**SMALL-SCALE BIOGAS DIGESTERS AS DEVELOPMENT AID: TALES OF HUBRIS AND FAILURE**

**Site ID: 06**

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**Interviewer:** Where did this digester originate?

**Interviewee:** We bought it from German – From a company called Catrine.

**Interviewer:** Who designed it?

**Interviewee:** It terms of installation or the digester itself?

**Interviewer:** Both

**Interviewee:** The digester was designed in German by Catrine. As far as installation, we sent someone to go to Germany to learn about its installation and to then install and train people here at Green Malata.

**Interviewer:** Who is this someone?

**Interviewee:** It’s a not a Malawian. It was a Dutch who was working in the renewable energy department here at Green Malata.

**Interviewer:** I can see that it was a process and a fortune was spent to have the digester running. Who funded it?

**Interviewee:** It was funded by our usually donor Children’s Fund Malawi.

**Interviewer:** Who else?

**Interviewee:** It was only Children’s Fund Malawi.

**Interviewer:** What was your role as Green Malata?

**Interviewee:** We are project implementers of Children’s Fund Malawi. So, our role is to be the end user of the biogas digester.

**Interviewer:** So, what was your involvement in the process?

**Interviewee:** As Green Malata, during the installation of the biogas digester and training we selected one person from each department to learn about biogas in terms of its operation and benefits. We also trained people from the nearby community on the same.

**Interviewer:** How did you identify these people?

**Interviewee:** Initially, we train students in renewable energy in terms of solar and windmill. So, we the coming in of biogas digester we thought it wise to incorporate the student in the training. Thus, student and heads of departments were part of the process. Also, we targeted and incorporated people from Ntilamanja community who had cattle and pigs because we believed that they had the potential to purchase and run a biogas digester. So, we targeted them to introduce them to biogas with the intention that they should appreciate what biogas is, and hopefully adopt the technology in their households and community at large.

**Interviewer:** Who built it?

**Interviewee:** It was the people who were involved in the training because the train was designed in a way that we were directly implementing what we were being taught.

**Interviewer:** Before this intervention, did you know about biogas?

**Interviewee:** We had no knowledge of biogas. But, we saw that cost for firewood was getting very high – like K75, 000 a month, so we to search for an alternative to reduce the cost that’s when we found biogas.

**Interviewer:** Okay, what were your expectations?

**Interviewee:** Our expectation was that biogas was going to help us reduce cost incurred from using firewood. We knew it wasn’t going to completely eliminate firewood use though. So, we thought of using electricity for cooking but it was not practical because electricity cost is too high. So, our expectation was to use biogas together with firewood for cooking.

**Interviewer:** Why did think that biogas was and is not sufficient to stop you from using completely?

**Interviewee:** Our demand for energy is high that biogas digester can’t meet since it produces little gas sufficient for our need. Also, even if we maximized gas production, we knew methane gas doesn’t produce strong heat enough to cook things like beans which requires intense heat. That’s why we use biogas to cook things like nsima, but for beans we use fire wood.

**Interviewer:** You mentioned you sent someone from Netherlands to go learn about biogas, what were you told to expect from biogas by this person?

**Interviewee:** We were told to expect to learn more about different types of biogas technologies that are available on top of the one we have – technologies simple enough to be adopted at a household level. Also, we were told that we can maximize gas production to a level that would allow us to commercialize our gas production to nearby communities.

**Interviewer:** What kind of training were you given by the installers?

**Interviewee:** During the training we had a training manual which outlined what biogas is, what type of gas it produces, its operation and maintenance, and its full installation.

**Interviewer:** What was the setting?

**Interviewee:** It was a like class – we had it for 2 weeks.

**Interviewer:** How many participated?

**Interviewee:** It was 5 people form different departments, 2 chiefs, 2 people from the community and 3 previous students from renewable energy department. In total, it was 12 people.

**Interviewer:** What was the selection criterion?

**Interviewee:** We had to select people from the community who are committed farmers with cattle to maximize their farming in 2 ways: one to use manure for fertilizer, and to use manure for energy – we wanted them not to use manure only farming. We recognized chiefs for their leadership role towards community development that’s why they were part of the training. Also, we incorporated students in renewable energy to enhance the knowledge and expertise on the subject.

