FOUNTAIN OF HOPE

P.O. Box 1194, Lilongwe.

E-mail: fouhope@yahoo.com

SOLAR BOREHOLE FOR CONSISTENT CLEAN WATER SUPPLY AND IMPROVING LIVELIHOODS

Author: Shora Kauluka[a,*],
Fountain of Hope P.O.BOX 1194, Lilongwe.

Corresponding author contact details: shorakauluka@yahoo.com Cell: +265 (0) 888637445

Abstract

Unreliable rainfall pattern in Malawi has heavily affected the country's economy because there is no consistent water supply. This has affected livelihoods where droughts, floods, Water scarcity, have been the topic of discussion every year. Agricultural production has been greatly affected as well due to either floods or droughts. This paper is a result of survey made at Chigumula farm in Blantyre where the main objective was to assess the effectiveness of Solar energy borehole in relation to consistent water supply, social and economic resource, rural livelihoods and sustainable development with consideration of mitigating and adapting to climate change effects. Focus group discussions were conducted in 4 separate sessions of 25 participants each. Individual interviews to community members and farm workers. **The study revealed that this technology is a : 1)Source of consistent water supply** 2)**Source of social and economic resource** 3)**Tool for sustainable development** 4) **Source of food security** 5) Tool of **Improving rural livelihoods** 6) An **Alternative solution to climate change impact like dry spell**.7) **Relevant to water supply, sanitation and hygiene.** Therefore, solar energy borehole is suitable for consistent Clean water supply and Improving livelihoods. As such, the survey recommends that: a)The technology should be adopted especially in areas where disasters have been more recurring. b) The technology should be implemented at each Area Development Committee Level (ADC). c)The technology can help reduce cases of cultivating in the river streams or along the river banks.

Keywords: Borehole, Consistent, Employment, livelihoods, production

1.0 Introduction

Climate Change is increasing frequency, intensity, and coverage of weather sensitive disasters, principally floods and drought, in Malawi. Statistics from the Centre for Research on the Epidemiology of Disasters (CRED) indicate that major floods are recorded every 1.8 years in Malawi. Poor and vulnerable people living in flood prone areas are always affected as flooding often results into loss of property, livelihoods and lives in extreme situations which are aggravated by low capacity of adaptation. The rural communities are facing harsh climate change impacts but the national action lags behind.

When it comes to climate change impacts on natural hazard vulnerability, Malawi is particularly prone to adverse climate hazards that include dry spells, seasonal droughts, intense rainfall, river floods, and flash floods. **Droughts** and **floods,** the most severe of these hazards, have increased in frequency, intensity, and magnitude over the past twenty years, with dire consequences on food and water security, water quality, energy resources, and sustainable livelihoods of the most rural communities. Floods and droughts are the leading cause of chronic food security, which is endemic in many parts of the country. **Floods** cause annual losses of about 12 percent of maize production in the south, where about one-third of Malawi's maize is grown.

People living near river banks are the most vulnerable to floods, which result in untimely deaths, large disease outbreaks, and the destruction of crops and property. Models estimate that floods may cause an average GDP loss of almost 1 percent every year, while during periods of drought, economic losses are found to be much higher. For example, during a 1-in-25 year drought, as was the drought that struck Malawi in 1991/92, GDP can contract by as much as 10.4 percent. Drought destroys on average 4.6 percent of the maize production each year in Malawi (based on to days adoption of different varieties); Together, droughts and floods constitute a major obstacle for agriculture and food security in the country. (**Climate Change country profile).**

Disasters disrupt people's livelihoods, endanger human and food security, damage infrastructure and hinder socio-economic growth and development. Disasters also increase the poverty of rural and urban households and erode the ability of the national economy to invest in key social sectors which are important to reducing poverty.

During disastrous period, gender becomes hugely impacted. There are different responses to disasters among gender categories. In this case, the impact of disasters is felt more by females (women and girls) as compared to males (men and boys) due to roles of community, reproduction and production. For instance, when families are displaced, women and girls still have the role to fetch firewood, food, housing and clothing just to mention a few for the household. Furthermore, when sickness falls in the household, women are at the forefront of nursing any family member patient like during families camping where issues of hygiene and sanitation becomes a challenge.

During the 2014/15 farming season, the agricultural production was strongly affected because of shortage of water supply in some areas while in other areas it was due to excessive flooding of water. Similarly, the 2015/16 rain fed growing season was affected through the dry spells experienced in many districts of the country.

This shows that Malawi is vulnerable to disasters especially floods and droughts, hence continuous efforts of looking for alternative measures should take place so as to save the country's economy and peoples livelihoods.

