Awareness on Solar Energy in Kenya

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Awareness on Solar Energy in Kenya

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Abstract

Solar energy coupled with energy efficiency awareness can be an important step to achieving the final goal of having a sustainable environment in the country. Together with a good energy policy including regulations, this goal can be achieved as it will help consumers make more rational decisions when it comes to new technology. A key problem identified in this work is the lack of awareness and strict energy policies.

The current funds put in place are not mobile and have not got to a large number of people. The government’s regulations on the other hand are not strict. This report aims to improve the current status by suggesting strategies to reach out to as many people as possible and educate them about solar energy options in Kenya. It aims to prepare to build a platform that creates awareness on solar energy, energy efficiency as well as the policies and finances needed to support their uptake.

In order to build this platform, analysis has been done through research and meetings with stakeholders who have provided first-hand information in order to formulate the foundation to a future platform. The information gathered has then been used to explain and meet the challenges faced in solar energy in Kenya. The conclusion of this project was that majority of the people in Kenya lack required knowledge about solar energy. There is need to create awareness in solar energy.
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Chapter 1: Introduction

1.1 Background

Kenya is a country located in East Africa with a population of 48.5 million people and a total area of 580,370 km$^2$. The energy use in the country mostly constitutes by wood fuel, petroleum and electricity. The informal sector, the urban poor and rural households provide for most of their fundamental need for energy with wood fuel. 68% of the energy consumption, in total, is from biomass (mostly wood fuel), petroleum 22%, electricity 9% and all the others explain the remaining 1%. 36% of the population have access to electricity (2017). The energy mix producing electricity is approximately 57% hydropower, 32% thermal (fossil fuel) and the remaining is geothermal and emergency thermal power (Gitone, 2014).

Wind power and solar PV constitutes a small part of the energy sources and is less than 1%. The total installed capacity in the country is 2.3 GW. The electricity capacity of the connected grid is about 1.429 GW. It costs to connect to the national grid, about 35000 Ksh (319 EUR). And, after that, the electricity service costs 0.1145 EUR per kWh. The costs are high; the prices make it a problem to expand the electricity connections to poor areas and smaller businesses. The rural households mostly use biomass energy resources, mainly firewood and charcoal (Energypedia, 2017).

Kenya as a country is aspiring to provide affordable sustainable energy to all, as spelled out in Sustainable Development Goal (SDG) 7. This is an important challenge with only 6% of the rural population with access to the grid electricity. Local energy resources have enormous potential in meeting immediate energy requirements for isolated institutions, businesses and households in remote areas (Wanjiru & Ochieng, 2013). Kenya has a vast renewable energy resource including solar, wind, biofuel, biogas, geothermal and hydropower, the issue they are facing is that their application is limited. The installed capacity cannot not meet the demand; therefore, the government has contracted emergency power to bridge the deficit (Kimuyu, Mutua, & Wainaina, 2012). The aim of the Kenyan government in the mid-2000s was to use solar photovoltaic systems
to operate in the remote areas. The use of solar in Kenya is mainly for photovoltaic systems, drying and water heating. Photovoltaic systems are mainly used for telecommunication, lighting and water pumping (Gitone, 2014).

Nairobi accounts for more than half of Kenya Power’s sales. This reflects the capital city’s economic dominance over the rest of the country. Kenya Power is the electricity company that operates and owns the majority of the electricity transmission and distribution system in Kenya. Predominantly owned by the government (Kenya Power, 2018). The electric power distribution company shows that Nairobi has consumed 3.5 TWh last year. That was 56.2% of the total electric power consumption. It was up from 55.8% in the previous year. Analysts state that the uneven growth in consumption of electricity will benefit some segment of the population especially in times of economic expansions. Kenya Power has divided the country into four regions. Those are Nairobi, Mt. Kenya, Coast and Western. Studies have shown that the number of customers in Nairobi using Kenya Power has a total number of 1.001,042, while the other 3 regions have a total number of 835,202 (Otuki, 2018).

1.2 Challenges definitions

The main problem that Kenya is facing in regards to solar energy is that people are not aware of its benefits.

