



**CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY**

Name(s) Gyan Prayaga	Project Number J0215
Project Title Piezoelectric Energy Harvesting	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Renewable energies such as solar, wind, hydroelectric and geothermal could potentially help to reduce our dependence on fossil fuels, but are expensive and not always available. Also, developing countries do not have the resources to build energy grids. Capturing energy from footsteps could be an economical and efficient solution to the global energy crisis that faces us today. I wondered if a shoe could be modified to harness energy from footsteps with only a few dollars and a basic knowledge of wiring and circuitry.</p> <p>My goal in this project was to build a small piezoelectric device to harness pounding energy from walking/running and then store it for later use.</p> <p>Methods/Materials</p> <p>METHODS 1. Tested energy output of 1 piezo disc using multimeter. 2. Tested energy output of 3 piezo discs in parallel array. 3. Inserted discs under insole of shoe and tested energy output. 4. Tested storage capacity of NiMH/Li-Ion batteries when using parallel array. 5. Experimented with capacitor as alternative to battery. 6. Built circuit to step-up voltage produced by discs and store it. 7. Attached breadboard with circuitry to shoe.</p> <p>MATERIALS piezoceramic discs; running shoes; 9V battery; NPN switching transistor; Hex Schmitt Trigger Inverter IC; 4.7KO, 560KO & 1KO resistors; pencil coiled with non-insulated wrapping wire; Li-Ion & NiMH rechargeable batteries; 47 uF & 1000 uF electrolytic and 27 pF ceramic capacitors; yellow & red LEDs; 2 breadboards; jumper wires; mini toggle switch.</p> <p>Results When stepped on, a piezoceramic disc produces enough energy to flash an LED (approximately 6 mA). A parallel series of three discs yields approximately 18 mA (milliamps). When I tried to store energy generated from 250 steps (1/6 mile) only 0.045% of the energy produced could be stored in a NiMH or Li-Ion battery. By integrating a 47 uF capacitor into the circuit, results improved to 0.06% - but still not enough to light an LED. I used a transformer circuit to increase the voltage of the disc and replaced the battery with a 1000 uF capacitor. I was unable to store the energy produced from stamping in a battery/capacitor for later use, but I was able to use the piezoelectric effect to make self-illuminating shoes.</p>	
Summary Statement My goal in this project was to build a small piezoelectric device to harness pounding energy from walking/running and then store it for later use.	
Help Received Father gave guidance about the scientific process; Uncle helped with advanced circuitry; Brother and Mother helped with testing	