Department of Mechanical and Materials Engineering

SENIOR DESIGN ORGANIZATION SYNOPSIS – SPRING 2013

R.I.S.E: Renewable and Integrated Systems of Energy

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Energy is currently at the center of public concern due to rising oil prices, energy security and the need to address climate change. The world is primarily dependent on fossil fuels as an energy source. This dependency is not only environmentally unsustainable but also economically unviable in nations which are struck by poverty. Almost one third of humanity lives in the dark, having no electricity for their everyday needs. In addition, several billion people across the globe rely on solid biomass as their cooking fuel causing large-scale deforestation, smoke pollution and severe health impacts such as Acute Respiratory Disease.

Our project introduces an interdisciplinary approach towards integrating renewable energy sources while exploring battery-free energy storage options for the implementation in sustainable communities. This concept branches out from our recently award winning proposal, in the 2013 Odebrecht Award for Sustainability which was aimed for post-earthquake sustainable development in Haiti. We have expanded the scope of our project to address energy, sanitation and water needs for other developing nations. By harvesting renewable energy and rainwater, recovering energy from waste and creating a recycling based economy, existing communities can have a dramatic increase in their quality of life.

The integrated energy system encompasses biogas, solar panels, an innovative wind turbine and a pico hydro turbine which is made from recycled plastics. The pico hydro turbine is placed at the bottom of a rain harvesting gutter downspout to supplement energy production. The collected rain water is then filtered and purified on site. The environmental engineering team members are designing the rain harvesting/ purifying system and treating household waste twofold. Greywater is treated by bio-filters which biologically degrade pollutants, while blackwater is treated by a bioreactor which produces biogas for cooking and a nutrient rich fertilizer for growing crops. The mechanical engineering team members have designed a recycling mechanism that processes thermoplastics and creates filament that can be used with a standard 3-D printer. This processed filament is undergoing laboratory testing to assess the quality of the recycled thermoplastics. This ensures that the end products have the required material strength for their intended usage, specifically that the recycled pico hydro turbine withstands the imposed stresses. The aim of this project is an initiative to join engineering technology with communities to impulse and assure the basic human rights of energy, water and sanitation to developing nations as part of the United Nations Millennium Development Goals for 2015.