<table>
<thead>
<tr>
<th>Causes</th>
<th>Consequences</th>
<th>Draft Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Less awareness mindset</td>
<td>1. Blackouts</td>
<td>How to create</td>
</tr>
<tr>
<td>2. Lack of innovative incentives</td>
<td>2. High cost of energy</td>
<td>awareness on Solar</td>
</tr>
<tr>
<td>3. Lack of implementations of government regulations</td>
<td>3. Climate change due to CO₂ emissions</td>
<td>Energy in Kenya</td>
</tr>
<tr>
<td>4. Technical Barriers</td>
<td>4. Inefficient use of energy</td>
<td></td>
</tr>
<tr>
<td>5. Social Cultural Behaviour</td>
<td>5. Lack of consumer awareness about the product</td>
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</tbody>
</table>
1.3 Aim

The aim of this project is to create the foundation to formulate a multi-stakeholder platform for awareness on solar energy (and energy efficiency required to get the most service out of it). This will bring together solar experts and solar users to help exchange their expertise in creating awareness in Kenya.

1.4 Specific Objectives

i. To analyse current energy situation in Kenya.

ii. To investigate measures, methods, techniques and approaches used for awareness creation on solar energy.

iii. To create the foundation to build a platform for awareness creation on solar energy efficiency.

1.5 Justification

Climate change has become a controversial issue due to use of fossil fuels. Most developed countries are moving from fossil fuels to renewable energy such as: solar, wind, biogas and geothermal. Developing countries through RES4AFRICA have come up with various solar initiatives to move from fossil fuels to solar energy. This has led to an increased number of solar professionals in Kenya and neighbouring countries (RES4AFRICA, 2018). To date, there is no platform where experts can collaborate and create awareness on solar energy. Therefore, this platform would be the first of its kind to create a pull of experts, solar users and those who are interested.
1.6 Scope and Limitation

The proposed platform will have different modules such as; awareness creation module. Awareness will be done using different modes such as; sending short message reminders to solar users and experts, experts sharing educative materials on the importance of solar and use of graphics. The experts’ collaboration module will help solar professionals share their knowledge and educate solar users on how to use solar systems. The users of the platform will have to use the registration module in order to use the platform. The system will contain a module that will have information about solar system specification. The platform should have more than the above mentioned modules; but this is the starting foundation idea.
Chapter 2: Literature Review

2.1 Introduction

This chapter reports a literature review on the current use of energy, how current systems operate now and what has been developed in the past. It will also reflect on the different measures that have been taken to create awareness on efficient use of energy and how people/users have responded to it in the past.

2.2 The Current Energy Situation in Kenya

Cost of electric energy is high in Kenya and stands at 0.1145 Euro per kWh which is high compared to other countries such as South Africa. Most users in Kenya however, use diesel powered generator as backups. These are expensive, have environmental impact and increases dependence on non-renewable energy. The resulting increased cost of energy needs to be addressed (Mukkam-Owuor & Kageni, 2018).

Another problem comes in from the kind of appliances used that lead to excessive consumption of electricity which leads to Kenyans using an extra $50-$100 every year. This happens as they lack awareness on the efficiency of such devices. And thus, have no idea what they would do and how they would distinguish energy efficient home appliances. This problem has also been influenced by the government as they lack strict regulations on the kind of appliances being shipped in to the country. When such appliances use too much energy they cause strain to the citizens as they use more energy, and spend more on electricity. The country then has to produce more to cater for the unnecessary growing demand (Sustainable Development Goals, 2017).

Kenya on the other hand has a rich availability of solar energy which could be maximized in its use. The country has an average of 5-7 sunshine hours per day, which results in 4-6 kWh/m². Because of the conversion efficiency of todays PV modules, 10%-14% of this energy could be changed over to electricity. This in its total installed potential would be about 23,046 TWh per year (RECP Africa-EU Renewable Energy Cooperation Programme, 2018). However, that is not
the case since the utilization is low, much lower than it should be. Some of the reasons why it is underutilized are; high initial costs which people do not realize that they will actually save much more on after the initial capital investment. Other reasons include low awareness of potential opportunities and economic benefits offered by solar technologies among the population (Stanley, 2013). Further, depending on the time of use, batteries are needed to store electricity from when it is produced to when it is used.

