Solar cell turns windows into generators

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(PhysOrg.com) -- Imagine a world where the windows of high-rise office buildings are powerful energy producers, offering its inhabitants much more than some fresh air, light and a view.

For the past four years a team of researchers from Flinders University has been working to make this dream a reality – and now the notion of solar-powered windows could be coming to a not too distant future near you.

As part of his just-completed PhD, Dr. Mark Bissett from the School of Chemical and Physical Sciences has developed a revolutionary solar cell using carbon nanotubes.

A promising alternative to traditional silicon-based solar cells, carbon nanotubes are cheaper to make and more efficient to use than their energy-sapping, silicon counterparts.

“Solar power is actually the most expensive type of renewable energy – in fact the silicon solar cells we see on peoples’ roofs are very expensive to produce and they also use a lot of electricity to purify,” Dr. Bissett said.

“The overall efficiency of silicon solar cells are about 10 per cent and even when they’re operating at optimal efficiency it could take eight to 15 years to make back the energy that it took to produce them in the first place because they’re produced using fossil fuels,” he said.

Dr. Bissett said the new, low-cost carbon nanotubes are transparent, meaning they can be “sprayed” onto windows without blocking light, and they are also flexible so they can be weaved into a range of materials including fabric – a concept that is already being explored by advertising companies.

While the amount of power generated by solar windows would not be enough to completely offset the energy consumption of a standard office building, Dr. Bissett said they still had many financial and environmental advantages.

“In a new building, or one where the windows are being replaced anyway, adding transparent solar cells to the glass would be a relatively small cost since the cost of the glass, frames and installation would be the same with or without the solar component,” Dr. Bissett said.

“It’s basically like tinting the windows except they’re able to produce electricity, and considering office buildings don’t have a lot of roof space for solar panels it makes sense to utilise the many windows they do

have instead."

Dr. Bissett said the technology mimics photosynthesis, the process whereby plants obtain energy from the sun.

"A solar cell is created by taking two sheets of electrically conductive glass and sandwiching a layer of functionalized single-walled carbon nanotubes between the glass sheets," he said.

"When light shines on the cell, electrons are generated within the carbon nanotubes and these can be used to power electrical devices."

Although small prototypes have been developed in the lab, he said the next step would be to test the carbon cells on an "industrial stage".

If all goes to plan, the material could be on the market within 10 years.

"When we first started the research we had no idea if it would work because we were the first in the world to try it so it's pretty exciting that we've proved the concept, and hopefully it will be commercially available in a few year's time," Dr. Bissett said.

Dr. Bissett is a winner of Flinders inaugural Best Student Paper Award, a now annual program which aims to recognise excellence in student research across the University.

Provided by Flinders University