DIFFUSION OF SOLAR ENERGY TECHNOLOGIES IN RURAL AFRICA: TRENDS IN KENYA AND THE LUAV EXPERIENCE IN UGANDA

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ABSTRACT: The diffusion of Modern Energy Technologies Africa has been found to be very low especially for solar energy systems. The installed solar PV capacity in Africa is a major issue of concern globally. This low trend in technology adoption is of interest because Africa enjoys some of the best solar radiation levels in the world averaging between 4 – 6 kWh/m^2/day for most of the year. It was initially speculated that the low uptake of solar technology was associated with the continent's high poverty levels and limitations in technical capacity as well as awareness; nevertheless, the introduction of Mobile Telephony Technology (MTT) has cast some doubt on those speculations due to the rapid assimilation and diffusion of the technology in several African countries. The paper elaborates on the approach taken by a successful MET business model known as the Lighting-up-a-village (LUAV), designed by an energy company, Barefoot Power (BFP), in Uganda. This model has been used to distribute micro solar home systems in rural Uganda and exhibited a rapid uptake rate that resulted in the establishment of 18 LUAV projects in a span of 12 months. Through the LUAV program, more than 3000 households took up the technology securing their own independent power generation hub. The success factors noted in the LUAV business model were identified and highlighted so as to present recommendations on the key factors that can possibly drive a rapid adoption of METs.
Keywords: solar energy diffusion, rural electrification, Africa solar potential

1 INTRODUCTION

The diffusion of solar and other modern energy technologies (MET) in African countries is very low with the solar penetration rate rising from 1% in 2010 to between 3% and 4% in 2013[1], [2]. Paradoxically, countries on the African continent are exposed to one of the best solar radiation regimes globally, receiving between 4 – 6 kWh/ m^2/ day in most months of the year as they lie within the Sunbelt region.

The Sunbelt is defined as the region of the planet that is found within ± 35^0 latitude. Incidentally, despite having the best solar resource, this region makes up only 9% of the global installed PV capacity today [3]. Moreover, the Sunbelt region is home to 75% of the world's population and represents 40% of the global electricity demand [4]. In essence, the region has the highest unmet OR latent demand for electricity services today and 80% of the expected global electricity demand growth will come from Sunbelt countries [3]. In addition, a survey carried out by the European Photovoltaic Industry Association (EPIA) [5] in 2010 into 66 countries within the Sunbelt region revealed that the region actually had the potential to achieve an installed solar PV capacity of 1.1 TW by 2030. The EPIA report however indicated that several changes and actions needed to be taken in order for such an ambitious capacity to be achieved. The report mapped out two possible scenarios in which the Sunbelt solar potential could be unlocked, these are a "Paradigm Shift" which would result in the achievement of the 1.1 TW installed capacity by 2030 and secondly an "Accelerated Scenario" which would seem more feasible and achieve an installed PV capacity of 405 GW by 2030. These projections are pegged on significant changes in the regulatory issues in the 66 Sunbelt countries as well as significant drops in the LCOE from solar systems [5]. Figure 1 is a representation of the growth in solar PV energy demand globally in 2012 by regions [6]. According to this survey Africa and Middle East represented only 0.48 per cent of the global solar energy demand, with Europe, a region with marginal viability for solar powered systems, reporting the highest demand of about 57%.

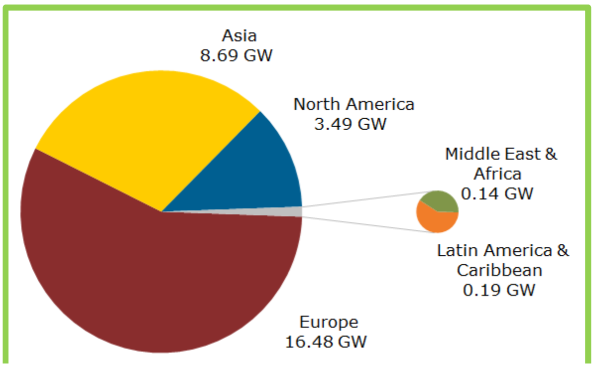

Figure 1: Solar PV Demand by Region 2012

Figures 2 and 3 show the global solar radiation and installed solar PV per capita respectively [7]. The figures reflect the findings from the referenced reports indicating that the regions with the highest average solar radiation levels also have the lowest installed capacity per capita. In the past, the poor diffusion of modern energy technologies, MET, in the developing countries, and especially in rural or remote areas was attributed to poverty and ignorance. However, recent market dynamics have cast doubts onto this theory because the Mobile Telephony Technologies (MTT) have had high success in market penetration in the same environments and under tougher conditions due to the lack of subsidization or donor support. In Uganda, for example, it was found that about 42% of the population owned a mobile phone, while only 12% had access to electricity [8]. A significantly greater contrast is observed in Kenya, where 93% of the population are mobile phone users, while only 16% of the population has access to grid connected electricity [9], [24]. Nevertheless, in Kenya, other dynamics are in play with more than 320,000 solar home systems installed by 2010 indicating that about 4.4% of rural households own a SHS (Lay et al. 2013).