**Interviewer:** Okay, how prepared to run or operate the reactor did you feel you were after the training?

**Interviewee:** I felt so confident because, the training was hands-on – whatever we were learning, we were also doing on the ground. And, at the end of the training we managed to install a biogas system which produced gas sufficient for cooking. So, you can see that the 2-week training was successful. On top of that, after we finished the training and installing the biogas here, we also had an opportunity to install one at the chief’s house. So, you can see that the training was successful and we felt that we could install and operate the reactor.

**Interviewer:** Okay, why did you choose to build a digester here?

**Interviewee:** We decided to build a biogas system because we wanted to reduce the cost of using firewood as well as alleviate environmental impacts due to massive cutting down of trees. Also, we chose to build a biogas because of its ability to produce manure on top of producing energy for cooking. It was no brainer to go for biogas once we learned that biogas system also produces manure as a byproduct which we could use for farming since we are very much into farming. Thus, we chose biogas because the system would address our cooking needs as well as produce manure for farming.

**Interviewer:** Okay, so before biogas, how did you meet your energy needs?

**Interviewee:** We used firewood.

**Interviewer:** Apart from firewood, what else?

**Interviewee:** Nothing else, but we have a business restaurant which requires sufficient energy for refrigeration, cooking so we use electricity and LPG gas at the restaurant. And we mostly use electricity in the restaurant because Liquid Petroleum Gas (LPG) is a bit expensive, and we use LPG only when electricity goes off.

**Interviewer:** okay, where were you getting all the firewood then?

**Interviewee:** Initially, we had tea estate companies which were giving us firewood as most of them do plant blue gam – so they were sharing us firewood. On top of that we used to buy firewood, which we still buy these days.

**Interviewer:** How was it possible for them to donate firewood to you?

**Interviewee:** We had a partnership with a tea estate company. Where we are sitting used to be a tearoom so many people where coming to have tea here – Many of them were people from outside the country. As a result, we used to use the tearoom to market and promote their tea – Because of that partnership they willing to donate firewood to us.

**Interviewer:** Which company is that?

**Interviewee:** Eastern Produce Tea Estate.

**Interviewer:** I have seen that you use manure to operate the biogas, how did you manage your waste (the feedstock) before the reactor?

**Interviewee:** We used to use the manure as fertilizer. As I have pointed out, we have gardens so manure used to go straight to the gardens. In certain cases, we used manure for making compost which we still do now.

**Interviewer:** And everything was going on smoothly?

**Interviewee:** Yes, there are a number of things that ensure sustainability of this organization. One of them is that we don’t buy vegetables. We produce vegetables for consumption using our own manure.

**Interviewer:** How has the coming of biogas affected your farming? Hasn’t vegetable production decreased because manure is now used for biogas?

**Interviewee:** No, it didn’t affect us in any way because we have a number of cattle sufficient for biogas and farming. We have enough manure that some we keep for future use as well. Besides, we practice natural agriculture meaning to say we don’t apply chemicals to our animals. This helps to keep the biogas running because we are assured to feed the digester with the manure all times.

**Interviewer:** You said you sent someone from Netherlands to learn biogas. He came, you had your hands-on training and finally installed it, how did the system work after commissioning?

**Interviewee:** It worked perfectly with no deficiencies. Besides, we had Dutch guy around to make sure that the biogas was working okay as well as ensure that we were able to maximize gas production to a level we could sell the gas to other companies and surrounding communities which use firewood for energy. So, the biogas worked quite well, the only challenge we had was our inability to produce enough gas to sell due to the fact that we did not invest further biogas to be able to reach the communities.

**Interviewer:** Okay, how much gas was being produced?

**Interviewee:** Our biogas which is 6\*2m produce 3 bags of gas on a sunny day – in summer – From August to December…... It can go as far as 4 bags of gas depending on the weather of the day. Of which, we could only use 2 bags to cook 3 meals a day giving us an opportunity to store 1 or 2 bags of gas for future use. It is possible to store gas – and we store gas in harvesting bags.

