Anaerobic Digestion in Pursat, Cambodia

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Introduction

The civil war and political unrest that ravaged Cambodia during the last half of the 20th century has led to deep impacts both economically and environmentally. Now a relatively stable country, Cambodia is looking forward to a future of peace, restoration, and reconstruction. However, the country is lacking the necessary resources and technical skill to achieve these goals and facilitate development. Engineers Without Borders at UF (EWB-UF) is a student run organization dedicated to providing engineering expertise to NGO's in developing countries. We were approached by Sustainable Cambodia, a grassroots NGO based in Cambodia and the US, with a request to develop technologies to improve the lives of villagers in the rural area to the north of Pursat. We have completed their request and require only the funds to implement it.

Over half the country is forested, but with the current environmental plundering occurring throughout the region, this is changing rapidly. Villagers use cheap firewood as fuel, and commercial logging goes unchecked. The deforestation rate is one of the worst in the world, and with it comes wildlife habitat destruction, local soil erosion, and lung disease from inhaled wood smoke.

Our Solution

To combat the environmental hazards that plague Cambodia, we need to guide civilians away from firewood as an acceptable energy source, but in order for this to occur, we also need a low cost and simple alternative. Anaerobic digestion produces biogas and converts organic waste into usable fertilizer. Biogas is a mixture of methane, water vapor, carbon dioxide, and trace elements. It is generated when organic matter is allowed to decompose in an anaerobic environment. Biogas is a high-energy fuel source, containing 650 BTU per cubic meter, and can be used in any application for natural gas.

We have built a working digester, which can be easily constructed and implemented for about $30 per unit. It uses 7 mil polyethylene plastic to form a cylindrical envelope in which the anaerobic process takes place and PVC piping for gas collection. A similar design proved successful in Colombia, Ethiopia, Tanzania, and Vietnam by organizations such as The National Biodigester Programme. The biogas is collected and stored in a double-barrel, water-sealed system and pressurized using the force supplied by the weight of the barrel.

To produce the biogas, organic waste is needed, which Cambodia has in plentitude. The animal waste produced in rural areas of Cambodia is currently applied directly to crops as fertilizer. Thus, when it rains, floods transport the untreated manure into the village where it poses health risks. This waste can be used instead to fuel the digesters. Moreover, anaerobic digestion with the addition of dried rice husks produces a favorable fertilizer that eliminates the health risks posed by the conventional use of untreated manure. The pressurized biogas stored in the aforementioned barrels is fed into biogas-stove burners to produce an efficient, smokeless flame.

Effluent from anaerobic digestion can be used as a safe, nutrient rich fertilizer that can be directly applied to crops. Effluent is rich in nitrogen, potassium and phosphate, the building blocks of agricultural fertility. Along with crops, effluent can be applied to soils to increase soil heath. Treatment with anaerobic digestion of waste is 99% effective in pathogen reduction, making it an effective waste management system.

The EWB-UF will provide 25 stoves to make use of the accumulated biogas and will replace the common wood-burning stoves that generate so much of the damaging smoke. The stoves are good quality, which will ensure durability and a sustainable life cycle. However, due to our limited budget, some families will have to share a stove. We hope that this will not cause a problem, as the stoves are portable and extremely simple to set up. We are currently exploring stove designs that use cheaper resources that will be implemented in a follow up trip. Our current goal is to make an immediate impact using sustainable materials.

Additionally, we intend to set up three community solar water heaters, which will use the energy from the sun to preheat water before cooking. The water is constantly being heated and would only be removed just before cooking. It will allow biogas from the digesters to be used more sparingly, with less fuel being required to bring the water to a boil. This technology also removes the burden from the environment of wood burning stoves, is simple to use and requires little to no maintenance.

Details of Implementation

EWB-UF will travel to Cambodia in the summer to install the digesters and, with the help of Sustainable Cambodia, educate the community on construction, use and benefits. Sustainable Cambodia will translate instructional material that we are currently developing concerning sustainability, construction, and maintenance of the digester into the native Khmer language. Our faculty advisor, Dr. Ann Wilkie, an associate professor at UF with extensive experience in anaerobic digestion, will join us.

To reduce travel costs, we will arrive in Cambodia with enough material to construct 3 demonstration digesters, but locally acquire the materials needed for the 27 remaining digesters, for a total of 30 units. Several rolls of polyethylene tubing will be brought in case local availability is scarce. We will need about three weeks to ensure a successful venture.

Impact

Anaerobic digestion paves the way to an environmentally and economically sustainable future for rural Cambodians. Converting the population to biogas will decrease the rate of deforestation, end the health risks people face from smoke emissions, and diminish the hazardous use of untreated manure. Sustainable Cambodia will help the people of Pursat to build and sell digesters to neighboring areas, thus creating a cottage industry, a model that the NGO has found successful elsewhere.

We hope that you believe, as we do, that this project is worthy of the 100 Projects for Peace Grant. If funded, we can have an impact on the lives of the people we reach, and those they reach as well. This trip will give us the experience necessary to improve our system for future implementations in other rural areas in Cambodia, allowing Cambodia to edge nearer to reconstruction and prosperity.

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