

FIRST, ONE ASTONISHING FACT FROM THE US Department of Energy: the energy from the sun that hits the Earth in a single hour could power the planet for an entire year.

Unsurprisingly, one of the best places to harness that abundant and environmentally friendly energy is a desert, but it turns out that deserts almost always come with a nemesis to solar panels: sand. The particulate matter that constantly blows across deserts settles on solar panels, decreasing their efficiency. The current method used to keep solar panels dust-free requires people to spray the dust off with desalinated, distilled water.

“That might not sound like a big deal, but if you have millions of square feet of solar panels out in a desert, it ends up being costly—especially if water is a scarce resource,” says John Noah Hudelson (ENG’14), one of several BU graduate students working to find a better solution. The team’s answer, called a transparent electrodynamic system (EDS), sets up an electrostatic field on the solar panels, causing dust particles to levitate, dipping and rising in alternating waves (the way a beach ball bounces along the upturned hands of fans in a packed stadium) as the electric charge fluctuates. In its final version, the EDS, which can be embedded in a transparent film, will be programmable or will automatically detect the presence of surface dust and



A solar panel with a transparent electrodynamic screen. When pulsed voltage is applied to the wires, the dust particles are swept away from the panel.



switch on. The entire process takes seconds, and uses a minuscule amount of power, generated by the solar device itself—about 1/100th of what it produces daily.

“There’s nothing like this on the market,” says Mark Horenstein, a College of Engineering professor of electrical and computer engineering, who is working on the project with Malay Mazumder, an ENG research professor of electrical and computer engineering and of materials science and engineering.

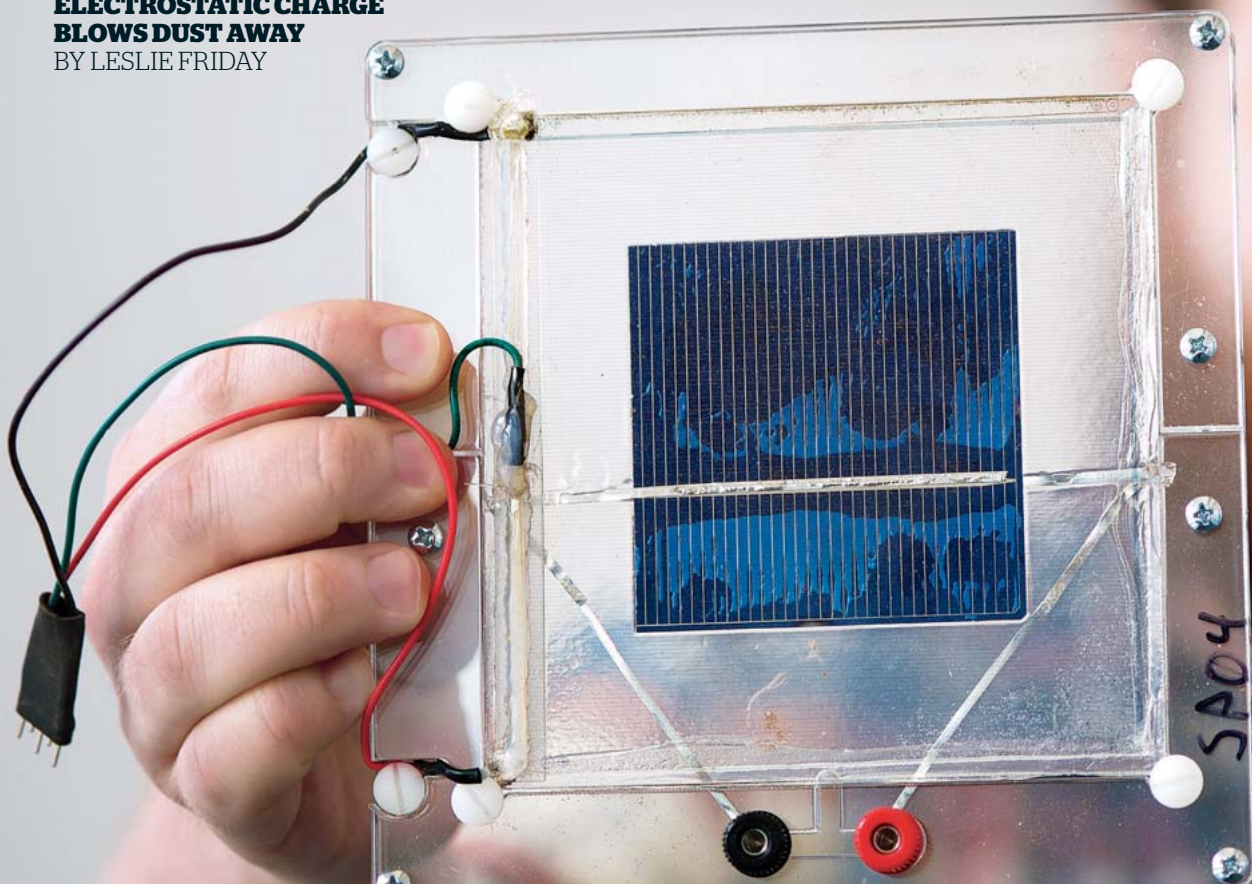
The inspiration for the EDS came to Mazumder from an unlikely source: human lungs. He remembers thinking that the self-cleaning hairs that sweep dust up and out of the respiratory system were “ingenious defense mechanisms.” He thought he could mimic that tidy biological system and apply it elsewhere.

