Applications of Piezoelectric Technology for Renewable Energy

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Piezoelectric energy harvesters have long been of technical interest, but their cost-performance ratio was not attractive, Recently, newer applications, especially those using new nanometer-scale-materials have suggested that piezoelectrics can become attractive for selective renewable energy applications.

The first phase of the project was to define the current status of piezoelectrics and a path, with criteria, for where these energy harvesters could develop to meet application requirements. Piezoelectricity is a developing technology that is currently undergoing discovery on ways it can be used as an alternative energy source. As of now, piezoelectric generators are cost inefficient; they produce small amounts of electricity of about 17 kWh/year at Calvin College, as compared to wind energy which produces about 1.2 kWh in a day. So, now, piezoelectrics are not very popular, but it is estimated that as the world is moving towards using more renewables, more devices that take in less energy would be created, and, piezoelectric generators would be able to power such devices.

The project focus also examined opportunities for applications on Calvin's campus; ideas include powering sensors in building hallways, powering elevator in Science Building, etc. With suitable applications identified a proposal will be scoped for a demonstration, which would be built later as an REO, Senior Design, or similar, Project. The applications included piezoelectric tiles on the stairwells in the Science Building; these locations were suggested because the stairwells are typically one of the busiest places on campus. The stairwell was preferred to the walkway because while climbing the stairs more pressure is applied which results in more energy. The cost for installing about 50 piezoelectric tiles, would be about $50,000 dollars; and the payback period would be very long, which would not be an economical investment.

As for Nigeria, piezoelectric generators were thought of being applied in the roads in the city of Lagos, due to the heavy amount of traffic in the city. Like the company Innowattech had done in Israel, the idea was to implement piezoelectric generators at least five inches below the asphalt in roads. The energy extracted would be then used to power street lights. A few roadblocks to this dominate. Since Nigeria is still a developing country, the idea of piezoelectric materials as an alternative form of energy is still new and therefore needs time to develop. The infrastructure for installing, maintaining and repairing piezoelectric systems does not exist yet. Critically, while Nigeria transforms from a 30%-electrified to a 100%-electrified country, care must be taken to provide windows for renewable energies like solar, wind, and piezoelectrics to enter when they are appropriate.