Biomass is another used source of energy. This is especially in the rural areas of Kenya where it is cheap, people are poor and alternatives are expensive. The biomass sources mainly include charcoal and wood fuel. This has adverse effects such as deforestation which then leads to desertification and affects the climate. Biomass contributes up to 70% of Kenya’s final energy demand which has negative impact. It causes land erosion and the new trees are not growing as fast as the old ones are being felled (Stanley, 2013). Further, the smoke caused by its burning to heat food, water and homes causes respiratory disease.

2.3 The Solar Energy Environment in Kenya

Professor Da Silva has a PhD in Power Systems Engineering and is a Certified Energy Manager. He started the Strathmore Energy Research Centre in 2012. As presented by the professor the challenges that are holding back solar technologies in Kenya are as follows (Silva I. P., 2016):

i. Enabling Environment

An enabling environment is one that encourages growth to the society or country. The government regulations put across in a country will highly determine the growth rate of a country. For clarification, “Kenya Least Cost Power Development Plan” provides a good example of how government regulations can hinder growth. The country’s energy commission makes no provision for the generation of electricity from solar energy resources at any point in the projected 20-year
period. The decision to omit solar PV was based on previous assumptions that labelled this technology as too expensive, which is not the case today (Silva, 2016).

ii. Access to Finance and Affordability

This has been seen as the most significant challenge that’s holding back solar technology in Kenya. With minimum financing options most people are stuck with the one-way journey of seeking loans from banks which getting is not a hassle but with their high interest rates of 15%-25% it is becoming harder for citizens to borrow loans. Additionally, foreign investors, who would bring in affordable rates, are weary about the market because of the assumption of high risk of investing in third world countries (Silva, 2016).

iii. Awareness

Consumer education is another key challenge, particularly in rural areas. Awareness about available energy options and their benefits needs to be increased. In addition, the hazards involved with using fossil fuels such as diesel and paraffin also need to be brought to people’s attention. The marketing of solar products to end users has also been limited. This is partly because there is a shortage of entrepreneurial capacity in the energy sector, particularly in rural areas. Finally, there is the issue of substandard products in the market which result in users not trusting the technology. A study on LED torches in East Africa found that 90% of the users experienced quality related problems during the six-month study period (Silva, 2016).

iv. Access to Technical Support Service

Among the most important things before starting a particular business is to make sure there is access of technical support services that will help in running maintainances and also in case of any unexpected emergencies that may emerge. But the fact that consumers live far apart, coupled with their low buying power, makes the notion of setting up service centres in the distribution regions unsustainable (Silva, 2016). There are not many experts in this field it is estimated there
are less than 3,000 solar photovoltaic technicians in Kenya yet the regulations require only the licensed technicians to design and install solar systems (TheEastAfrican, 2017).

2.4 Measures that have been Taken to Create Awareness on Solar Energy

CFL (compact fluorescent lamp) bulbs campaign which was launched by Kenya Power and Lighting Company that was to encourage Kenyans to use the bulbs as they save energy. The program was faced by several challenges as delays in CFL deliveries which interfered with proper implementation of the project. Citizens also found it hard to buy the bulbs as they were a little more expensive than what they were using and that kind of laid them back from embracing the technology. Moreover, they lacked the knowledge that using the CFL bulbs would save on their energy bills and since they were durable they could help them save in the long run (Figuero, 2016).

Lack of awareness and information regarding equipment performance and operating costs, inability to check the entrance of low-quality products by authority and lack of appropriate Energy Efficiency incentives and regulations, is what is hampering energy saving efforts. In addition, inefficient equipment and appliances consume more power than necessary thus exacerbating poverty by straining the country’s capacity to provide electricity (Sustainable Development Goals, 2017).
2.5 Importance of Raising Awareness on Energy Efficiency

An example from a neighbour is useful. Rwanda is one of the countries with a very high number of people living in poverty, which stands at 45%. It had only 6% of its total population connected to electricity in 2009 and faced acute shortage of electricity. In a bid to solve this, the Rwandese government in collaboration with World Bank, they introduced a strategy which was dubbed Economic Development and Poverty Reduction Strategy that aimed to increase connections to the grid by 70%. They also used CFL lamps to make energy use more efficient and to encourage people access the original CFL lamps they had to raise awareness of the existence of the fake CFL bulbs (The World Bank, 2014).