**Interviewer:** To have a clear picture, I would like to know how long use it to prepare those meals, and the quantity of the meals

**Interviewee:** I will put it as a percentage. Initially, we used to use high volume of firewood, like K75, 000 per month on firewood.After biogas, we could only use 75% firewood and 25% biogas for meals of 120 -150 people three times a day. We use firewood to cook heavy meals which need more energy like Nsima for a larger group of people. We use biogas to cook things that need less energy like vegetable as well as Nsima for a small number of people.

**Interviewer:** When you decided to buy a biogas digester did you envision that you could only produce and use 25%?

**Interviewee:** Our target was to produce and use 50% for cooking, and the rest to use it as an income generating system because we believe that on top of donor funds we need our own income generating activities to cater for other expenses.

**Interviewer:** So, clearly, your expectations were not met. Can we say it’s a failure to some extent?

**Interviewee:** Yes, you can say it’s a failure because our hope was to get it to 50% but we managed 25 – 30%.

**Interviewer:** Why do you think it was a failure? We are you at 25%?

**Interviewee:** I believe the biogas we bought couldn’t match that target. Besides, maybe our expectations were very high.

**Interviewer:** Why do you say that?

**Interviewee:** Mmmh, having had firsthand experience with the biogas digester I don’t think it can produce enough gas to reach many people as we thought – I don’t know how big the reactor has to be to get that amount of energy (Laughs).

**Interviewer:** Apart from using the gas for cooking, how else did you use the gas?

**Interviewee:** Initially, we used the gas for cooking food as well as for baking at our confectionary. However, we saw that the bakery oven was consuming more gas that it was affecting our cooking, that’s when we decided to use it for cooking only.

**Interviewer:** What happened to the bakery?

**Interviewee:** We still have bakery, but we don’t use biogas because it doesn’t produce enough energy to run the oven.

**Interviewer:** Okay, what were the operation requirements?

**Interviewee:** Firstly, we got a biodigester bag, harvesting bags and pipes we got from Germany. However, there was some equipment that was required that we had to make on our own like the burner. So, we had a team from the welding and fabrication who worked on the burner so that it could produce energy. Luckily enough the team improvised and came up with a burner. As a matter of fact, all the burners that we use we made ourselves.

**Interviewer:** Not anyone can do such an impressive job, how was the team able to build a burner?

**Interviewee:** Our manager has a qualification in welding and fabrication and metal work, so he has the expertise to build a burner **–** so, he designed and put together the burner.

**Interviewer:** Oh, he did all that himself?

**Interviewee:** Yes, he worked on the burner by himself with support from other staff and students. But, the bakery oven was mainly done by a consultant.

**Interviewer:** Who is this consultant?

**Interviewee:** It was a certain technician. He retired because he was diseased with a respiratory problem due to prolonged exposure to smoke.

**Interviewer:** What was the feedstock requirement? Manure Ummhu….

**Interviewee:** Cow dung, kitchen waste and sometime we feed sugar or maize flour. We also put milk or sour milk to facilitate bacteria activities in the reactor to boost gas production. Thus, we feed manure, kitchen waste, and additives as well as water.

**Interviewer:** Where did you get the information that you also need additives to boost gas production?

**Interviewee:** Initially, this information was not provided by the Dutch guy; rather, as time went by we had an opportunity to research this information on the internet.

**Interviewer:** Who spearheaded this process?

**Interviewee:** It was our director.

**Interviewer:** Okay, how do you prepare that feedstock?

**Interviewee:** At the cowhouse we have a team that collects dung in buckets to feed the digester. The guys mix dung and water in buckets, just like you have seen. So, the guys feed the digester after every 2 or 3 days. If dung is excess they store dung for future use, because dung can be stored in buckets.

**Interviewer:** Okay, how much dung do you feed the digester?

**Interviewee:** We feed 2 buckets of 50L manure per feed – That’s 100L of dung which we add 100L of water. Thus we mix 100L volume of dung and 100L of water and stir till the mixture becomes watery, then we feed after every 2 or 3 days.

**Interviewer:** Who feeds the digester?

**Interviewee:** We have 2 people responsible for feeding the digester. On top of these, we have [name redacted] from renewable energy department who supervise them, and is also responsible for monitoring operations and maintenance issues.