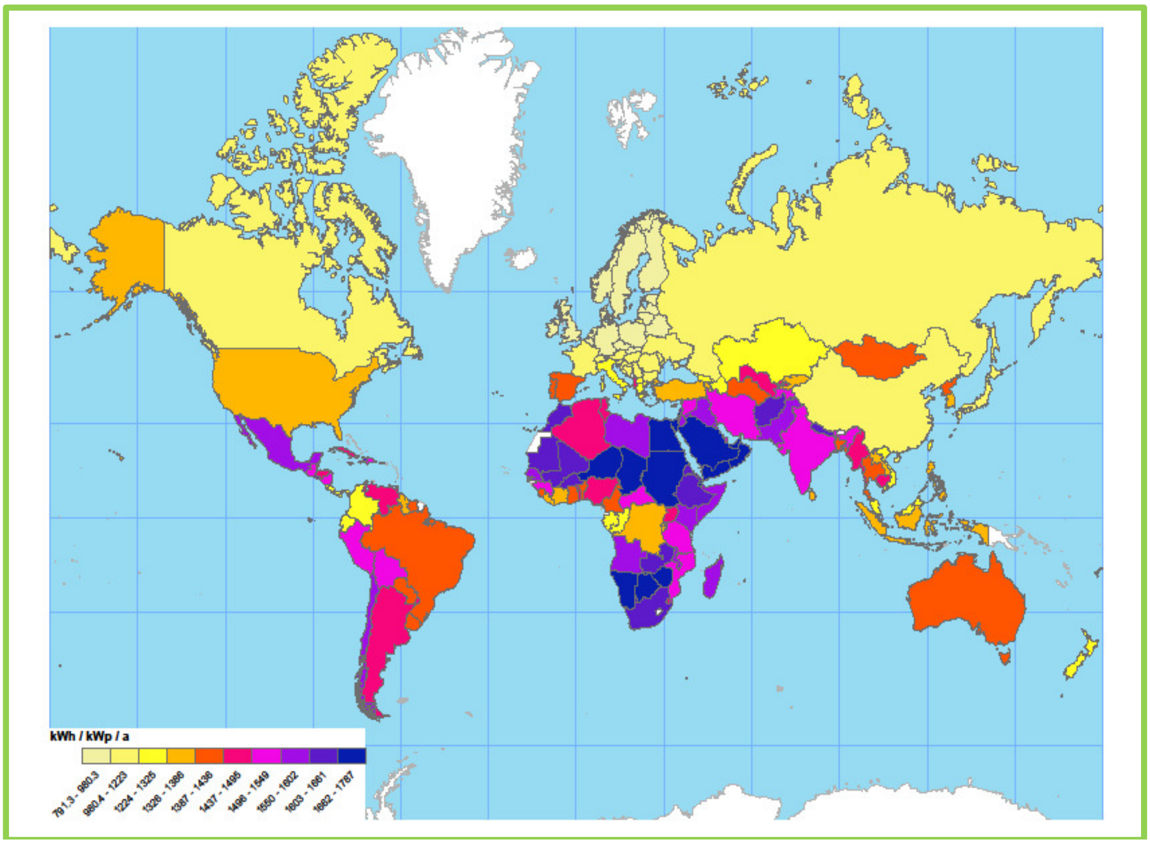

Figure 2: Global solar radiation levels [7]

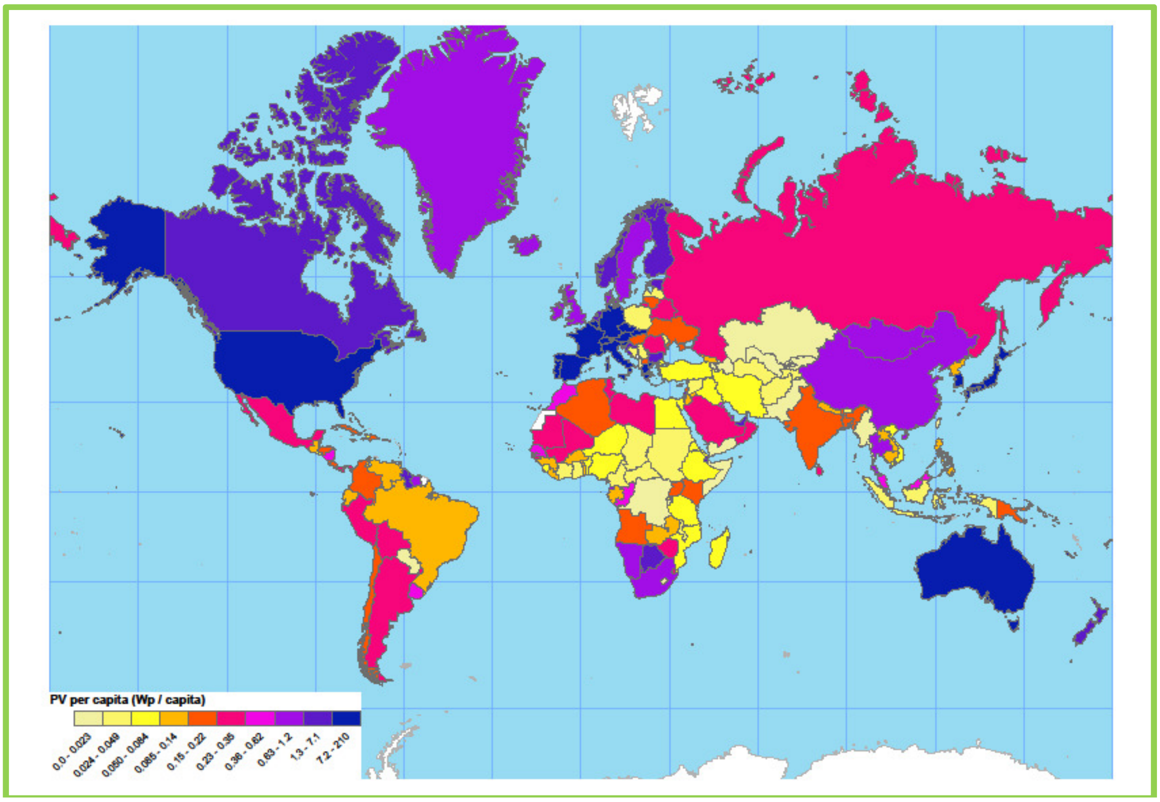

Figure 3: Global Installed Solar PV Capacity per Capita [7]

