

Flat-pack lens boosts solar power

February 10 2014

Micro-machining could be used to create almost flat, Fresnel lenses, that boost the electrical efficiency of solar panels, according to researchers in China.

Fresnel lenses were invented by French engineer and scientist Augustin-Jean Fresnel, in the early nineteenth century, they are essential twodimensional equivalents of conventional optical lens, but they have ridges in concentric rings that focus the light to a point behind the lens without the three-dimensional bulk of a conventional lens. Image quality is reduced when using a Fresnel lens to focus because the concentric rings which can be used to significantly reduce the depth of the lens compared to a standard convex lens mean that some light is not focused at the gaps between the ridges. This limits the use of Fresnel lenses in photography and other applications where the user does not wish to lose fine detail.

However, where a detailed image is not needed this quality compromise is acceptable especially if the benefits of reduced bulk outweigh the losses. As such, early applications of Fresnel lenses were in providing a lower-cost way of focusing the light from a lighthouse beacon. More recently Fresnel lenses have found use in inexpensive focused rear-view mirrors that allow drivers to see a wider angle view of the rear of their vehicles. Fresnel lenses have also been used in inexpensive handheld magnifiers to assist the visually impaired and for artificially enlarging a display from a television or other device.

In the area of solar panels, researchers have attempted to use bulky and



cumbersome parabolic reflectors to boost efficiency. Now, Y. Cheng, X.D. Zhang and G.X. Zhang of the State Key Laboratory of Precision Measuring Technology & Instruments, at Tianjin University, in China, have developed a technology that allows them to craft the necessary surface structures on a Fresnel <u>lens</u>, an array of microscopic cones, rather than concentric ridges, so that incident light is brought to a point at a more precise depth on the photoactive layer in the panel.

Initial tests with their precision-machined Fresnel solar collector showed that they could obtain a peak power four times that possible with a standard panel at low resistance. The difference in power falls off quickly as the device's resistance rises, which it does as it gets hotter under sunlight and as a byproduct of its generating electricity. Nevertheless, the differential would be enough to boost its electrical output substantially offsetting the additional cost of the Fresnel collector so that the overall cost of solar panels might be reduced. This simple addition to older, less efficient solar panels might also make them viable for places and applications where modern devices of higher intrinsic efficiency are not commercially tenable.

More information: "Design and machining of Fresnel solar concentrator surfaces" in *Int. J. Precision Technology*, 2013, 3, 354-369

Provided by Inderscience Publishers

Citation: Flat-pack lens boosts solar power (2014, February 10) retrieved 22 May 2024 from <u>https://phys.org/news/2014-02-flat-pack-lens-boosts-solar-power.html</u>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.