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Project on local family farms with biodigesters in the el Povenir de Ticaban community in the Province Pococi in Costa Rica

Summary:

I have been visiting Costa Rica for 2 months in August and September and I have been working on a biodigester project in the el Povenir de Ticaban community in the Province Pococi. At first, we have simulated the biodigester in a laboratory setting to figure out the correct pressure range applicable. Then, we found and choose the proper gasflowmeters and installed them on the family farms biodigesters. The measurements are running currently. At this moment we are preparing the application for carbon neutral bonds with an independent consultant. The measurements will finish in the near future and the application will be submitted.

Outline:

The central goal of our project consists of two main parts. First, measure the methane production of biodigesters on local farms in Costa Rica. Second, with that knowledge apply for carbon neutral bonds. The result of that is the quantification of the methane footprint on the environment and the provision of additional funds for the community for future projects.

Project remarks:

From a historical perspective, the land in the Povenir de Ticaban community was initially owned by the government around 15years ago and then distributed to families to live there and to take care of the land. The government has built and provided electricity to the families 8 years ago where also pumps are used to pump water from the ground to storage containers from where it is used for

cooking and cleaning purposes. However the government has not installed gaslines to the local communities and this is where the biodigesters are useful.

Let's take a look at the process of methane production. It starts in the pig stall. The pig stall and the pigs are cleaned regularly with water, which then flows into the biodigester with all the poop and feces from the pigs and the pig stall. Over time, microorganisms in the poop and the feces produce methane, sulfur, carbon monoxide, water vapor and other residual gases which are collected in the pressurized biodigesters bag. A pipe connects the biodigesters bag to the kitchen of the family where the gas is burned and the flame is used for cooking food and water. The process is depicted in Figure 1.

In order to properly measure the methane production rate one needs to determine the percentage rate of the methane production (since different gases are being produced). This type of measurement requires highly specialized equipment which is not easily available. Thus an external laboratory was hired to do the measurement of the gas composition and methane rates.



Figure 1 Left) Pig stall with pigs, Middle) filled pressurized biodigester bag and Right) burned methane flame.

Biodigester lab simulation:

We simulated a biodigesters pressure in the laboratory and concluded on an estimated flowrate of the biogas to be around 0.030 kg/s. The lab setup is shown in Figure 2. The difference in the heights of the water in the U-shaped tube gives the pressure through $\Delta p = \Delta h * g * \rho$, where Δp is the pressure difference, where Δh is the height difference in the water columns in the U-tube and ρ is the density of the fluid in this case water.



Figure 2: Left) Pressurized container which simulates the pressure in a biodigester and is being used to estimate the flowrate of the biogas. Right) Enlarged picture of a laboratory type gasflowmeter.

Installation of the gasflowmeter:

Figure 3 shows the proper choice of a gasflowmeter and its insertion into the gasline which counts the amount of biogas being burned. Currently the gasflowmeters are taking measurements.

We are also waiting for the external laboratory to determine the amount of methane produced in the biogas. This concludes the first part of the project.