By narrowing down the focus from Africa as a whole, to regional settings and further to the community setting, it is possible to look at the actual factors affecting the diffusion of METs at the bottom of the pyramid where people are most affected by the lack of access to modern energy technologies. The majority of the rural population in East Africa lack access to electricity. In fact, only about 10% to 20% have grid connected electricity in the vicinity of their homes [11]. The people living in these areas have limited energy options and have to choose between using kerosene, candles or firewood to light up their homes. Apart from having poor illumination levels, which are about 1% to 10% of the recommended levels, these light sources pose several health risks to the user such as burns, respiratory ailments and blurry vision among others [12]. In addition to the risks, these fuel based lighting systems are an expensive source of light in the long run [1]. A study carried out by GIZ [13] found that some households would save up to 100% in lighting expenses simply by replacing their kerosene lamps with solar lanterns.

Furthermore, due to the significant difference in diffusion levels of MTTs and METs, many mobile phone owners in rural communities in Africa have no direct means to recharge their phones. In such cases, people pay for mobile phone charging services in charging centres located quite often far from their homes. People who use the modern solar lanterns equipped with phone charging options have begun making some extra money by selling this service to their neighbours [13], which was the case with 70% of the users involved in the survey.

2 APPROACH/ METHOD

In order to identify major challenges of solar technology diffusion in Africa as well as highlight some factors driving the adoption of the technology, a review of previous documentation into the subject of the penetration of METs in Africa was undertaken. Special interest was placed on the solar energy technologies and the limitations of adoption in the Sunbelt region as opposed to the regions outside the sunbelt zone that have had better performance in the implementation of solar energy projects despite having limited solar energy resources.

Once the challenges on the global scope had been identified, more reviews were carried out to find out what the specific challenges were in the regional setting. This was done by evaluating the factors affecting the penetration of MET in Kenya and Uganda. As it was identified that the penetration of METs was significantly surpassed by the diffusion of MTTs it was necessary to look into the factors that contributed to such a variation. A review of a research carried out to investigate the diffusion patterns of the MTTs to the METs [8] was done in order to compare the two technologies and pick out key lessons.

Finally, a review of a successful MET business model in East Africa was carried out in order to highlight specific factors that led to the successful implementation of the program in rural Uganda as well as the possible scaling-up strategy. This was the rural development program known as Lighting-up-a-village (LUAV) initiative that was deployed in Uganda in 2012. The initiative has drawn interest because it has been able to achieve a high adoption rate by successfully providing micro solar energy systems for over 3000 households in a span of 12 months. It was deduced that certain aspects of the LUAV business model as well as the MTT strategies can be employed in other solar energy businesses and yield better diffusion results than the ones currently being observed across Africa Sunbelt region.

3 CHALLENGES FACING DIFFUSION OF MODERN ENERGY TECHNOLOGIES – METS

The limited diffusion of solar technology in Africa can be attributed to a wide range of factors associated with players on every level of the value chain from the end user through to investors. Despite the global viability and growth of the solar energy market in the developed world, African countries continue to lag behind representing less than 1% of the market demand for solar energy [6]. Several developments and market forces have resulted in the global growth of the solar industry due to the consistent decline in solar module prices. In essence, the price of solar modules has effectively dropped by more than 80% over the last five years [14]. Although the MET solutions have proven to be a safer and more cost effective alternative when compared to the traditional fuel based lighting solutions employed in the rural communities, the low MET adoption rates in Africa indicate that there other factors apart from module price that affect the diffusion of solar technology in the region.

A study carried out in Kenya in 2013 (Lay et. al, 2013) sought to define the cross sectional energy ladder as it applies to the choice of lighting fuel in Kenyan households looking into various factors such as education level and income bracket of the household heads, the average household overall expenditure, ownership of the dwelling, potential grid access, rural/ urban setting of the household and the prevalence of SHS in the area. The leading factors affecting the transition from traditional to modern fuels for lighting according to Lay (2013) were found to be income levels, level of education and proximity to existing SHS. These results were corroborated by other studies in order to zero in on the larger factors at play in African countries. Lighting Africa's research into the penetration of Pico PV lighting systems in rural Africa found a similar array of challenges including Access to Finance, Distribution Challenges, Consumer Education, Market Spoilage by poor quality products, unsuitable Government Policies and lack of After Sale Support [11]. Consolidating the factors listed in this research, it was found that the challenges affecting the growth of the solar energy industry in Africa can be grouped into the following four categories:

i. Enabling Environment
ii. Access To Finance
iii. Awareness
iv. Access to Technical Support Services

3.1 Enabling environment

An enabling environment refers to the prevalent conditions in a country or region that support the growth of that industry. The enabling environment is mostly a function of the national government and regulatory bodies. National policies are an effective way to boost the viability of a business model and private sector participation when those policies as suitable. In Europe and the US, several solar energy projects came to realization due to subsidies and tax breaks as well as other supportive policies in the early stages of development. In 2012, nine of the ten leading countries in solar power installations saw a drop in small scale investments in the industry because their governments cut back on subsidies [14].