**Interviewer:** Okay, what are the maintenance requirements?

**Interviewee:** Most of the maintenance work is on the dome of the green houses which regulates temperature on the digester**.** The structure needs constant maintenance because it is made of bamboo material so gets eaten every now and then. But, we are thinking of using metal bars in place of bamboo to enhance durability of the structure.

**Interviewer:** Was this also part of the training?

**Interviewee:** No, it’s something that we are thinking of improvising.

**Interviewer:** How?

**Interviewee:** (Laughs) There are something that we just observe and decide to do differently to suit our available resources, because we have an innovative team that handles that very well. Just to add, there are so many things that we learned that we don’t implement, instead we improvise to meet our local resources.

**Interviewer:** Okay, who handles these things? Who is responsible for maintenance?

**Interviewee:** We have a department of maintenance that is responsible for all maintenance work here. For example, if people who work on the biogas digester observe a fault, they write to the maintenance department to fix the problem.

**Interviewer:** After installation, did the reactor meet your needs?

**Interviewee:** Mmmh (Takes long to respond) ……. During the first 8 months it didn’t meet our needs because one reactor was not certainly enough in terms of gas production. But, after 8 months we sourced another digester, that’s when our needs started to be met.

**Interviewer:** What were the gaps?

**Interviewee:** Yes, challenge comes in when we want to balance the use of antibiotic and other chemicals for cattle management with using dung of the same cattle. Our standard practice is to avoid use of antibiotic and chemicals for cattle management. However, it reaches a point where we have no choice but to use antibiotics, for instance, when we have diseased cattle that need medication. In this case, we separate diseased cattle from healthy cattle so that dung for diseases cattle injected with antibiotics is not fed in the digesters. This is important because when dung containing antibiotics is fed in the digester it shuts down the reactor as it kills all bacteria in the digester as a result gas production cease completely. The possible solution for this is by flushing out the feed – that’s where you remove feedstock and clear the bags with water, and then you put new feedstock so that the process starts again. We have had this problem before where a staff fed one of the two digesters with dung containing antibiotics. We flushed it out and it was restored. Also, the system is made of nylon plastic which breaks, and when it breaks, it causes leakages which reduce gas production. We normally detect this problem by noticing strange smell especially in the green house structure.

**Interviewer:** So, what other challenges do you encounter?

**Interviewee:** Mostly, it’s what I have already explained. But the other challenge is that not all materials can be sourced within Malawi. For instance, we were told to use ordinary plastic to cover the green house, but we realized that after 2 or 3 weeks, the plastic was getting damaged. And you should know that the greenhouse structure can’t work properly without proper covering. So to deal with this problem we made a heavy duty plastic covering, and since then the problem hasn’t occurred.

**Interviewer:** You mentioned that it hasn’t been smooth sailing, at some point one digester failed. How did these problem manifest?

**Interviewee:** We had an incident where someone unknowingly fed the digester mixed dung from healthy cattle with dung from cattle on antibiotic treatment. This caused the digester to cease working. Our standard practice is to separate cattle on antibiotics for one week from healthy cattle. But, that time we failed to do that, and it broke down the digester.

**Interviewer:** How did it stop working, did it stop gradually or it just stopped at once?

**Interviewee:** No, it was gradual process *–* Gas production diminishes slowly to a point where it ceases completely because bacterial activity does not stop at once when you feed it antibiotics.

**Interviewer:** We are almost half way, Okay, how long did you use it for before it stopped working?

**Interviewee:** It took a year then that’s when that happened. And it took about 3 weeks from the time we started noticing the decrease in gas production to a point where gas production completely ceased.

**Interviewer:** When it stopped working, where was the Dutch guy?

**Interviewee:** She wasn’t with us then – she was back in Netherlands.

**Interviewer**: So, once it broke, did you try to fix it? What did you do?

**Interviewee:** We tried to reach out to Dutch guy, and also we searched on the internet to learn more about the problem and its possible solution. Then, through our research we found out that the problem caused by antibiotics which found their way into the digester as a result of mixing cow dung for healthy cattle and cow dung for cattle which was on antibiotic treatment.

**Interviewer:** You have said during your training you were given a manual, I presume it also outlined issues and their possible solutions?

**Interviewee:** No, it didn’t address troubleshoot issues and its solutions. It only talked about installation in terms of what material are required to install a biogas and all that.