Therefore, this paper addresses some of the challenges faced due to shortage of water supply by promoting the use of groundwater for irrigation as adaptation measure to a changing climate in the agricultural sector.

2.0 Materials and methods

Focus group discussions were conducted where 100 (79 women and 21 men) community members were interviewed in 4 separate sessions of 25 participants each. This was to allow more participants voice out their views unlike having all the 100 participants at once. The qualitative data collected from the groups helped to have a clear picture of how the community was benefiting from the Solar energy borehole and how much knowledge did they have about the technology. Some of the questions asked were:

1. What role does solar energy borehole play in human lives?
2. What are the advantages of the technology?
3. What contribution does the technology have towards climate change fight?
4. What is the uniqueness of the technology from other sources of water?

Respondents gave different answers in their different groups.

There were interviews in Education Level of Respondents. This aspect was very important because the level of education determines the level of self esteem and asserting the respect of respondents' rights and entitlements in addition to levels of knowledge on adopting various forms of agricultural technologies and enterprises that are essential in improving the economic status as well as food security status.

Table 1: Education Level of Respondents

		Frequency	Percent
Valid	No formal education	21	21
	Std 1 to Std 3	32	32
	Std 4 to Std 8	11	11
	Junior Certificate	28	28
	MSCE	5	.8
	Diploma to Degree	3	1.2
	Total	**100**	**100**

There were also individual interviews to 12 participants who were selected from the four groups. The idea was to dig deeper on how households were benefiting from the technology and their recommendation.

Another interview was conducted to the 10 farm workers on how they manage the system, in terms of installation, maintenance, production and relationship with the community. In this interview, it was narrated that the borehole was dug 55 meters deep and other set of installations were made like 4 solar panels of 300 watts each, 10,000 litres' tanks, taps just to mention a few. Water from the borehole has been supplied through taps to the fields as well as for the use of the communities.

Land measurement took place to find out how much land was being used under the technology. A measuring tape was used to measure the area of the field by multiplying the distance of two sides i.e. length times width.

3.0 FINDINGS/RESULTS AND DISCUSSION

The study has revealed the following from the solar energy borehole farm project:

3.1 Source of consistent water supply

It was found that for over ten years, there had been no shortage of water supply in the field as well as to the community. Crops in the field receive enough water all the year round just as people surrounding the farm. This is in line with Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all.

Table 2

No of participants accessing water	Before technology	After the technology
From open wells	27	0
From borehole	17	9
Covered well	12	5
From river streams	29	2
From taps	8	84
From Combined sources	7	3

There is a decrease in number of participants using different sources of water after the installation of the technology because majority had started using the water from the improved borehole.

3.2 Source of social and economic resource

This solar energy borehole has contributed to the country's social and economic resources through the communities in Traditional Authority kapeni n Blantyre. In this case, some community members are employed by the farm thereby able to support their households, relatives and even friends. Not only that, but also there are community members who have engaged in business of farm produce where they purchase from the farm for reselling in other places like Blantyre market. This means that the technology has been more effective in reducing economic challenges among the rural communities thereby fulfilling the sustainable development Goal 8: "Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all"

Table 3: How Much Money Can you Dispose over in a Year

		BEFORE	AFTER
Valid	< K10000	31	0
	K11000 to K20000	24	0
	K21000 to K30000	21	7
	K31000 to K40000	16	9
	K41000 to K50000	13	27
	> K51000	7	57
	Total	**100**	**100**

3.3 Tool for sustainable development

This technology is sustainable in nature because it is reliable with modern energy for all. Just as Goal 7 states: Ensure access to affordable, reliable, sustainable and modern energy for all. Once production began, there were no stoppages due to shortage of water supply or power supply. This means it can sustain in developing the communities once installed.

From the tables shown above, the technology is able to sustain lives of human beings in accessing enough clean water and economic source through income generating activities.

3.4 Source of food security

Sustainable development Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture is achieved through this technology. The farm of ten hectares of land has components of different crop varieties and types. There were cereals, legumes, vegetables and tubers. The production of all the crops was available even during the dry season. This means that the technology contributes to consistent food supply hence source of food security in the communities.

TABLE 1: CROPS HARVESTING STATISTICS.