Raising awareness was done to sensitize people understand why the bulbs were important even if they were expensive. It also was to encourage citizens to reduce the use of biomass which was popular in the rural areas. The project together with raising awareness helped Rwanda receive carbon credits from the United Nations Framework Convention on Climate Change (UNFCCC) in 2012. Demand of power also reduced and more households were connected leading to increased rate of economic development. (The World Bank, 2014).

Therefore, raising awareness on solar energy will have a positive feedback as people will be able to understand the importance of having renewable energy in their households. These will enable more solar energy used and less carbon emissions will occur hence saving on economy and saving the environment.
Chapter 3: Methodology

3.1 Introduction

The methodology to be employed throughout this project is design thinking. In design thinking the people who face the problem are the ones who hold the key to their problem’s solutions. Design thinking is human-centred approach problem solving tool which emphasize on empathy, collaboration, co-creation and stakeholder feedback to unlock creativity and innovation, which devises feasible and viable idea/solutions. The main process is empathizing with the users to uncover unmet needs by understanding their beliefs, values, motivations, behaviour, pains, gains and challenges and provide innovation solution concepts to create impact in the society (Leow, Lau, Ho, & Yong, 2016).
3.2 Semi-Structured Interview

This type of data collection method is used to gather focused, qualitative and textual data. In this project the data collection method chosen is semi-structured interviews because this method offers a balance between the flexibility of an open-ended interview. The semi-structured method is used during both early and late stages of exploring the research domain. Semi-structured interviews can give a specific topic new factors and variables which makes it easier for the user to understand. Semi-structured interviews give a good foundation for the subject. To gather accurate information in semi-structured interview it is important to keep the questions constant to interviewee (Hanna Kallio, 2016).

The basis for the interviews are:
1. What is your profession?
2. What is your opinion of energy awareness in Kenya?
3. What is your opinion of awareness specifically in solar energy?
4. How do you think (more) awareness regarding solar energy should be created?
5. How do you look at the future for solar energy?
6. Have you done anything in this area before?
7. What challenges have you faced in creating awareness?

3.3 Focus Group

This is the other mode of data collection that will be used in the project. A focus group consists of a number people who come together to discuss on a specific topic. This type data collection helps generate ideas on the topic you are discussing about. This is a form of qualitative research (Study.com, 2018).
Chapter 4: Data analysis, Findings and Interpretation

4.1 Introduction

In this chapter the findings from the data collection, semi-structured interviews and focus groups, is represented. It explains who the eight interviewees are, this in the form of profession, experience, gender, age bracket and education. The reason for this is to be able to analyse how good the different interview subjects represent the whole picture in the area of solar energy awareness in Kenya. A conclusion regarding the data collection process has been drawn based on this.

4.2 Interview Subjects

Semi-structured interviews as well as focus groups were used, as explained in the method. The interviewees were eight people with different backgrounds and professions. The first interviewee was Zachary Mikwa. He is a Sustainability Initiatives Officer at Kenya Climate Innovation Centre (KCIC). KCIC is an organization launched by infoDev’s Climate Technology Program and funded by the Danish Ministry of Foreign Affairs and by the United Kingdom’s UKaid. Their vision is “to be the one stop shop supporting innovative climate change solutions in Kenya” and their mission is “to provide incubation, financing and awareness that empowers the private sector to deliver innovative climate change solutions” (Kenya Climate Innovation Center, 2018). Two of the interviewees, Sheila Olga and Samuel Wanjiru, work at Strathmore University Energy Research Centre (SERC). SERC started 6 years ago with the aim to offer services to the private sector, the general public and the government in the renewable energy sector. Apart from research they offer training, project development and international standard laboratory testing services on Solar PV components. Their vision is “to become a leading outcome driven entrepreneurial research centre by translating our excellence into major contribution to greater adaptation and penetration of renewable energy and energy efficiency technologies in Africa” (Strathmore University Energy Research Centre, 2017). To get different perspectives some interviewees are university students. The sessions with the students were also taken as focus groups since the
students and I shared ideas. One of them is Cynthia Muchiri, who is undertaking BBIT (Bachelor of Business Information Technology) and works with the Career Department in Strathmore University. Beth Mwangi is undertaking Mathematics at University of Nairobi. Lucy Njoroge pursuing BCOM (Bachelor of Commerce) and is also dedicated to environment work in her home town, she recently organized a group of people which planted trees. Strathmore University was founded in 1961, their vision is “to become a leading outcome driven entrepreneurial research University by translating our excellence into major contribution to culture, economic well-being and quality of life” (Strathmore University, 2018). The other interview subject was Professor Izael Pereira Da Silva; he has a PhD in Power Systems Engineering from the University of Sao Paulo (Brazil), and is also a Certified Energy Manager. He started Strathmore University Energy Research Centre and is currently a professor at Strathmore University. He was the leading force in installing solar panels at Strathmore University, which is the only university in Kenya that has solar panels. He also created the Centre of Excellence in Renewable Energy and Sustainable Development (CERESD). This was in collaboration with United Nations Industrial Development Organization (UNIDO) (Strathmore Business School, 2018).

