Solar-powered hydrogen production with improved efficiency

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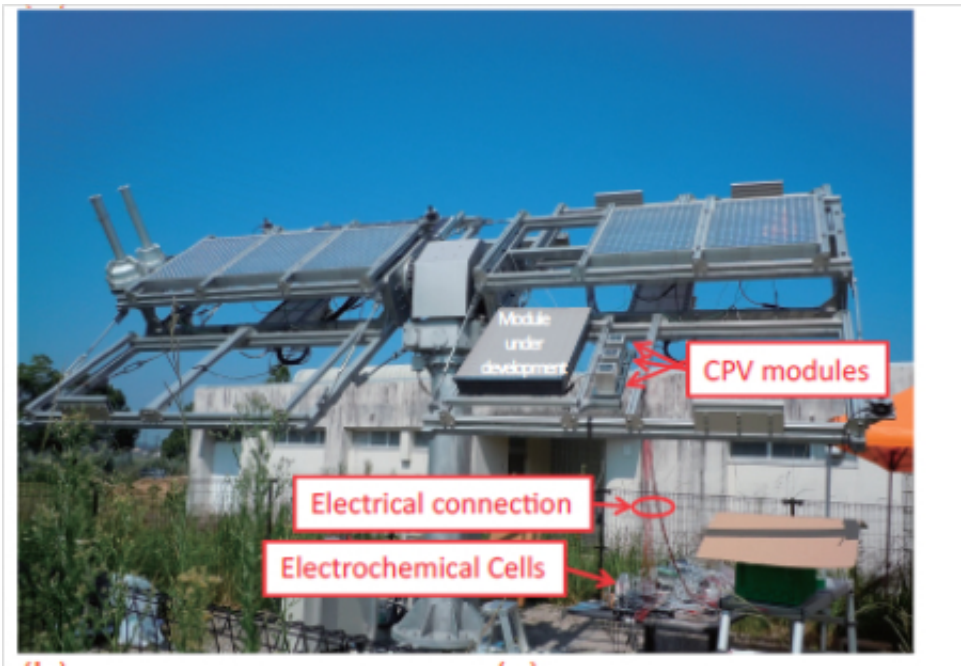

Researchers in Japan have developed an efficient way of splitting water to produce hydrogen using energy from the sun. Their technique uses a combination of concentrated photovoltaic modules with electrochemical cells, and achieves a hydrogen production efficiency of 24.4%, the highest solar-to-hydrogen efficiency yet recorded.

Hydrogen could potentially provide a readily available, clean form of energy derived from solar power. To achieve this, scientists need to find a highly efficient, low-cost way of splitting water into its constituent parts of oxygen and hydrogen using the energy from the sun.

Now, Masakazu Sugiyama, Katsushi Fujii and colleagues at the University of Tokyo, together with co-workers at the University of Miyazaki, Japan, have found a way to produce hydrogen at the highest efficiency yet, using a combination of concentrator photovoltaic (CPV) modules and electrochemical (EC) cells.

CPV technology generates electricity by using mirrors or lenses to focus an intense beam of sunlight onto tiny but highly efficient solar cells. The researchers used the most efficient CPV modules currently available, with an efficiency of around 31%. They used a InGaP/GaAs/Ge three-junction solar cell at the sunlight focus point inside the CPV. The EC cells, which provide the means for splitting water, were then connected in series to the CPV modules using copper wires.

The team placed their combined device outdoors, and fed pure water into the EC cells. They found that their device was able to produce hydrogen at an efficiency of 24.4% – the highest level of solar-to-hydrogen efficiency yet achieved. Sugiyama and Fujii believe the direct connection between the high efficiency CPV modules and EC cells optimized the energy transfer from sunlight to hydrogen, and that further improvements of both components and their connecting parts will enhance the efficiency still further.

The team are convinced that combining CPV modules with EC cells in this way is a realistic method of generating renewable hydrogen.

More information: Akihiro Nakamura et al. A 24.4% solar to hydrogen energy conversion efficiency by combining concentrator photovoltaic modules and electrochemical cells, *Applied Physics Express* (2015). DOI: 10.7567/APEX.8.107101

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