Nanoparticles improve solar collection efficiency

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Using minute graphite particles 1000 times smaller than the width of a human hair, mechanical engineers at Arizona State University hope to boost the efficiency -- and profitability -- of solar power plants.

Photovoltaic (PV) solar panels are popping up more and more on rooftops, but they're not necessarily the best solar power solution. "The big limitation of PV panels is that they can use only a fraction of the sunlight that hits them, and the rest just turns into heat, which actually hurts the performance of the panels," explains Robert Taylor, a graduate student in mechanical engineering at Arizona State University.

An alternative that can make use of all of the sunlight, including light PVs can't use, is the solar thermal collector. The purpose of these collectors—which take the form of dishes, panels, evacuated tubes, towers, and more—is to collect heat that can then be used to boil water to make steam, for example, which drives a turbine to create electricity.

To further increase the efficiency of solar collectors, Taylor and his colleagues have mixed nanoparticles—particles a billionth of a meter in size—into the heat-transfer oils normally used in solar thermal power plants. The researchers chose graphite nanoparticles, in part because they are black and therefore absorb light very well, making them efficient heat collectors. In laboratory tests with small dish collectors, Taylor and his colleagues found that nanoparticles increased heat-collection efficiency by up to 10 percent. "We estimate that this could mean up to $3.5 million dollars per year more revenue for a 100 megawatt solar

power plant," he says.

What's more, Taylor adds, graphite nanoparticles "are cheap"—less than $1 per gram—but with 100 grams of nanoparticles providing the same heat-collecting surface area as an entire football field. "It might also be possible to filter out nanoparticles of soot, which have similar absorbing potential, from coal power plants for use in solar systems," he says. "I think that idea is particularly attractive: using a pollutant to harvest clean, green solar energy."

More information: The article, "Applicability of nanofluids in high flux solar collectors" by Robert A. Taylor, Patrick E. Phelan, Todd P. Otanicar, Chad A. Walker, Monica Nguyen, Steven Trimble, and Ravi Prasher, appears in the *Journal of Renewable and Sustainable Energy*.

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