In Kenya, the Energy Regulatory Commission (ERC) together with Ministry of Energy and Petroleum developed new energy generation growth path based on the Least Cost Power Development Plan (LCPDP). The latest version of the LCPDP, released in March 2011, covers the 20-year period from 2011 to 2031 [15]. Methodologically, the report utilizes a least-cost planning approach aimed at delivering the required level of electricity supply at any given point in time at the least overall economic cost [16]. Looking closely at the LCPDP for Kenya, as illustrated in figures 4 and 5, it is clear that there is no provision for the generation of electricity from solar energy resources at any point in the projected 20 year period. The same stand point is evident in the Medium Term Plan 2012-2016 [17]. The conclusion to omit solar energy sources from the electricity supply projections was based on previous assumptions that rendered solar too expensive in this setting. The LCPDP consequently stresses the "great potential for the use of solar energy throughout the year because of [the country's] strategic location near the equator" [15] but limits it to SHS, solar water heating and other off-grid uses in rural areas not meant to be covered by the grid in the next 10 years [16].

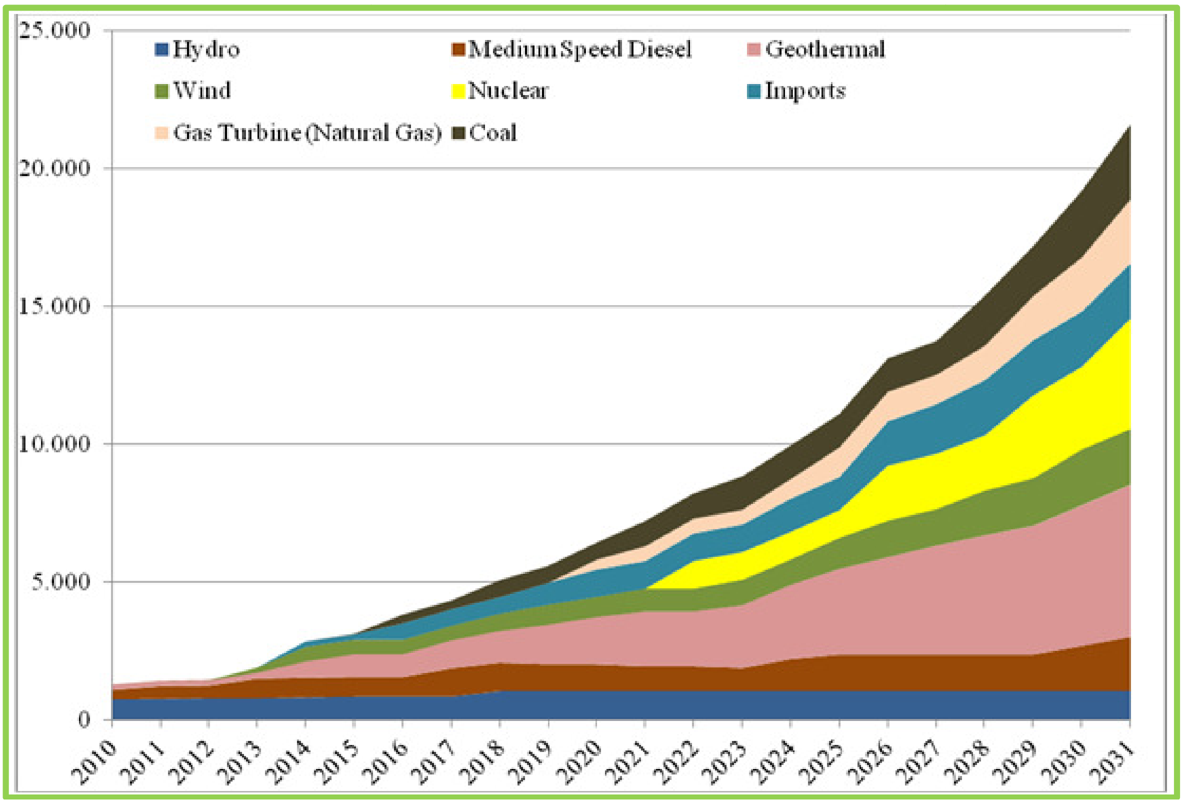

Figure 4: Total installed electricity generation capacity in GW by technology (includes imports of hydro-electricity from Ethiopia) according to LCPDP 2011-2031 ("base case") [16].

