Solar-thermal flat-panels that generate electric power

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(PhysOrg.com) -- High-performance nanotech materials arrayed on a flat panel platform demonstrated seven to eight times higher efficiency than previous solar thermoelectric generators, opening up solar-thermal electric power conversion to a broad range of residential and industrial uses, a team of researchers from Boston College and MIT report in the journal *Nature Materials*.

Two technologies have dominated efforts to harness the power of the sun's energy. Photovoltaics convert sunlight into electric current, while solar-thermal power generation uses sunlight to heat water and produce thermal energy. Photovoltaic cells have been deployed widely as flat panels, while solar-thermal power generation employs sunlight-absorbing surfaces feasible in residential and large-scale industrial settings.

Because of limited material properties, solar thermal devices have heretofore failed to economically generate enough electric power. The team's introduced two innovations: a better light-absorbing surface through enhanced nanostructured thermoelectric materials, which was then placed within an energy-trapping, vacuum-sealed flat panel. Combined, both measures added enhanced electricity-generating capacity to solar-thermal power technology, said Boston College Professor of Physics Zhifeng Ren, a co-author of the paper.

"We have developed a flat panel that is a hybrid capable of generating hot water and electricity in the same system," said Ren. "The ability to generate electricity by improving existing technology at minimal cost makes this type of power generation self-sustaining from a cost standpoint."

Using nanotechnology engineering methods, the team combined high-performance thermoelectric materials and spectrally-selective solar absorbers in a vacuum-sealed chamber to boost conversion efficiency, according to the co-authors, which include MIT's Soderberg Professor of Power Engineering Gang Chen, Boston College and MIT graduate students and researchers at GMZ Energy, a Massachusetts clean energy research company co-founded by Ren and Chen.

The findings open up a promising new approach that has the potential to achieve cost-effective conversion of solar energy into electricity, an advance that should impact the rapidly expanding residential and

industrial clean energy markets, according to Ren.

"Existing solar-thermal technologies do a good job generating hot water. For the new product, this will produce both hot water and electricity," said Ren. "Because of the new ability to generate valuable electricity, the system promises to give users a quicker payback on their investment. This new technology can shorten the payback time by one third."

More information: www.nature.com/nmat/index.html

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