Hybrid Renewable Energy Systems: Project Proposal

The Hybrid Energy System team is committed to provide free and clean energy, through renewable and sustainable solutions, to different areas in Africa with no access to electricity. Consisting of several engineering students from Purdue University, the team has been working with ACREST, a local partner in the village of Bangang, Cameroon, to build renewable energy systems since 2009. As of now, we have successfully implemented a functional micro hydro turbine and a hybrid energy system, which is donated by American partner Wind Stream Technologies. Our goal is to power the entire village by 2018.

This team is devoted to solve the energy problem in Africa through the implementation of renewable energy systems. According to a World Bank's report, only 24% of sub-Saharan countries have access to electricity. In Cameroon, where the team activities are undertaken, 47.3% of the population has no access to this fundamental utility. The lack of energy causes numerous problems such as children at school are unable to read after dusk or hospitals are unable to provide immediate and effective medical treatment to patients. Additionally, due to the lack of electricity to dry crops in rainy season, tons of grain and cocoa bean are wasted each year in wet storage environment. However, there are always solutions no matter how hard the challenge seems to be. In 2009, the village of Bangang, Cameroon was selected as our first target to work with.

"TheWorldBankAndEnergyInAfrica"Web.15Nov.2015.

The activities of the Hybrid Energy System team are undertaken in the US and Cameroon. We established partnership with Purdue's Mechanical Engineering Department, Windstream Technologies Inc, and ACREST center in Bangang, Cameroon. Every spring semester, Purdue students are recruited to work on specific tasks ranging from engineering applications to the social impact of the project itself. During the semester the team develops an energy system at Purdue University that will later on be entirely fabricated in Cameroon. In spring semester of 2015 a hydropower turbine prototype was developed to generate 10-20 kW power of electricity with approximately 60% efficiency. In Fall 2015, a vertical axis wind turbine(VAWT) was designed and will be fabricated by the end of 2015. The team will cooperate with Windstream Technologies in 2016 to work on the next generation of PowerMill, a hybrid system consisting of solar panels and wind turbines. This PowerMill has potential to supply electricity to the entire village. It's planed to be finished by the end of 2016 and implemented in May 2017. All the designs are made with the purpose of addressing energy issue in Cameroon. However, the implemented design in the village might be different due to certain operating conditions such as local constraints in terms of material availability and engineering tolerance

during fabrication and assembly. So far a functional micro hydro turbine and a hybrid energy system, donated by American partner Wind Stream Technologies, have been working to successfully in the village.

Hybrid Energy Team was originally set up to work solely on hydropower design in 2009. However, based on the observation to local environment, a decision of combining of solar, wind, and hydro energy was made in 2015. There are dry and rainy seasons in Cameroon. Though with highest efficiency of 50-80%, hydropower turbine works most efficiently during rainy season but doesn't perform well during dry season. It costs lots of money, time, and labor force to build dam which is a key part in hydropower system. Wind turbine with 30% efficiency costs least but requests sophisticated mill to fabricate blades. Solar panel with the lowest 14% efficiency compared with hydro and wind but is the easiest one to implement and fabricate in local community. By combining different types of renewable energy, the hybrid system will adapt to different environment and maximize its efficiency and reduce cost.

The commitment success will be judged by measuring how much kilowatts of electricity can be generated in a certain period of time and how many families can be powered by hybrid energy system. Team members in Purdue University should complete desired design mission in each semester to meet pass requirement. The amount of funds raised from grant, organizations, college, and companies can be used to determine the team reliability in objective way. The number of students recruited each semester reflects the team impact and popularity in campus.