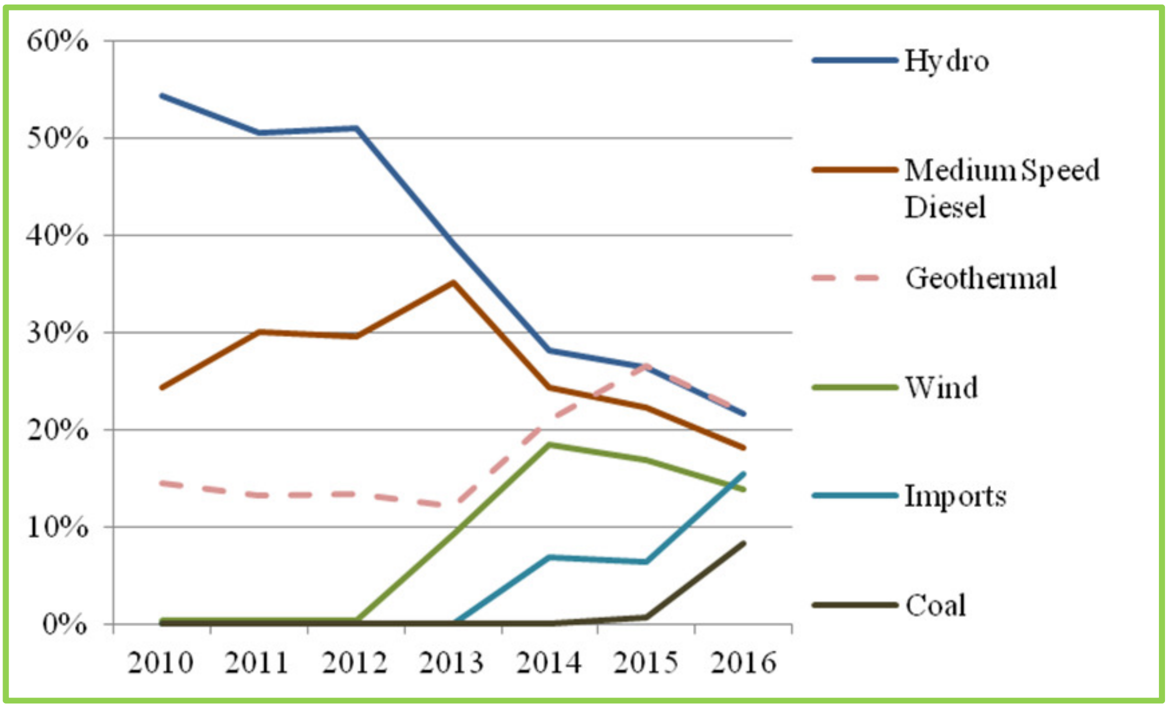

Figure 5: Share of total installed electricity generation capacity by technology between 2010 and 2016 according to LCPDP 2011-2031 ("base case") [16]

3.2 Access to finance/ affordability

Access to finance has been defined as the most significant challenge to the penetration of solar energy systems in Africa. The effects of limited financing options are felt on all levels of the distribution value chain from the manufacturer through to the importers, distributors, dealers and finally the end user [11]. The lack of detailed information about the solar industry in African countries is a major impediment to foreign direct investment. The limited awareness of market trends and rates of return along with the fears of political instability raises the risk elements for investors. These factors lead to the development of a 'High Perceived Risk' level that results in an overall investment uncertainty. However, in 2012, investments into the solar industry in developing countries went up by 19% as a result of about $112 billion injected into the market. This was the highest ever investment on solar energy in Africa [14].

The limitations of the Access to Finance can also be attributed to the Cost of Capital which has emerged as a major impediment to the growth of the solar energy in developing countries [16]. Cost of capital is the cost of the funding used to finance a business and is dependent on the mode of financing as well as the policies at the firm or lending organization. It is usually determined by the ratio of the cost of equity to cost of debt capital used to finance the venture. It has been found that in Africa, high interest rates combined with the cost of technology and foreign expertise has negatively affected the implementation of solar energy projects. This high cost in effect raises the cost of energy (COE) making solar power one of the most expensive sources of energy for electricity generation. In Kenya, this research has found out that the solar based LCOE was approximately 21 $ct. /kWh based on data collected in 2010 [16]. Nevertheless, in 2012, the share of foreign investment in the African solar industry rose significantly as already mentioned. At the same time investment in the US and Europe dropped a notch due to policy uncertainty and cuts in subsidies for renewable energy [14]. These emerging trends could positively affect the cost of capital in the region and lower the LCOE of solar energy as Europe and the US will start venturing into the African market.

Furthermore, with strategic negotiations and financing models, larger solar projects can achieve a lower cost of capital in Kenya and thus become commercially viable. Strathmore University, SU, for example has begun the installation of a 600 kW roof top, grid-connected solar plant that is economically viable through the acquisition of a soft loan from the French Development Agency, AFD. Strathmore University will sign a PPA with Kenya Power (KPLC) that would see the utility purchase its solar generated electricity for twenty years at an agreed price. SU further filed an application to be exempted from the newly introduced Value Added Tax on solar energy products as well as to be considered for zero-rated import duty on the equipment. This application was granted and effectively reduced the project cost by 16% significantly increasing its viability.

Finally the access to finance challenge at the bottom of the pyramid are defined by the end user's inability to afford paying upfront for the MET products. The cross sectional energy ladder in Kenya has shown that the people's choice of fuel for lighting their homes is defined by their income levels [10]. Traditional unsustainable fuels are used by the poor and transitional fuels such as kerosene are used by the rural middle class. Conventional electricity and solar home systems are then employed by the rich. However, in Africa, the bulk of the population live in rural and peri-urban areas. Although the long term cost of solar technologies are cheaper than the alternative fuel based lighting, the upfront cost for solar remains a barrier. People prefer to buy the products through a stretched out payment plan making use of microfinance institutions despite of their high levels on interest [18].

3.3 Awareness

Consumer education has been highlighted as one of the top three challenges facing the penetration of Pico PV systems in rural areas in Kenya and the rest of Africa [11]. There is a major need to raise awareness levels of the target market on the available energy generation options and their benefits as well as the hazards involved with using fossil fuels to light their homes. Furthermore, there is a shortage of entrepreneurial skills and entrepreneurial capacity in the energy sector [8] which has limited the marketing and the availability of solar products and other METs to the end user.