**Interviewer:** (shown table of interventions) have you seen something like this?

**Interviewee:** I have never seen something like

**Interviewer:** What do you think about this kind of information and do you think it would have helped you the time one digester failed?

**Interviewee:** I believe the information is very helpful and could have helped us solve the problem easily. Like I said, everything we do is based on the information we were given during training. So I believe with the expertise we have and with this kind of information, we could have been and we can be better placed to operate and maintain the biogas digester.

**Interviewer:** How would you describe the current state of the digester?

**Interviewee:** It is in good state and gas production is quite okay.

**Interviewer:** From my understanding, you started with one reactor but it wasn’t enough then you bought another one. After some time, one failed but you were able to fix it. And now you have said you current state is okay. In your opinion, what is the caused it to fail at that time? And how have you managed to be fully operational again?

**Interviewee:** In the first cause it failed because we mixed cow dung containing antibiotics with dung of healthy cattle. And I think we have managed to be where we are because we have a capable team which is committed and innovate.

**Interviewer:** Out of curiosity, how did you know that it failed because you mixed the dung?

**Interviewee:** We observed, like I said we observed for three weeks, from the time we gave the cattle antibiotics to the time it failed, because gas production in one digester started diminishing some days after we gave the cattle antibiotics. Besides, we searched on the internet and it showed that antibiotics and detergents kill bacteria in digester, and eventually they break down digester systems.

**Interviewer:** (Laughs) okay, when one digester failed, what did you do for energy i.e. cooking?

**Interviewee:** Like I mentioned we have two, so when one digester failed the demand for firewood increased as gas production reduced due to the failure. Thus, when one digester failed more firewood was required.

**Interviewer:** How did you manage your waste (feedstock) when one reactor failed?

**Interviewee:** We used to store waste and some we were using as manure.

**Interviewer:** We have done almost 80% of the interview; we are going towards the end. How much did the reactor cost to build?

**Interviewee:** It cost us K350, 000 – K400, 000 then. I believe it must be around K600 000 now because of how prices of goods have risen.

**Interviewer:** When did you buy it?

**Interviewee:** It must be in 2016 or 2017

**Interviewer:** Who paid for it?

**Interviewee:** It was a donation from children’s fund Malawi

**Interviewer:** Did your organization contribute anything in kind?

**Interviewee:** Yes, in terms of labour and expertise in producing things which were not available like burner and covering.

**Interviewer:** How much labor was involved in terms of digging?

**Interviewee:** It was basically everyone who was involved in the training, and people who were responsible for masonry work – 15 people

**Interviewer:** Masonry**?**

**Interviewee:** It was 3 people.

**Interviewer:** For how long?

**Interviewee:** 2 weeks

**Interviewer:** Was there any other work which was done?

**Interviewee:** Yes, there was need for plumbing work to fit pipes – one person did that.

**Interviewer:** What kinds of special items had to be imported from another country?

**Interviewee:** The harvesting bags and biodigester bags were imported from Germany, and plumbing items. Yet, we came to a realization that most of the plumbing items which we thought we couldn’t find locally are locally available – We have seen them in local hardware stores here in Mulanje and Thyolo. For example, the 100mm pipes which were installed are locally available in the hardwire stores though the quality is not the same.

**Interviewer:** Are the digesters saving you money in terms of energy consumption?

**Interviewee:** Yes.

**Interviewer:** Please, can you quantify it?

**Interviewee:** Like I said, we used to spend K75, 000 on firewood, so from that take away 25 – 30 %.

**Interviewer:** We are going towards the end, we remaining with 2 questions. What is your opinion of biogas?

**Interviewee:** Biogas is a viable technology, and it’s of capable replacing sources of energy that degrades the environment like use of firewood. For example, at a household it can address all energy needs, and at a household institution it can reduce cost for energy.

**Interviewer:** Last one, if you could have designed your own waste or energy intervention, what would you have chosen instead?

**Interviewee:** look at other option, I think it is to easier and more practical to adopt simple biogas technologies that use manure or food waste to generate energy than other interventions because other interventions are expensive and complex to develop. Thus, I would design simple biogas technologies instead.

**Interviewer:** (Laughs) this is the end of our interview. Thanks a lot the interview.

**Interviewee:** Welcome.