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## Texas High School Student Designs Self-Cooling Solar Cell

She received the IEEE Presidents' Scholarship for a cell that regulates its own temperature

By [JOHN R. PLATT \(/author/platt-john-r\)](#) 5 July 2016



Photo: Lynn Bowlby

A recent Texas high school graduate has a bright future ahead of her after designing a new kind of silicon photovoltaic solar-power system.

Tiasha Joardar, a 17-year-old graduate of Plano West Senior High, presented her “High-Efficiency Solar Cell Using Adaptive Self-Cooling” project at the annual [Intel International Science and Engineering Fair \(https://www.societyforscience.org/international-science-and-engineering-fair\)](https://www.societyforscience.org/international-science-and-engineering-fair), held in May in Phoenix. Her invention earned her three awards plus the annual US \$10,000 [IEEE Presidents' Scholarship \(http://www.ieee.org/education\\_careers/education/preuniversity/scholarship.html\)](http://www.ieee.org/education_careers/education/preuniversity/scholarship.html).

“This is a really big honor,” says Joardar, who plans to attend the University of Texas at Austin next month. “I hope to use [the scholarship] to help pursue my exploration in the fields of science and engineering.”

Administered by [IEEE Educational Activities](#)

[\(http://www.ieee.org/education\\_careers/education/eab/DF\\_IEEE\\_MIG\\_MCT\\_19173\)](http://www.ieee.org/education_careers/education/eab/DF_IEEE_MIG_MCT_19173), the annual Presidents' Scholarship is given by the [IEEE Foundation \(http://www.ieeefoundation.org/\)](http://www.ieeefoundation.org/) to a high school student who creates a project that demonstrates an

understanding of electrical or electronics engineering, computer science, or another IEEE area of interest. The \$10,000 award, payable over four years of undergraduate study, includes complimentary an IEEE student and student society membership during the four years of college. The winning student also receives a certificate and a plaque.

Joardar's invention allows the solar cell to regulate its own temperature with a thermoelectric heat pump. An adaptive control mechanism maintains the cell temperature within about 2° C of the outside air temperature. "Without this," Joardar says, "the cell temperature would rise about 15 to 20 degrees." That is important, she points out, because a solar cell's power output drops at higher temperatures, so the cooler cells produce more power than traditional cells operating under identical conditions.

#### INSPIRATION

The idea for Joardar's system stemmed from a project she submitted four years ago to her first science fair, for which she built a thermoelectric air-conditioning system.

"I realized that thermoelectrics only work well when they're pumping a small amount of heat energy," she says.

While doing a summer internship in a lab at the University of Texas at Dallas, she learned about solar power and silicon photovoltaic solar cells. Last year she realized that she could bring her two ideas together in a way that could possibly work to close the gap in the cost of electricity from solar compared with that of fossil fuels. A [Bloomberg New Energy Finance report published last year](http://about.bnef.com/press-releases/wind-solar-boost-cost-competitiveness-versus-fossil-fuels/) (<http://about.bnef.com/press-releases/wind-solar-boost-cost-competitiveness-versus-fossil-fuels/>) found that the cost per megawatt hour of solar was \$122, compared with \$73 to \$105 for coal, depending on where in the world the energy was produced.

"Thermoelectric devices are extremely underrated today," Joardar says. "They have the potential to be inexpensive and efficient, but they don't receive much notice."

Her current working model is a single 10-centimeter-wide by 10-cm-long silicon solar cell attached to the thermoelectric controller. The same controller could work with a much bigger array, she says: "My circuitry could control 100 solar cells. It could be pretty economical."

Her idea took shape with trial and error over a period of two years. She figured out how to implement the mechanical aspects of the hardware. She learned how to best integrate the single solar cell with her thermoelectric cooler module using thermal paste, taking extreme care with the insulation around the integrated device. She mastered other technical skills, as well, including learning to code the cooler's microcontroller. Working in the lab helped with the hardware challenges, while her high school computer science classes taught her coding.

Joardar credits her teachers—including Tracy Ishman, Neil Milburn, Deanna Shea, and Karen Shepherd—for keeping her on track. "They definitely inspired me to keep trying even when my projects weren't going as successfully as I thought they should have," she says. "I don't think I would have persevered through the past four years without them motivating me."

She also found inspiration closer to home: her older brother Rounok, who was a 2011 [finalist](http://www.pisd.edu/news/archive/2010-11/intel.finalist.shtml) (<http://www.pisd.edu/news/archive/2010-11/intel.finalist.shtml>) in the Intel Science Talent Search.

"He provided a lot of the motivation for me to go to science fairs and to innovate and excel," she says. "Seeing him bring one of his own ideas to success with a project he did in our garage motivated me to do something similar."

#### A BRIGHT FUTURE

With high school out of the way, Joardar plans to hone her project over the summer and then possibly collaborate on it with University of Texas faculty.

"Building a scaled-up model would be the next step," she says.

She also hopes to investigate the use of cascaded thermoelectric modules that would be stacked in a pyramidlike structure to decrease temperature differentials between successive thermoelectric cooling stages to see whether that improves the cooling modules' efficiency.

She plans to major in both business and either electrical engineering or computer science, she says, adding that her involvement with the solar project has her leaning toward computers. "My experience with coding—not just in the traditional classroom setting but also in implementing this project—made me realize the importance and applicability of computer science in today's tech world," she says. She'd like to start her own company someday, she adds, but one that "stays close to STEM fields."

Participating in the Intel fair and in other science fairs over the years has made an indelible impression, she says.

"As much as this project has grown the past four years, it's been parallel to how I've grown," she says. "I started with a project that didn't really work, and because of that, my confidence wasn't that great. That's now turned around."

Her technical skills have improved, as has her ability to present talks about her ideas, she says: "Everything has led to a point where I have reached the goals that I established for myself four years ago."

Information on her self-cooling solar cell project is available [online \(http://www.tiashaj.com/\)](http://www.tiashaj.com/).

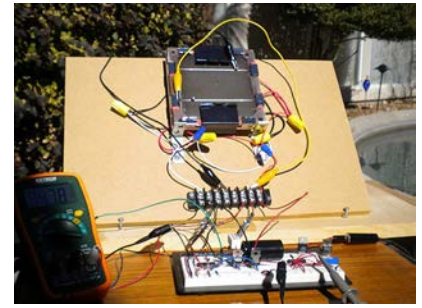


Photo: Tiasha Joardar

Joardar invented a silicon photovoltaic solar-power system that allows the solar cell to regulate its own temperature with a thermoelectric heat pump.

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