Dutch student offers new insights into power-generating windows

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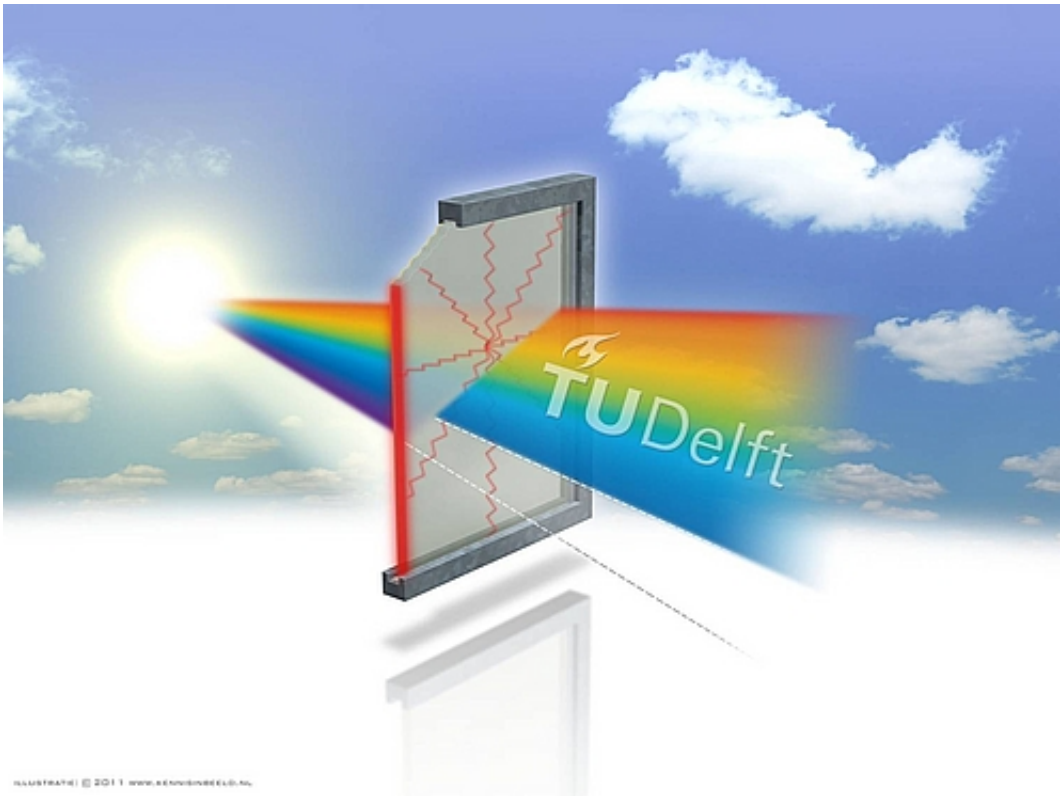

Beeld: Eric Verdult, Kennis in Beeld

On 5 July Jan Willem Wiegman graduated from TU Delft with his research into power-generating windows. The Applied Physics Master's student calculated how much electricity can be generated using so-called luminescent solar concentrators. These are windows which have been fitted with a thin film of material that absorbs sunlight and directs it to

narrow solar cells at the perimeter of the window. Wiegman shows the relationship between the colour of the material used and the maximum amount of power that can be generated. Such power-generating windows offer potential as a cheap source of solar energy. Wiegman's research article, which he wrote together with his supervisor Erik van der Kolk, has been published in the journal *Solar Energy Materials and Solar Cells*.

Windows and glazed facades of office blocks and houses can be used to generate electricity if they are used as luminescent solar concentrators. This entails applying a thin layer (for example a foil or coating) of luminescent material to the windows, with narrow solar cells at the perimeters. The luminescent layer absorbs sunlight and guides it to the solar cells at the perimeter, where it is converted into electricity. This enables a large surface area of sunlight to be concentrated on a narrow strip of solar cells.

The new stained glass

Luminescent solar concentrators are capable of generating dozens of watts per square metre. The exact amount of power produced by the windows depends on the colour and quality of the light-emitting layer and the performance of the solar cells. Wiegman's research shows for the first time the relationship between the colour of the film or coating and the maximum amount of power.

A transparent film produces a maximum of 20 watts per square metre, which is an efficiency of 2%. To power your computer you would need a window measuring 4 square metres. The efficiency increases if the film is able to absorb more light particles. This can be achieved by using a foil that absorbs light particles from a certain part of the solar spectrum. A foil that mainly absorbs the blue, violet and green light particles will give the window a red colour. Another option is to use a foil that absorbs all the colours of the solar spectrum equally. This would give the window

a grey tint. Both the red and the grey film have an efficiency of 9%, which is comparable to the efficiency of flexible solar cells.

Wiegman's research has also shown the importance of a smooth film surface for the efficient transport of light particles to the perimeter of the window as they are then not impeded by scattering between the film and the window surface.

The research into power-generating windows is in keeping with the European ambition to make buildings as energy neutral as possible. Luminescent solar concentrators are a good way of producing cheap solar energy.

More information: Publication: "Building integrated thin film luminescent solar concentrators", Solar Energy Materials and Solar Cells, Volume 103, August 2012, pages 41–47.

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