

Student's flashlight works by body heat, not batteries

1 July 2013, by Nancy Owano



(Phys.org) —Ann Makosinski from Victoria, British Columbia, has an LED flashlight powered by body heat. This inventor has a flashlight that glows when she holds it. The story gets more interesting, though. She is 15 years old and her flashlight has got her into the finalist ranks for the Google Science Fair. Her work is a result of a general interest in alternative energy. She said that she is "really interested in harvesting surplus energy, energy that surrounds but we never really use." Enter the Hollow Flashlight, which works according to the thermoelectric effect—creating electric voltage out of temperature difference. As a Grade 10 student at St. Michaels University School in Victoria, she was deciding on a topic for a science project when she discovered the Peltier tile, producing electricity when one side of the tile is heated while the other side is cooled.

"Using four Peltier tiles and the temperature difference between the palm of the hand and ambient air," she said in her project statement, "I designed a flashlight that provides bright light without batteries or moving parts. My design is ergonomic, thermodynamically efficient, and only needs a five degree [temperature difference](#) to work and produce up to 5.4 mW at 5 foot candles of

brightness."

She ran some calculations to see if the warmth from a human hand could generate enough energy via a tile to power a flashlight. She presented her hypothesis: "If I can capture enough heat from a human hand and convert it efficiently to electricity, then I can power a flashlight without any batteries or [kinetic energy](#)." She presented her objective: "To make a flashlight that runs on the heat of the human hand."

To begin, she bought Peltier tiles and tested them to see if they could produce sufficient power to light an LED. The power was no problem but getting the needed voltage was, as the tiles did not generate enough of the voltage needed. As she learned, making some changes to the circuit design might turn a page. She used the Internet for information, experimented with different circuits, and got lucky, finding an energy-harvesting article on the Internet that made note of a circuit that could provide enough voltage when used with a recommended transformer.

She talked about a point where she realized her battery-free flashlight could behave as she had hoped: "The final design included mounting the Peltiers on a hollow aluminum tube which was inserted in a larger PVC pipe with an opening that allowed ambient air to cool the tube. The palm wrapped around a cutout in the PVC pipe and warmed the tiles. The result was a bright light at 5 degree Celcius [sic] of Peltier differential. The flashlight worked!" In conclusion, she said, she succeeded in powering a flashlight using only the heat of the hand. Out of two flashlights that she made, neither which needed batteries, they worked.

Materials for the flashlight project cost her \$26. Considering that the effort has qualified her as a finalist in the Google Science Fair, where 15 finalists from around the world are competing for

the prizes, that is not an unwise investment. The top winner gets a \$50,000 scholarship and trip to the Galapagos Islands. The prize ceremony takes place in September. Winners will be chosen in different age categories—13-14, 15-16, 17-18.

More information: [Google Science Fair project](#)

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