Finally, the aspect of awareness that is most challenging to overcome is caused by Market Spoilage. Market Spoilage occurs due to the presence of substandard products in the market. In a study carried out by the Lumina Project on LED torches in East Africa it was found that 90% of the users experienced quality related problems during the six-month study period [19]. Poor quality products, albeit cheap, increase the difficulty of market penetration because the end users no longer trust the technology. In 2009, Lighting Africa began testing the quality of solar products available in the Kenyan market. The study revealed that 13 out of the 14 Pico PV products in circulation did not pass their quality tests. A second round of tests was carried out in 2012 when the number of products in the market had risen to 120. The results showed an improvement as 46 of the products passed the quality tests [11]. This nonetheless is not satisfactory as less than half of the products were substandard. Market regulation is an expensive hurdle that has to be overcome for any solar energy product to develop a client base especially in rural Africa.

3.4 Access to technical support services

Availability of technical assistance in the proximity of the end users is a key factor in countering the effects of market spoilage. The presence of technicians well versed in trouble-shooting, repair and maintenance of the MET systems in the locality increases the trust of the consumers [20]. Due to the novelty of most of the solar energy products, it is important to develop local maintenance capacity in the area where the products are being marketed. Nevertheless, the scattered nature of BOP consumers coupled with their low buying power makes the notion of setting up service centres in the distribution regions unsustainable [21].

4 MET VS. MTT PENETRATION IN KENYA AND UGANDA

In order to develop solutions to counter the 'African Energy Challenge' [16] innovative approaches towards increasing the penetration of alternative sources of energy should be implemented on all levels of the value chain. In Uganda, for example, despite long term efforts by the government to increase access to electricity in rural areas, the growth rate is negligible this far. In fact, only 12% of the population has access to modern electricity services. With the onset of solar lanterns and the mini PV systems, it was expected that people would buy them and consequently replace the use of kerosene lamps for lighting purpose. Nevertheless, the factors influencing people's choice of fuel combined with factors limiting the uptake of solar technologies in rural areas in Africa continued to prevent the diffusion of the METs. These factors were found to be centred on the income and education levels of the end users as well as the exposure or proximity to households where solar powered systems are operational [10]. Furthermore, as already mentioned, initial speculation that poor adoption of MET was due to ignorance and poverty was dispelled by the rapid uptake of MTTs by the same people leading to 46% of Ugandans and 93% of Kenyans using mobile phone that are in most cases more expensive and more complex than the solar lanterns [8].

Table I: MTT vs. MET penetration levels in Kenya and Uganda

Country	MTT penetration	MET penetration
Kenya	93%	16%
Uganda	46%	12%

5 CASE STUDY REVIEW: LUAV

The LUAV business model has achieved rapid success in its 12 month trial period by successfully lighting up more than 3000 households in rural Uganda through 18 LUAV programs. The LUAV program, devised by an energy company known as Barefoot Power (BFP), is a rural development initiative designed to improve access to METs in remote areas of developing countries. It addresses the challenge of Pico PV market penetration by empowering rural communities to actively participate in lighting up their own villages using micro-solar systems. This is achieved by leveraging local organizations and authorities in the product awareness, dissemination processes and management of payments on a community by community basis rather than individual end users. The program incorporates local SACCOs and Community Based Organizations (CBO) as well as local governmental bodies in the identification and recruitment of participants.

A single LUAV program is designed to involve at least 100 households per community by providing each home with its own versatile power generation solar system which, in this case is the BFP Connect 600 system priced at 130 USD. This product provides a range of services including domestic lighting, mobile charging and the option to power a small radio or fan. The participating households are given the choice to either pay for the micro solar power system upfront or to pay for it in 3 to 12 monthly instalments and the local CBO is given the responsibility and relevant training to manage the revenue collection at a marginal cost. Riding on its initial success, the LUAV business model is set to expand into South Sudan, Rwanda and Kenya in 2014/ 2015.

Some of the unique features of the LUAV system is that each household will purchase a off-grid energy high quality solar system 'Lighting Africa approved', able to provide lighting, mobile charging services and powering small loads. The business model addresses a number of the challenges facing new businesses in Africa as well as the solar industry. The model seems to answer successfully three challenges posed by MET diffusion in the African setting:

i. How consumer awareness levels can be improved in the community.
ii. How the solar technology can be made affordable.
iii. How technical support can be made readily available to the end users.