Finally, Charles Kilonzi was interviewed. He is currently a PhD student at the University of Nairobi and previously worked at KPLC as an electrical engineer. He helped breakdown the generation, transmission and distribution process within the Kenya Power and Lighting Company. He also said that the main sources of energy are hydro-power and geothermal, solar energy adds up very little percentage of about 0.3%. He supports the idea of having solar as a main source of energy however feels that there are some drawbacks especially on the cost of batteries. The batteries are too expensive but he added on to say that they are worth investing in especially for households that may require more energy at night when there is no sunlight.
4.3 Sample demographics

4.3.1 Gender
The stakeholders as mentioned above and the summary of their genders is as follows:

<table>
<thead>
<tr>
<th>Tool Used</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus groups (the students)</td>
<td>3 females, 1 male</td>
</tr>
<tr>
<td>Semi-structured Interviews</td>
<td>4 females, 4 males</td>
</tr>
</tbody>
</table>

Among these people, they all have different capacities and therefore it was necessary to avoid gender bias in such a project. Their gender also helped to get perspectives and impacts that these people have or what their visions are.

4.3.2 Level of education
It was not a requirement for the stakeholders to be educated, but since the educated elite in the community is expected to give back and they usually have more knowledge, most stakeholders in this project are educated. Some of them are experts in the field of solar energy and renewable energy in general while others will have less information. That helped to clarify the different perspectives about solar energy.
4.3.3 Involvement in Sustainable development projects

After finding out the level of education of the respondents, it was necessary to learn how much involved they have been in the past in sustainable development projects. Some of the most likely activities they would have been part of in the recent past would be training people on renewable energy, planting trees to be good ambassadors of environment, creating awareness about a project such as tree planting, campaigning against deforestation, launching sustainable development projects, etc.

<table>
<thead>
<tr>
<th>Involvement level</th>
<th>Number of respondents</th>
<th>Rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very involved</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Involved</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Moderately involved</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>Less involved</td>
<td>1</td>
<td>12.5</td>
</tr>
<tr>
<td>Never involved</td>
<td>2</td>
<td>25</td>
</tr>
</tbody>
</table>

**Level of involvement**

- Very involved
- Involved
- Moderately Involved
- Less Involved
- Never Involved
4.3.4 Willingness to support Green Energy

From the responses received, there was evidence in interest on this project. Solar energy being readily available is a project worth a fortune. The stakeholders were all willing to take part in it and create awareness or by educating the public the importance of using solar energy. The respondents having being part of sustainable development projects gave their word to spread the word and be active participants of the project.

4.4 Interpretation of Findings

A number of stakeholders has been interviewed during this project, as presented above. They identified quite similar challenges/problems faced in implementing solar energy projects. Problems identified included; lack of awareness and peoples’ perception towards solar energy. Pro. Izael Da Silva mentioned that about 75% of Kenyan population is not aware (negative perception towards solar energy) about the benefits of solar energy hence the low rate of solar energy consumption in the country. Prof. Da Silva also mentioned about shortage of solar technicians around the country due to lack of professional training to equip technicians with the much needed skills. The stakeholders talked about lack of finances as an enabler in purchasing solar equipment in the country, long processes in acquiring loans and high interest rates make it almost impossible for people to address this issue of finances. Government bureaucracies in license application also hinder investors from putting up solar energy power plants in Kenya. The process of applying for license takes longer than expected due to corruption and many officers to approve the papers for independent power producers in the country (Silva P. I., 2018).

