TITLE: UP SCALING SOLAR COOKER PROJECT IN KILIMANJARO AND MANYARA REGIONS IN TANZANIA

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Abstract :

Human life in this globe depends on the use of energy to satisfy their cooking needs, more efforts have been made to reduce or cut down energy consumption. It is very important to save the environment by changing our customary ways of cooking done on open fires using biomass such as firewood, charcoal, and kerosene the process which leads to excessive deforestation lead to an increase in CO2 emissions, most women suffer from respiratory infections and eye irritation problems due to significant smoke inhalation while cooking. Alternative ways to rescue environment is to use eco-friendly solar cooker which helps to reduce our reliance on energy derived from burning fossil fuels.

A solar cooker is a device which uses energy from sunlight to heat that cook food or drink or pasteurize water. Solar cookers presently in use are cheap, low technology devices because they use no fuel and cost, nothing to operate, they does not pollute the environment since it does not produce smoke and slow down deforestation and desertification also helps women from spending hours for fuel wood collection or even from spending money to buy it. Solar cooking is a form of outdoor cooking and is often used in situations where minimal fuel consumption is important, or the danger of accidental fires is high.

The projects of Majengo, Olonaike and on-going Rau project were of success, therefore there is a need of up scaling solar cookers in Kilimanjaro and Manyara regions, where the project focused on poor and needy people. Up scaling of solar cookers will help poor and needy families in the regions who rely on fire wood for cooking result to deforestation and increase in health problems. Since poverty drive poor people to cut trees, there is a need of up scaling in order to reduce it.

Key words: Deforestation, biomass, upscaling, wood fuel, renewable energy

1.0 INTRODUCTION

Human life in this globe depends on the use of energy to satisfy their cooking needs, more efforts have been made to reduce or cut down energy consumption. It is very important to save the environment by changing our customary ways of cooking done on open fires using biomass such as firewood, charcoal, and kerosene the process which leads to excessive deforestation. In developing countries, cooking energy requirement is meeting through fuel wood which resulted in deforestation, fuel-wood shortage, increased costs of fuels and adverse environmental effects.

Climate change expert at the world Bank Daniel Kanmen noted that there is a “nexus “ between energy, poverty and climate change; for all these three challenges are complementary as they impact one another. For example in the 70’s deforestation in developing countries without exception my country Tanzania was mainly attributed to the use of firewood as a domestic energy supply while in urban areas the commercial market for wood and charcoal is linked to deforestation. In rural areas its linked to extreme poverty.

Energy has a major impact on every aspect on social economic life as it plays a vital role in the economic social and political development of our country. There is restrictions growth limitations and the quality of life being adversely affected as a result of inadequate supply energy. For it is estimated that 2.5 billion people depend on food cooked over open fires with biofuel, such as

human have done for hundreds of thousands of years, which had adverse effect to their health of mostly women and children.

In rural and urban areas in Tanzania a typical household will burn 3.6 tonnes of wood per annum for heating and cooking. Such consumption of firewood has had adverse effects as this wood must be either gathered by hand or purchased which is one of the major household expenses. As to this case many families consume a lot of time on fuel collection and food preparation and hence denies them time to engage in extra economic generating activities. And this makes it difficult to cater for their children's school's expenses e.g. fees and uniforms. More over children being forced to gather firewood and hence affects their overall educational's development. Cases of snake bites have been reported in rural Tanzania due to firewood fetching. 35,661 tonnes of firewood and charcoal is consumed undoubtedly means that large patches of forests are being cleared per year. Besides, the Ministry of Natural Resources and Tourism estimates that 97.9% of total wood consumed in Tanzania is firewood and charcoal.
Between 2010 and 2014, Macedonia Ministry an NGO in Moshi, Kilimanjaro Region, Tanzania and Kyoto Twist an NGO from Canada have jointly implemented 2 projects aimed at promoting solar cookers whereby one project in Majengo Ward, South-East of Moshi, Tanzania ended in 2012 and another Project in Olonaike Ward, South-East of Longido District, Arusha Region, Tanzania. In 2015, Macedonia Ministry and Solar Cookers International have jointly implemented one project in Rau Ward, Moshi District, Kilimanjaro Region, Tanzania.