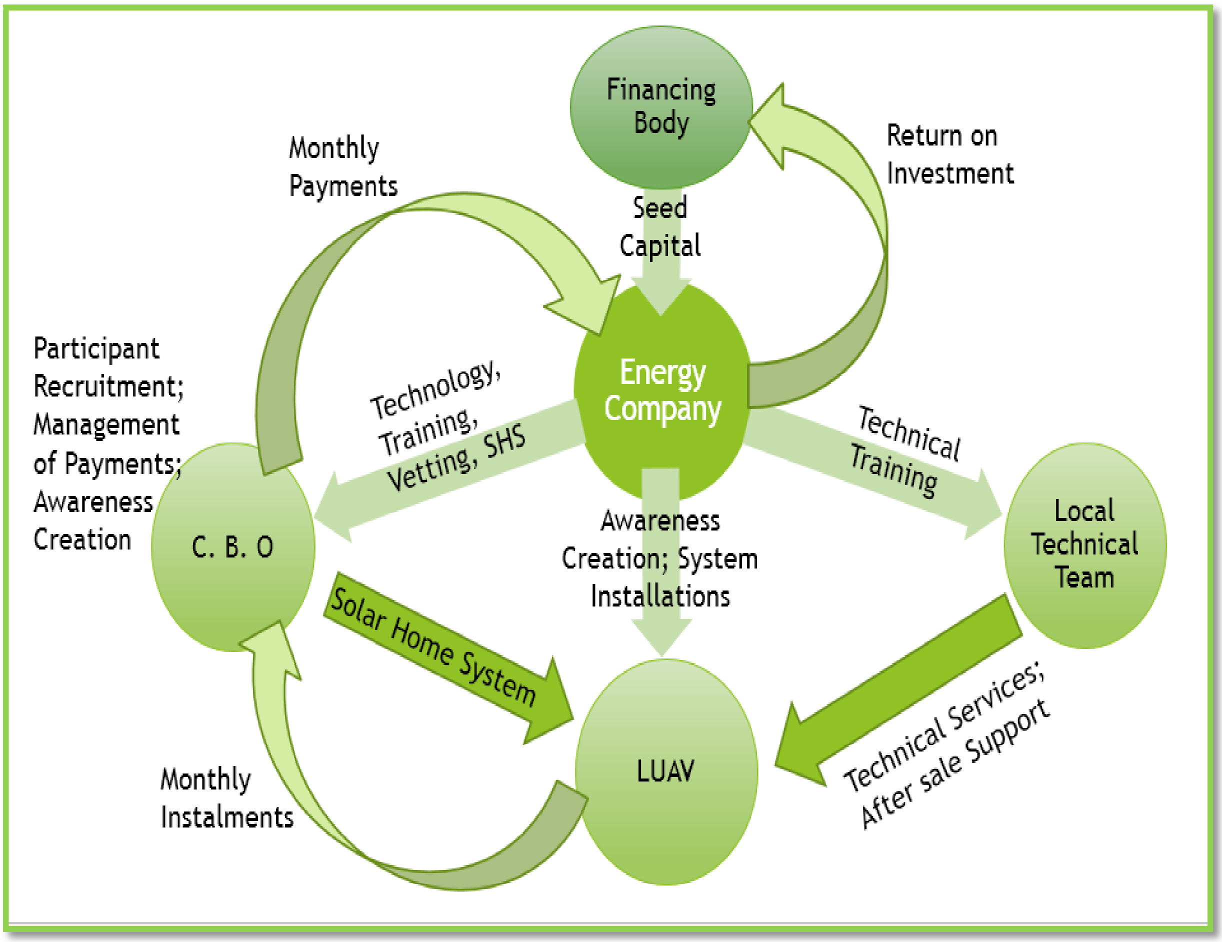

Figure 6: Representation of the LUAV Business model Structure

5.1 Consumer awareness

The LUAV model took on an innovative approach by focusing on developing the entrepreneurial capacity in each region and leveraging local Community Based Organizations (CBO), Savings and Credit Cooperative Societies (SACCOS) and Governmental Organizations/ Officials towards creating consumer awareness as well as recruiting community members in to the LUAV program. The program was built on a community to community basis and the local organizations became the face of the energy company, BFP, on the ground. The success of the LUAV model is built on the competence and reliability of the CBO partnering with the energy company in implementing each LUAV. As such, the energy company has to take careful considerations when selecting the CBO they will work with. A good CBO will repay the energy company which in turn will return the external financial support given to it in the form of a revolving fund to buy upfront the 100 systems. The LUAV model was designed to incorporate at least 100 households per community, as such, the awareness campaigns would carry on as people sign up and register with the CBO. Once the number is reached, the BFP team of trained technicians comes to install the micro solar systems in each house. Rural people tend to trust more in the opinion of locals rather than in demonstrations by "strangers"

5.2 Affordability

A number of innovative solutions have being devised to battle the lack of access to finance at the BOP in African communities [11]. The LUAV system uses the CBOs as an intermediate between the company and the main target group for the solar portable lantern who are kerosene users spending an average of 25 cents of U$ per night and thus unable to raise the130 $U to pay for the system even though they realize the benefits of switching to solar. Their choice of fuel for lighting or cooking is based primarily on their income [10].

The LUAV system gives the project participants 2 payment options, namely pay for the micro-solar system in cash up front or sign for a loan with the CBO for an instalment system. The system of choice is the Barefoot Power Connect 600 system that has a retail price of 130 USD. At the community level, it was expected that most people would not afford or be willing to pay up front. The energy company collects the payment from private investors who initially believes in the concept. With time, as the LUAVs gained popularity multiple stakeholders such as the SACCO member's deposits, NGOs donations, crowd funding, and savings groups became involved in raising the funds. The CBO buys at least 100 lanterns from the energy company at a wholesale price about 10% to 20% below the retail price and sell them to the LUAV participants for payment over 3 to 12 months.

This model worked well because the CBO officials knew the project participants directly and had the ability to follow up the payments reducing greatly the levels of delinquency. The energy company or MFIs would be overwhelmed with the task of keeping track of at least 1200 transactions per LUAV and the growth of the program to other regions of the country would be staggered. Financing organizations were interested to participate because they would be working with groups at community level rather than individuals.

5.3 Technical support

In order to ensure sustainability of the project, BFP needed to prove that their product works and is reliable. This element has been a challenge in rural African communities. The existing mistrust on solar technology was addressed in Kenya by the establishment of quality assurance standards for testing and approval of solar Pico PV products by Lighting Africa. The BFP Connect 600 is a Lighting Africa approved product that consists of a 6Wp polycrystalline panel with a 4 Ah AGM sealed battery and 4 LED lights which give light for a minimum 6 hours once fully charged. Additionally two USB output allows for charging mobile devices such as phones and tablets. A 12 Volt output provides for radio or fan powering. Every unit comes with a standard two year warranty.