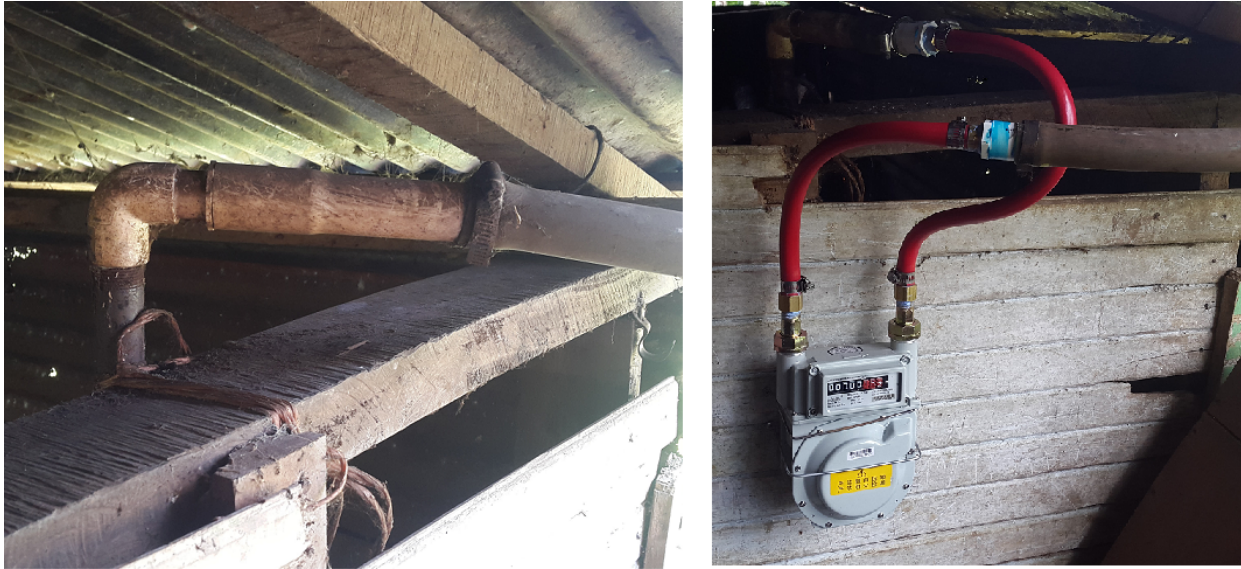


Figure 3: Left) connecting pipe before inserting gasflowmeter. Right) connecting pipe with gasflowmeter.

Application for carbon neutral bonds:

The second part of the project which is still ongoing and will be performed once the measurements are finished. It will consist of applying and taking the measurement results to government officials for the carbon neutral bonds. We are in contact with Miss Carla Mena Soto who advises and oversees the application process for carbon neutral bonds. It is work in progress that takes some more time to be finished.

Future projects within the community:

Future projects within the community will focus on connecting to the existing setup of the biodigester and its produced sediments within the bag. Currently Dr. Jose Luis Leon examines the usage of sediments that are by-products of the biogas production in the biodigesters as fertilizers for local garden usage within a separate project with students at the Tecnológico de Costa Rica in Cartago.



Figure 4: Prototype of a future local garden setup

Note on my personal impressions from my stay:

Being asked on my personal impression on Costa Rica I have been lucky enough to have mostly made only good and kind experiences. People have been open, welcoming, warm and willing to help when it was possible or necessary. It was great to immerge into a culture where solidarity is not only written big but also followed by actions accordingly. A quite different experience that came up and made me thinking was, how it is possible to live off a minimum wage of \$3.55/hour (for a cashier in Costa Ricans) while food prices in the regular supermarket in Costa Rica are priced the same as in the USA(California,Riverside) or twice as expensive than in Germany (e.g. for milk or chicken or sweets). I have met with a UC Riverside alumni Gian Guzman Verri who is now a Physics Professor at the University of Costa Rica (UCR) in San Jose and among other things we have discussed this but did not come to a proper explanation and conclusion. Extending this thought to the people in the rural area of the Povenir de Ticaban community (where prices do not differ considerably) I have to conclude that living is only possible if supplied by most inexpensive products or what can be produced on their own, for example by growing locally in the gardens.

Thank you note:

At this point I would like to thank the people that helped me along the way of the project for the rich and encouraging discussions and hands on help. In particular I would like to express my gratitude to Jose Leon Luis for organizing all the trips to the local community, Vanessa Villarreal Chávez who always had an open hand to help me out with different problems coming along and was a great roommate, Rui Leonard for all the literature and contacts and suggestions provided, Claudia Villarreal Chávez who encouraged me to go to Costa Rica for this program, and Allen Puente who helped me with the setup of the gas pressure simulation in the lab. I would also like to thank Ana Corrales and Lurdes who were kind enough to be hosts for our stays in the community. Everyone made my stay at the community in Pococi and the Tecnológico de Costa Rica a unique experience for me. Finally, I'm grateful to have received the service based self-learning BLUM fellowship which allowed me to take part in this project.