for lighting, batteries for powering radios and lamps, whereas car batteries are used to power TV sets and other smaller appliances. Generators are

on the other hand really used for various needs based on their capacities. Therefore, the issue of usage type and rate enormously triggers the purchase of any of these SSE.

The situation in the rural communities is relatively different compared to the urban dwellers. Within the rural communities, the main source of income comes from peasant farming generated from seasonal sales of crops. The study established that some rural citizens' livelihood is highly dependent on their farming activities with virtually no source of extra or other income to save. It therefore leads to yet a more positive conclusion that, their need of a SSE highly varies. The basis for the usage of both primary (conventional) and SSE is for powering lights, radios, TV sets and in some circumstances refrigerators. In view of the fact that most food stuffs come from the rural areas the implications was obvious: Most rural communities are instrumental in serving one of the basic necessities in life: sustenance. It is thus socially justifiable if some of their energy needs are met and supplementary financed by people in the urban communities. Nevertheless, the donkey principle tries to emphasize the need for transparency in all the activities for which such extra levies are collected, thus justifying the extra load they have to carry on behalf of the rural communities.

Table 1. Secondary sources of energy production in Ghana

Source of energy	Fuel	Capacity	Usage	Price Range (GHC*)	Consumer Category
Candle	Paraffin	Unknown	Light	.20 - .50	The product is available to both rural and urban communities.
Lamps/Torch/Flash Lights	Kerosene and Dry cell batteries	1 – 9 Volts	Light	.50 - 3	The product is available to both rural and urban communities.
Car Battery		12 – 24 Volts	Light, Radio, Television	50 – 200 depending on brand and ampere	Higher percentage by some rural communities
Generator	Petrol / Diesel	2-7.5 Kva ¹	General household appliances including fridge and other portable equipments	590	Urban households and small and medium sized enterprise (SMEs)

c. 1 dollar = 1.5 GHC as at 1st March 2010, *GHC – Ghana Cedis, ¹Kva – kilovolt-ampere

5. Conclusions

Considering these parameters and the configuration of energy usage give a glimpse into reasons why political decisions and state-based activities are needed for a reasonable distribution and billing of energy systems in the country. It is noteworthy to mention that people often adopt and adapt different forms of energy systems due to desperation and the unreliability of the national grid. Although the purpose for using these SSE might not often be seen or directed to productive activities, it was observed that the bottom line of the quest for acquiring such systems is for the end user to have their peace of mind.

Interestingly, the research discovered a different sense of sharing. During an earlier focus group discussion leading to this supplementary research, one of the participants explained an interesting scenario involving how generators are used in the country; this was confirmed by others present. Apparently, households who own generators developed their own distributed energy solution, in that they share excess capacity of their system with their neighbor for a small fee. Although the original objective was to avoid being a nuisance to one's neighbor due to the noise made by generators, the individual/household have found a mutual way to share both the pain and gain from this specific energy system.

Evidently, the study helps in identifying certain shortcomings of the SSE discussed and it was applicable to both the urban and rural dwellers. The disadvantages were as follows:

1. Variable cost factors (*regularity of refueling and recharging car batteries etc*)
2. Environmental pollution and unfriendliness (*noise from generators, burning of fuels, disposal of batteries etc*)
3. The unreliability of supply

From the aforementioned points, it is apparent that following the Robin Hood principle in electricity distribution has the inherent possibility in bringing an end or reducing immensely the purchase of SSE like candles, generators, batteries etc. This is possible since the diverted energy weaned from the urban to the rural communities will help improve the agro-base industry by helping them to add value to its production and distribution cycle. Furthermore, these SSE that is erratic at best, with seemingly shorter life span cannot be compared to a lasting solution (photovoltaic or any renewable energy systems) which in itself could promote tremendous amount of savings on energy over a realistic period. Since patronizing tendencies are rampant in developing countries whose government, NGO, and other advocates tend to propose, build and launch laudable but limited energy programs to the few only to repeat the phenomenon at their political whims, makes consideration to the Robin Hood theorem a paramount issue. It is obvious that giving power to the people promotes individual and social responsibility as well as fosters a conscious effort to building a viable platform for economic development and growth.

Furthermore, the Donkey principle suggests that urban dwellers should carry some of the burden of energy costs of the rural communities. Moreover, policy makers should promote transparency and to implement policies that uphold trust among the people. Since taxpayers' money is involved, accountability goes a long way to foster mutual understanding of the direction and developmental objective of the authorities. The principle also suggests an educational platform where all parties involved (policy makers, service providers, households and individuals) gain access to relevant information by any medium available to not only be aware but also be concern about the needs of the people and how to serve them better.

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