Barriers to solar cook in the regions are the cost of fuel, labour in collecting firewood which is a significant fraction of the overall total household cost since biomass fire based cooking takes so much time and labour and hence robs women and children of other opportunities such as education and small business, limited livelihood opportunities outside the natural resources, and institutional environment that influence solar cooker and inadequate skills at all levels required for promoting and /or adopting solar cookers. Efforts to remove the barriers have been exerted by Kyoto Twist and Solar Cookers International (SCI) in the form of pilot project entitled "Solar Cooker Project" the goal of which is to ensure that solar cooker provides the basis for economic development, health and sustainable livelihoods while restoring the ecological integrity of the Kilimanjaro and Arusha regions' ecosystems". The objective of the project is "to provide solar cooker users and makers with the enabling environment (financial, capacity, household) for solar cookers adoption". The objective was achieved through three outcomes:

i) To reduce workload and walking long distances for boys, girls and women on collecting firewood;
ii) To reduce the rate of tree/forest cutting of livelihood options in Kilimanjaro and Arusha to reduce pressure on natural resources and increase income;
iii) Trained Users to be able to impart skills and knowledge based solar cooker/fireless cookers and adopt this technology for climate change resilient Natural resource supported development

1.1 Progress and Achievement

According to the Evaluation reports, the project has successfully delivered most of the intended four outcomes with targets being met for more than 90% of the out-come. The project has made remarkable progress in terms of promoting the uptake of solar cookers/fireless cookers with

associated reduced rate of tree cutting, money saved used for other activities e.g. medication, school fees, time saved used to do other activities, reduced health problems etc.

1.2 A case for up-scaling Solar cookers

From the Evaluation Report, it can be surmised that the pilot was success in illustrating that it is possible to remove the barriers, except that project focused on 3,500 families only directly under solar cooker project as a pilot 200 families has up-scaled because of its budget, about US$ 27,717, which was benefiting a pilot projects, but not adequate enough for upscaling broadly. Considering the successful performance, it's important that the lesson learnt are upscaled to the entire regions and the whole country. Given that Kilimanjaro region has a population of 1.64million, Moshi District 466,737 and Arusha region has a population of 1.694 million, Longido District 123,153 according to 2012 population and housing census.

Considering that the project implemented by Kyoto Twist ended in 2014 in Arusha region and part of Kilimanjaro region, it's appropriate to introduce outside of the pilot project areas that have shown great potential in terms of performance. Macedonia Ministry (MaMi) which oversees the project in these regions, suggested to upscaling the cookers (solar/fireless). Using filled follow up form and support meeting after participant receive training from the first month for ten months (ten support meetings), adoption data ------ computed by SCI based on their usage. However the project focused on supplying materials/equipments for training than on making/manufacturing the cookers which is equally important because of transportation and its storage. Once cookers are manufactured/constructed in Moshi will reduce the cost and create job for youths and women.

As such, Macedonia Ministry team agreed to upscale it. Kilimanjaro region has comprised by District 6 Councils and one Municipality while Arusha region comprised by 6 district councils and one City.

One of the participants Putting food in solar cooker

A group of participants standing behind their cookers

One of the participants removing cooked food in her solar cooker

Participants carrying their Cookers after 2 days training

participants carrying their cookers on the way to their Homes with her child

One of the participants standing infront her house holding "guard" which is used to keep milk.

Pictures taken by: Sperancea K. Gabone

1.3 The Objective

The objectives are in line with the United Nations' Sustainable development Goals, particularly No. 7, I.e., Energy – Ensure access to affordable, reliable, sustainable and modern energy for all, No. 13, which is on climate- Take urgent action to combat climate change and its impacts, and No. 15 on Ecosystems – protect, restore and promote sustainable use of terrestrial ecosystems, sustainable manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss. The objectives are also in line with Green Climate Change.

The objectives include are:

i) To conserve the environment and heal Tanzania by solar cookers and fireless cookers. -To enhance control of land degradation and reverse in Kilimanjaro, Arusha and Tanzania at large with thirty regions (provinces) through adaptation to climate change by the use of solar/fireless cookers.

ii) To construct/manufacture cooking pots, solar and fireless cookers in Moshi.

Studies on Fuel-efficient Technologies indicate that in the region, increasing demand for wood-based biomass is visible in public institutions such as hospitals, prisons, boarding secondary schools, university campuses and factories which consume large quantities of wood fuel, estimated at 35,661 tonnes of firewood and charcoal annually (Mutimba et al., 2014), thereby contributing to deforestation and land degradation.

Household consumption, is at 7.3 tonnes of firewood per annum, producing 13.3 tonnes of carbon (Mkanda et al., in press).

