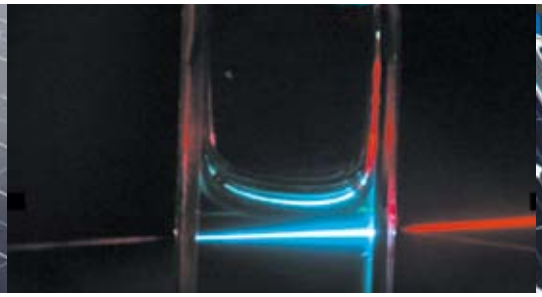
Fact Sheet
Round 2 Project

AUSTRALIAN SOLAR INSTITUTE


Upconversion of the solar spectrum for improved PV energy conversion

SUPPORTING THE UNIVERSITY OF SYDNEY, THE UNIVERSITY OF NEW SOUTH WALES, THE UNIVERSITY OF ADELAIDE, IMPERIAL COLLEGE (UNITED KINGDOM) AND THE HELMHOLTZ CENTRE FOR MATERIALS AND ENERGY (GERMANY)

AT A GLANCE

Grant Recipient
The University of Sydney

ASI Funding
$0.5 million

Total Project Value
$2.1 million

This project aims to overcome the limitations of normal solar cells incapable of using sunlight beyond a certain wavelength. Novel devices will capture this light, and convert it to a usable wavelength to boost the efficiency of solar cells.

This project will lay down the foundations for improving the efficiency of any single threshold solar cell, bringing down the cost of solar energy significantly. The University of Sydney will achieve this by harvesting that part of the solar spectrum currently unused by solar cells, using a process known as upconversion.

All except the most expensive solar cells utilise a material with a single energy threshold which brings about the cell voltage by promoting electrons above this energy upon absorption of light. As a consequence, particles of light (photons) with energy less than this threshold cannot be harvested by the cell. Additionally, energy in excess of this threshold is lost as heat. These two effects conspire to limit the energy conversion efficiency of single threshold solar cells to about 33 per cent under the standard solar spectrum.

This research team will develop a device capable of harvesting low energy photons which can be 'glued' together to make higher energy photons, which can then be reflected back into the cell to be harvested. To achieve this, the project team will develop a solid state upconversion layer to realise a third generation device. In addition, they will also lay the foundations to apply upconversion to the crystalline silicon cells (c-Si) which dominate the photovoltaic market.

The upconvertors at the University of Sydney apply the combination of a sensitiser molecule to absorb the low energy photons and an emitter molecule to re-radiate energy at a shorter wavelength. By designing the molecules to absorb and emit the wavelength of interest, upconvertors can be tailor-made to fit many applications.

> "The project team has shown theoretically that this approach can boost the efficiency limit to over 40% under the standard solar spectrum."
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> *Assoc Prof Tim Schmidt.*

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