In summary, the respondents were supportive and willing to share their ideas regarding solar energy and this gave hope in working on the project. The respondents showed interest in using solar energy and therefore I believe they would be of great help in creating awareness on solar energy.
4.5 Discussion

Lack of sufficient information and understanding on the part of consumers (according to the interviewees) leads to them making irrational consumption and investment decisions and hence the need for this system (the proposed platform). The government should also put in place strict measures and regulate the standards of the appliances that come into the country so that prices can also be affordable to all consumers.

The proposed platform will help to move the country towards utilization of energy-efficient appliances which will reduce capital investment in energy supply infrastructure, enhance national economic efficiency by reducing energy bills, enhance consumer wealth, strengthen competitive markets and meet climate change mitigation goals (Sustainable Development Goals, 2017). The platform also aims at increasing the population that is connected to solar power.

According to the stakeholders that have been interviewed, there is some awareness on solar energy however, it is not clear to many people in Kenya. Most people lack information on the technical aspects of solar energy while some believe that solar is only applicable in the rural areas and not in an urban setting. Moreover, most people rely on assumptions that solar will not be reliable enough especially during the cold or rainy seasons. What they fail to understand is that solar energy does not require eight hours of very hot sun in order to charge their batteries.

The stakeholders also pointed out that there is a future for solar energy only if people are taught more about the need of using it. There is also a gap that the government needs to chip in and put in incentives that will encourage people to embrace renewable energy and solar energy in particular. However, there is a gap between the citizens and the solar energy experts that needs to be worked on, so that the solar energy situation can be improved.

When it comes to creating awareness, there are several ways that could be used including creating forums for common citizens for cultivating money or environment. This is because people care about the money, not the environment. This was a major subject in the focus group with the students: money has to be in focus. Churches and other institutions reason differently when targeting the common citizens. Creating facilities and poster advertisements that provide
testimonials from people who have used solar energy before. Kenyans in general prefer proof, if the word is out there being possibility the market will grow. Government regulations for instance, there should be tax exemptions for solar equipment importation.

Unfortunately, there are challenges expected when using different methods of creating awareness as highlighted by some of the stakeholders. Giving talks sometimes can be challenging in that most people only show up or pay attention to the speaker when they have background knowledge about the person. Moreover, the mindset of many people is aligned to politics and relationships and hence most advancement doesn’t take place as planned. The other thing is that people are not patient enough to see the results of something and therefore fail to embrace such technology as solar, as it takes time to see the advantage of using solar energy.
Chapter 5: Conclusion and Future work

5.1 Conclusion

The current electric energy situation in Kenya has been analysed and a founding was that a very little percentage of solar energy is used compared with hydro power and thermal (fossil fuel) which is being the most depended on. The main challenge that the country is facing and hence not able to use solar energy is because people lack the required knowledge about solar energy. Government regulations and long processes are a major challenge to those investors trying to invest in solar production plants. The other main challenge is finance where the solar equipment is too expensive and majority of Kenyans lack the finances to acquire such equipment. High interest rates in banks make it almost impossible for people to acquire loans for purchase and installation of solar panels.

From the findings, it is quite clear that there is a gap in regards to the information out there about solar energy. From the interviews it was found that the people experience blackouts and high electricity bills which is caused by expensive energy resources. According to the stakeholders most people tend to use the above resources because they do not understand some of the benefits and hence tend to depend on the traditional methods of energy use. With this, there is need to create awareness on solar energy which will help people embrace the solar technology.
5.2 Future Work

Amid brainstorming, in both the interviews and focus groups, to come up with solutions to the above mentioned problems, the proposed solutions are the following; automate independent power producers’ license application process. This system is aimed at reducing the number of people involved in the application process and also curb corruption due to reduced human interaction. License applicants will self-register in the system so that they have access to the services. Upon approval of their registration, they will fill an online form with all the required details; they will be prompted to pay a small license processing fee via Mpesa (a well known payment system in Kenya) or any other online payment method. To approve payment, the applicant will enter payment code in case of Mpesa, and finally submit application. The application will be verified by the receiving application verification officer for to confirm if all requirements are met as per the regulations. It will then be forwarded to final stage for approval. A suggestion is that applicants can either print the certificate direct from the system, or from the link sent to their email. This whole process should take at most 5 days. Investors will be required to coordinate with NEMA for environmental assessment. However, the problem with this solution is the level of government involvement and the government approvals that take so long to process.