In 2003, NASA, whose scientists thought the technology had promise for future Mars missions, gave him a three-year, \$750,000 grant. When that funding expired, a \$50,000 Ignition Award from BU’s Technology Development office kept Mazumder’s research afloat. His big break came in 2010, when he gave a presentation on the EDS at an American Chemical Society conference in Boston. News of the technology spread through articles in such publications as the *New York Times*.

Mazumder got a call from David Powell, a research and development manager at Abengoa

## Self-Cleaning Solar Panels

**ELECTROSTATIC CHARGE  
BLOWS DUST AWAY**  
BY LESLIE FRIDAY





COURTESY OF JEREMY STARK

Solar, a global pioneer in the construction of CSP (concentrated solar power) and PV (photovoltaic) power plants. The company operates the Solana Generating Station in Gila Bend, Ariz., and the soon-to-open Mojave Solar Project near Barstow,

**WEB EXTRA**  
Watch a video about how the self-cleaning solar panel works at [bu.edu/bostonia](http://bu.edu/bostonia).

Calif. Each has the capacity to produce 280 megawatts—sufficient to power more than 100,000 homes. With at least two plants in desert locations, Abengoa was keenly interested in the success of the EDS and

eager to test Mazumder's prototypes.

In 2012, Mazumder and Abengoa landed a two-year, \$945,000 grant from the Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy to further test and expand the capacity of the EDS. Horenstein and Nitin Joglekar, a School of Management associate professor of operations and technology management, are coprincipal investigators of the grant, and Sandia National Laboratories in Albuquerque, N.M., signed on to help evaluate the prototype's efficiency and develop larger-scale models. With a \$40,000 grant from the Mass Clean Energy Council, the team's total funding rose to nearly \$1 million.

For two months last year, Hudelson and doctoral candidate Jeremy Stark (ENG'14) tested nearly 20

Doctoral candidate Jeremy Stark (left) and graduate student John Noah Hudelson take a specular reflection reading last year on mirrors they installed at Sandia National Laboratories in Albuquerque, N.M.

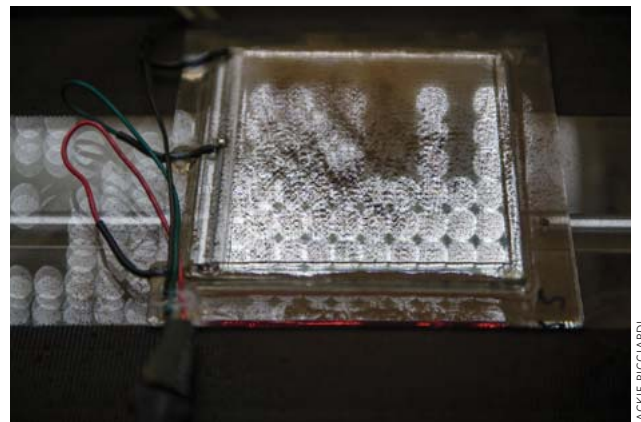


Within seconds, the transparent system sweeps away at least 90 percent of dust particles and sand on a solar panel.



EDS prototypes at the Abengoa and Sandia sites before rain and snow cut their work short. They found that the system performed as expected, removing at least 90 percent of dust particles from solar panel surfaces. Next, the BU team must figure out how to protect the EDS from Mother Nature and how to upscale to industrial-sized models.

Mazumder is meeting with manufacturers who can scale up the models, and with representatives of the DOE, which may provide some additional funding for the project. He believes that the self-cleaning system could hit the market within the next three years.



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