VEGETABLES/CROP	EXPECTED HARVESTING PERIOD AFTER PLANTING	EXPECTED HARVEST(TONNES)/HECTARE
Beans	7-9 WEEKS	2-3
Carrot	2.5 -3 MONTHS	18-20

Cabbage	12 WEEKS	12-33
Egg plant	10-16 WEEKS	18-30
Mustard/ Rape	4-6 weeks	2 -4
Okra	4-6 WEEKS	10-12
Onion	5-7 MONTHS	10-15
Pepper	8-12 WEEKS	4-10
Potato (Solanum tuberosum)	3-4 MONTHS	14-18
Tomato	12-15 weeks	18-20
Pea	2.5-3 MONTHS	3-6
Maize	90-140 days	4-10

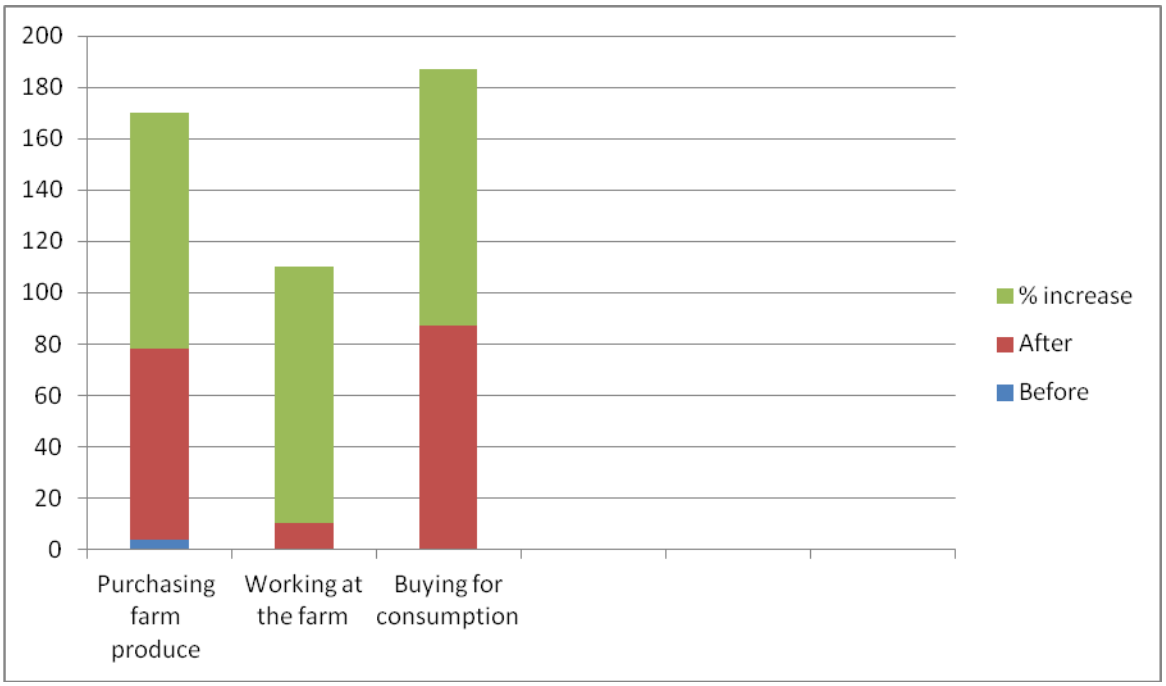
The table above may have different interpretation based on the purpose of the research. On this paper, it explains how food security can be attained if the technology is applied to as many places as possible. For instance, if maize was grown in the ten hectares of this farm, then a minimum of 40000 kilograms(KGS) of maize harvest could be realised which is enough to feed almost 148 people all year round. Furthermore, if the production is done through out the year, then for thrice, the crop yield would 40000kgs X 3 =120,000 kgs that would benefit 148 people x 3= 444 people all year. But if the production is carried out under proper management(improved maize variety, good crop management) the yield will be 100000 kgs per growing session summing up to 300000 kgs for 3 growing session in a year thereby 1111 people having food all year round. (300000kgsdivide by 270 kgs required by one person per annum).

With vegetable production, it would be also available all year round. In this case, a person is estimated to eat 50 kilograms of vegetables per year which could be achieved through the technology. Therefore, having basic food of maize and vegetables would be a starting point of relief from hunger among the poor and the vulnerable.

3.5 Improves rural livelihoods

This technology has proved to be a hope for rural livelihoods. People in the community around the farm were able to purchase produce from the farm for re selling in other places of low supply. The interviews revealed that some head of households relied on this farm produce business for survival of their families. Others had even left their far places to come and stay near the farm for easy carrying out of the business. School fees and materials have been realised from these business. Therefore, it is ideal for improving livelihoods.