Furthermore, the energy company deploys its own trained technicians to carry out the installations according to the set standards and train the end users on the operational aspects and basic troubleshooting. Finally, the BFP staff, during the installation and commissioning phases would train local technicians on the maintenance and repair as well as the operational challenges posed by end users. This built the participants' confidence in the system reliability and increased the uptake rate.

Table 2 below shows a list of the first 14 LUAV projects that were established in Uganda. The seed capital was provided by different partners in each case with some partners supporting more than one LUAV. Some LUAV projects were supported despite having less than the minimum 100 households signed up while other projects had up to 500 households enrolled. The impact of the LUAV projects continues to be felt in each of these communities and consequent research will be carried out to determine the long term impacts of the program in the participants themselves and the community as a whole.

Figure 7: BFP Connect600 which is the micro system utilized in the LUAV project.

Table II: Summary of the results for the first 14 LUAVs installed in Uganda.

	Name of Project	Partner and/or CBO	No of HHs	Month Started
1	Kiprotich Village – Kapchorwa	BFPU/ MESICS	100	Jul-12
2	Buswiriri LUAV – Bugiri	CARITAS-JINJA/ MESICS	120	Jul-12
3	Kasese (LUAV) – Kasese	Karambi Sacco/ WWF/MESICS	70	Dec-12
4	Kyabarungira Sacco – Kasese	Kyabarungira SACCO	90	Dec-12
5	Kalalu – Iganga	Mivule/ Solar Links	162	Dec-12
6	Friends of Nature – Kasese	Friends of Nature/ WWF	28	Dec-12
7	Okabi – Arua	GIZ/ Barefoot/ Community	130	Feb-13
8	Fofo – Nyo	GIZ/ Barefoot/ Community	132	Feb-13
9	Tororo LUAV1 – Mbale	CARITAS-Tororo/ MESICS	500	Jun-13
10	Tororo LUAV2 – Mbale	CARITAS-Tororo/ MESICS	500	Jun-13
11	Kiwani – Iganga	Mivule/ Solar Links	140	Aug-13
12	Maddo LUAV-Masaka	CARITAS-Masaka/ MESICS	300	Sep-13
13	Kiyinda LUAV – Mityana	Kiyinda-Mityana Diocese	200	Sep-13
14	SOS Children's Village – Fort Portal	SOS Children's Villages	100	Nov-13
	Total		**2,572**	

6 CONCLUSIONS/ RECOMMENDATIONS

The LUAV model has been able to exhibit a high uptake of a versatile 130 USD micro solar home system in the rural areas of Uganda despite all the existing challenges detailed in this research by employing an unconventional model of marketing and distribution of their product. The energy company has been able to develop markets in villages that did not have previous awareness or demand for the product. Diffusion of solar technologies in the African setting requires unique localized solutions. Energy companies must seek to develop local authenticity [22] in order to effectively penetrate the rural markets.

6.1 National Policy Reviews

There is need for frequent review of national policies in line with the ever reducing cost of solar PV modules [16]. In order to take advantage of the solar energy opportunity, it is vital for policy makers to keep up with the continual drop in prices and changes in the industry. In fact, solar energy penetration in the Sunbelt region will not reach optimal levels unless future projections are made to estimate future prices and possibilities of solar energy projects. The EPIA study on unlocking the Sunbelt region's solar potential shows that realistic projection can be made today by presenting an estimation on the LCOE for solar PV in 2020 and 2030 as well as the implications on the feasible installed solar pv capacity [5].

6.2 Affordability

The Energy Company is able to facilitate the setup of a revolving fund that allows end users to pay for the technology in installments of up to 12 months to be managed by the prequalified local partner CBO at a marginal cost. This is possible because financing organizations are more likely to lend money to a bankable organized group than to independent individuals. By establishing LUAV projects on a community by community basis with a minimum of 100 households each, the chances of getting other communities to sign up for the project greatly increases. It is hoped that even Government could eventually find this scheme suitable to received direct funding from their national budgets.

6.3 Building Consumer Trust

Consumer awareness in Africa is best spread through peer influence and word of mouth marketing [23]. By ensuring that a critical mass of participants are involved in a program such as LUAV before rolling it out, greatly increases the chances for success. Additionally, Lay et. al (2013) goes on to site proximity to operational solar technology solutions increases the tendency of people to take up the technology.

6.4 Local Authenticity

Making a business authentically local as defined by [22] is a vital aspect to the company's success in the African setting. This is especially true for new companies that have not had enough time to build local trust in their brand. Local Authenticity involves incorporating local personnel in the day-to-day running of the business or simply partnering and cooperating with local organizations. Cooperating with local organizations and community leaders as is the case with LUAV creates a leverage effect that results in more effective awareness campaigns, builds brand trust and lowers the risk of delinquency because the partners know the end users directly and are more effective in following up payment collection.

6.5 Local Capacity Building

The ability to scale up and increase the number of LUAVs in Uganda at the rapid rate reported was mainly due to the fact that the energy company separated itself from the day-to-day activities involved in running a single LUAV and delegate the tasks to the local CBO. This was possible due to the stringent vetting process used to select and approve a credible CBO and the consequent capacity building which involved training technicians and CBO entrepreneurs to operate the LUAV.

Training of technicians and entrepreneurs in the community ensures the continuity of the project and assures end users of quality support services which eventually results in low levels of delinquency. Another side of the same reality is that technicians are more likely to stay in the business given the broad clientele. Quite a good amount f funds have being used to train technicians who later abandon this trade because of lack of enough customers. [21].

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