Six cookers which use Charcoal and fire wood Nearby

Cooking using three stone stove produces smoke

The bicycle loaded with firewood near Moshi Town

Pictures by: Sperancea K. Gabone 2016

1.4 The purpose of the project

The purpose of upscaling is to create an enabling environment for the adoption of solar cookers practices through helping disadvantaged women in Majengo and Rau Wards in Moshi District in Kilimanjaro Region and also the people who are marginalized and vulnerable communities in Maasai in Longido District Arusha Region due to environmental and geographic; the area lacks erable land as a result of low (300-500) levels of rainfall and the population is entirely dependent on livestock production in terms of its food supply (either directly or through trade for cash or agricultural products).

2.0 METHODOLOGY

Macedonia Ministry conducted solar cooking projects through selection interviews, whereby questionnaire was used to collect data because it is considered to be more appropriate than other techniques. Questionnaire design considered content, wording, and format, as recommended by another author. To this end, open-ended questionnaire was formulated to allow interviewees to construct their own accounts of experiences. The sections included general information of the study area, family size, energy types used, sources of biomass used, the amount used in a week. Prior to the survey, a pilot study of 56 respondents was undertaken to check a number of questionnaire design aspects, such as clarity, appropriateness of the questions, and respondents' willingness to adapt new technology. A total of 300 people were targeted (130 –Olonaike, 50 – Rau and 120 -Majengo). Data analysis involved calculations of sums and percentages with the following criteria:

In Olonoike Ward,

The community in the location are Maasai. These communities are among the most marginalized and vulnerable, while

In Majengo and Rau Wards, Disadvantaged women were chosen who have a low income because they are too poor to buy a sun oven and fireless cookers to use them while they will save the money for another uses.

Those who are selected must show enthusiasm in use of sun oven and fireless cookers, who like to learn about the new cooking technologies to save money on charcoal, since the group of 75 families can tell and teach others on the use of sun oven and fireless cooker that is an economic use of charcoal.

The participants of the selection interview were only chosen if they agree that they are ready to attend the meetings in each month. The meetings were very important as the trainers ask how much charcoal was needed for the daily cooking during the last month, to exchange information on the use of 2 equipments in the practical way, participants get a chance to ask their problems occurred when using the cookers. Practical was full participatory.

The number of people who will receive solar cooker and training in the Project and the number of alternates were chosen which involved 75 participants of the selection they paid 10,000 Tshs, approx. $5. US, after 2 days training, they received 1 sun oven with 2 pots and 1 fireless cooker, and 1 WAPI. After selecting 75 disadvantaged women, alternates were chosen if something happens to a participant (disease, long term voyage to her village because of the illness of a family member, etc.). The substitute received the utensils of the one who had stopped and paid 10,000 Tshs, $5, which were to be returned to the former. Changes were allowed in the first 3 months. Two interviews were conducted. The first interview 81 were selected and the second one 75 were selected while the remaining 6 people were reserved.

The process for locating and choosing participants for the project was as follows: 105 disadvantaged women to filled a preliminary questionnaire as indicated in the profile which shows the population number of selected area as it appears in the proposal. Then we selected 81 but Macedonia Ministry needs 75 participants. We do interview them again using the selection Interview Forms which have been translated into Kiswahili by Macedonia Ministry as are the Follow-up Interviews. English summaries of Kiswahili interviews are sent to Kyoto Twist and

Solar Cookers International. It is good for them to be able to express themselves because they can assist in teaching their fellow friends about the cooker and later can be teachers.
All steps have been taken in order to get good result in which participants get used to their cookers, this leads to success in using the new cooking systems.

Training plan was 2 days training, a room (hall to accommodate the number of selected people) with open space outside and shade was hired the trainers do come early with all the materials, the training start at 9.00a.m. The first day the trainers will show the participants how to cook food for the mid-day meal. The second day the participants cook themselves under the guidance of trainers.

3. 0 RESULTS AND DISCUSSION

The results were computed by SCI shows that most of women who took the cookers are using them ranging from 4 to 5 days saves almost a half of their normal use of cooking energy.
The lesson learnt is that if women can be trained and supplied with equipments/materials, they can reduce their workload of collecting firewood from far and cutting trees as the source of their fuel, which leads to: Better health for residents, clean environment , community becomes aware and educated on environment, Money will be saved and used to send children to school, forest and trees are preserved, better income and development (houses, health, education, etc), also the people can teach others (people and neighbours) the importance of the cookers.