Table 4 PEOPLE INVOLVED IN INCOME GENRATING ACTIVITIES



No of participants involved in	Before	After	%
Purchasing farm produce for resell	6	74	92
Working at the farm	0	10	100
Buying for consumption	0	87	100

The figures illustrate that before the technology was installed, only 6 participants had access purchase farm produce for resell but installation of the solar borehole the figure reached to 74. Employment has been created and people have access to buying farm produce for consumption as well.

3.6 **Alternative solution to climate change impact like dry spell**.

Solar energy borehole is one of the alternatives for mitigating as well as adapting to climate change impact. The system mitigates because there is no carbon emission due to solar energy which is used unlike other technologies which require fuel engines to operate.

It is also an adaptive measure to climate change impacts because it is used throughout the year whether there is dry spell or flood which are affecting majority of Malawians. In this case, the system also takes water from lower water table. Like in this farm, it draws from a

55 metres depth which is different from other technologies which need shallow wells only**.** This compliments Sustainable Development Goal 13: Take urgent action to combat climate change and its impacts*

3.7 Relevant to water supply, sanitation and hygiene.

The technology is very relevant to water supply, sanitation and hygiene because of its consistence and easily manageable. Water from the well is not contaminated since it is closed in the pipe right from the well to the place of supply. Also chemicals like chlorine is applied in the tanks before being released for use in the field and in the community thereby making water safe for human use.

There is sanitation and hygiene in households which fetch water from this farm because they have access to water at any time unlike others who can not do all domestic chores due to scarcity of water. Issues of bathing, washing clothes becomes a big challenge in such scenarios.

4.0 Conclusions

The main objective of the action was achieved which was to assess the effectiveness of Solar energy borehole in relation to consistent water supply, social and economic resource, rural livelihoods and sustainable development. The technology is really effective through consistent water supply which is followed by other social factors advantages.

In addition, it has been found that the technology is the source of food security in the communities, it is relevant to water supply, sanitation and hygiene, it is the alternative solution to climate change impact like dry spell.

The solar energy borehole play an important role in human lives as it has been observed by community members' responses and what was seen on the ground. The advantages of the technology noted were easy maintenance, consistent water supply, can draw from the lower water table area just to mention a few. The technology has contributed towards climate change fight through mitigating and adapting measures.

The uniqueness of the technology from other sources of water was that it supplies water to a large area of land, does not require expensive cost for maintenance, is environmentally friendly, it is a source of safe water since chlorine can be added before supplying.

Therefore, solar energy borehole is suitable for consistent Clean water supply and Improving livelihoods.

Recommendations

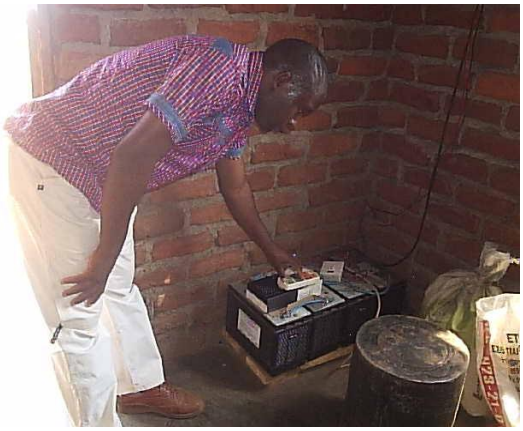
There is recurring cases of droughts and floods in Malawi which have heavily affected the country's economy thereby denying citizens from being resilient. There is also seasonal droughts which have brought wilting of crops and affected crop production of selected crops.

As a result every year, there are some areas whose communities require relief aid.

Therefore, based on this survey, it is recommended that:

- More interventions should be designed by different stakeholders using this technology especially in areas where disasters have been more recurring.
- If the technology can be implemented at least, at each Area level then increased number of citizens can have access to water supply for both irrigation farming and drinking.
- The technology can help reduce cases of cultivating in the river streams or along the river banks if the community is provided with this set of technology.
- Areas with droughts cases should be considered with this technology as an alternative rather than relief aid.

IN PICTURES



A small house with solar panels on top of the roof and Batteries housed inside as shown on the right hand side.

A 10000 litres water tank was mounted on top of metal welded pillar (storey) which was installed where the borehole was dug 55 metres deep. Here there is an electron wire connected from the small house to inside the borehole water. The borehole was lined up with cement and covered with the slab. There is apipe inside the borehole that takes water to the tank before being opened for supply.

A farm manager is explaining about how the farm operates and how people are benefiting from this farm. Other smaller tanks are also installed inside the field as seen on the right.

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