The other solution proposed is awareness creation platform that will consist of banking module, experts’ module and solar dealers’ module. Community members can come together to have a small power plant for at least 50 households. They will put together all the required documents then proceed to the platform to fill in the required details and finally submit for processing. Pay a small processing fee upon approval of their request, if accepted the listed banks will be notified. The first bank to accept the offer will verify the documents and the feasibility of the project. If approved, bank offers loan and finally link them to the listed solar dealers in the system to supply them with solar equipment, the bank will pay the dealers for upon verification of the delivered equipment.

The platform will list various solar technicians who will be selected to do the installation and payment to the technicians done by the bank once the work is completed. Households will pay monthly electricity bills direct to their group bank account, monthly deductions will be done for loan repayment. The remaining amount will be used for maintaining the system. The system will
be fully owned by the group upon settling their loan. Money earned after settling loan will be used for development activities in the community. The bank would be the main subject in this solution and will probably take up all the mandate of getting the solar experts and creating awareness.

Another solution is an awareness creation platform that will consist of the following actors; customer, solar expert, solar dealer and system manager. All actors will register as users of the system to be able to interact with the system. Once they are registered, the system manager will approve all registrations for authenticity. All details entered in the system will be stored in a data store for ease of retrieval.

The customer will have to request for an installation of a solar system on the platform. The customer will then put together all the required documents then proceed to the platform to fill in the required details and finally submit for processing. If in the process the customer can not afford the installation the platform will suggest to them a SACCO or a bank that can give them a loan in which they can pay within a certain duration. The system manager will then verify the submitted project for approval. In case the project is rejected, the customer will make corrections and resubmit the request for approval.

If project is approved, the system manager will prepare a quotation with the solar experts for the customer. The quotation will be sent to the customer for approval. If the customer is comfortable with the quote, the solar expert and the system manager will have a contract agreement for the installation. After the contract agreement between the system manager and the solar expert the system manager will then check the suppliers’ items to check if the supplier has the equipment in stock. After identifying the supplier, the system manager will then place an order for the equipment. When the system manager receives the equipment he will then deliver it to the solar experts who will then proceed for installation. After installation the customer will then be able to give feedback to the system.

Due to the time constraint and the frame of a bachelor thesis, the system can not be built, therefor it is suggested as future work. However, the stakeholders mentioned in chapter 4 of this report gave their views on the proposed system and gave their honest reviews. There was positive feedback and they promised to take part in the final implementation of the system towards a sustainable plan.
On the methods and techniques used for creating awareness, it has been researched and found out that the media is used for creating awareness and that impressive advertisements attract customers/users. Giving incentives also helps attract users and prospective customers. On preparing for the building of the system, it was possible to come up with ideas to a system with some functionality on the system manager. The system manager could login, view and verify all the registered users as well as give them different rights such as solar expert or household. The person could also create accounts for those users who needed help as well as delete unused accounts.

The proposed system that was taken to the named stakeholders, and they were satisfied with the progress and made some recommendations which has been taking into account. Suggestions were made that meetings with stakeholders from rural areas should take place, as well as approaching SACCOs to help them finance households that would be interested in the project.

MKOPA Solar is one project that aims at encouraging the use of solar however it mainly focuses on the lighting rather than educating. The proposed solution therefore has an advantage as it will help educate people on solar energy and eventually increase the number of people who embrace renewable energy. The main limitation of the proposed solution is the fact that there is need for good network connectivity and location detection as the experts need to know the exact location of the household which may be impossible in areas such as north western part of Kenya.

In summary, the users of the proposed system will be able to view all uploads from the experts and do everything as presented. It was recommended to be a mobile application for easy access to the system. For locations that are harder to access, regular updates on locations may be recommended. Another recommendation is coming up with SACCOs that work purely on solar energy projects. This will bring together more households and encourage people to take up solar energy projects.

I would like to meet more stakeholders, especially from the rural areas because they are the main beneficiaries of the project. The other future work that is proposed is to add an e-learning platform on the system to help people learn about solar equipment and installation process as well as share ideas on solar in general. It should also be partnered with Strathmore Energy Research Centre as well as Kenya Climate Innovation Centre since they are more experienced in the field of renewable energy and solar energy in general.
References