3.1 Willingness to switch solar energy sources

Eighty eight percent of the women expressed willingness to switch to solar cookers for cooking which can only mean that widespread adoption of this technology can take place once the issue of financing system installation costs, which is the main barrier, is addressed. The availability of funding under the SCI Project offers such an opportunity. This level of willingness is encouraging because if an energy-switch project were to initiated, it would be well received and implemented

3.2 A SHORT STORY ABOUT SOLAR COOKER

A. NAOMI YOHANA KAIKA OF OLONAIKE WARD

She has been using the cooker for almost a year now, she is happy with using the cooker when there is sunlight and she says that she doesn't use the cooker only when there is rain/clouds. But during the time of sunlight she use the cooker for five days in a week, she cooks makande (maize mixed with beans), banana, ugali (maize flour), rice, potatoes, groundnuts. Naomi and the family said that the food cooked in the solar cooker is delicious and also does not burn while cooking. She cooks for 5 people. The family helps her to cook. She saves money which she uses to send children to school, medication, getting time to do other activities, it also protect environment by reducing the number of tree cutting also she said she is able to teach others. She said her and the family are now happy eating the food cooked in the solar cooker. Like others with similar problem of eyes and chest, it protects her from eye and chest problems because her eyes now doesn't get

irritation. She is now o.k. She said, I thank Kyoto Twist for their good assistance brought to our community the knowledge of the technology of using the cooker.

She requested Kyoto Twist to assist the Maasai community who are facing a critical problem of fuel shortage and water for drinking and grazing.

B. ELIZABETH JOHN OF MAJENGO WARD

Elizabeth John using her solar cooker at home

Elizabeth saving the food on the charcoal stove (makande – beans mixed with maize) cooked in the solar cooker.

Elizabeth before used to cook on the local method using three stones which uses firewood and charcoal stove.

Before Elizabeth was using firewood and charcoal costing her 2,000/- per day and food was burning. After getting the cookers she is now saving 1,000/- per day and food not burned. More families now want new technology because it saves time and money.

Some of the cookers cooking food at Majengo ward in 2012

Moshi District Commissioner Hon. Musa Samizi giving the cooker to one of the widow women while city mayor clapping in 2012

One participant cooking in Solar cooker infront of her house

Picture taken by: Sperancea K. Gabone in Olonoike 2015

5. CONCLUSION

In order to do better in the future, after monthly meetings regular visits in their homes should be done. To do it perfectly a vehicle is needed to reach their homes regularly and on time, it can be

used to carry materials. To have a demonstration center in Moshi Town whereby other people will learn e.g. students can learn.
The following are important factors when choosing participants these include: Screening or careful selection of candidates, peer support among the group of women who were receiving the training and cookers, regular monthly meetings that every woman pledged to attend, trusted support from the project team for one year, the capacity to have repairs done on the cookers when they need it also economic need or significant hardship collecting firewood and other fuels is another factor. There are factors involved in a woman not getting the most benefit from solar cooking, these include: If does not use the cooker and not attend the monthly meetings she cannot be confident in using the cooker and explain it to others.
The meetings and follow up makes the women stand with their cookers due to the fact that during the meetings they have time to ask questions and explain the difficulties they face when using the cookers, also the trainer keep encourage them to continue using the cookers.
The women who received training and followed, who use their solar cookers and fireless cookers have saved their time to do other activities, sent their children to school; have reduced deforestation and carbon emissions; women have reduced their workload of collecting firewood from far and cutting trees as the source of their fuel; better health for residents; clean environment, community become aware and educated on environment; Better income and development (houses, health, education, etc).

Sperancea Kakuba and Caitlyn Hughes This paper sets out to provide an understanding of type of energy used, cooking devices, and willingness of women to switch energy sources. As such, it reveals that firewood is the most widely used fuel because of availability, affordability, and reliability. That 98% of women are willing to switch to solar and fireless cookers implies that there is an opportunity for energy-switch. This level of willingness means that widespread adoption of this technology can take place once the issue of financing system installation costs, which is the main barrier, is addressed to the whole country of Tanzania

5.1 Challenges:

- There is a Problem to reach participant's homes because of lack of transport, public transport does not reach
- Lack of solar cooker manufacturing plant in Moshi

5.2 Solution to challenges

- Macedonia Ministry to have its own transport through environmental well wishers in order to reach the users of solar cooker in time.

- To have a plant where the cookers and pots will be manufactured/constructed.

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