Hydrogen power moves a step closer

September 14 2017

Fossil fuels accounted for almost 90 percent of energy consumption in 2015. Credit: Lancaster University

Physicists at Lancaster University are developing methods of creating renewable fuel from water using quantum technology.

Renewable hydrogen can already be produced by photoelectrolysis

where solar power is used to split water molecules into oxygen and hydrogen.

But, despite significant research effort over the past four decades, fundamental problems remain before this can be adopted commercially due to inefficiency and lack of cost-effectiveness.

Dr Manus Hayne from the Department of Physics said: "For research to progress, innovation in both materials development and device design is clearly needed."

The Lancaster study, which formed part of the PhD research of Dr Sam Harrison, and is published in *Scientific Reports*, provides the basis for further experimental work into the solar production of hydrogen as a renewable fuel.

It demonstrates that the novel use of nanostructures could increase the maximum photovoltage generated in a photoelectrochemical cell, increasing the productivity of splitting water molecules.

Dr Hayne said: "To the authors' best knowledge, this system has never been investigated either theoretically or experimentally, and there is huge scope for further work to expand upon the results presented here."

Fossil fuels accounted for almost 90% of energy consumption in 2015, with absolute demand still increasing due to a growing global population and increasing industrialisation.

Dr Manus Hayne said: "Fossil-fuel combustion releases carbon dioxide into the atmosphere, causing global climate change, and there is only a finite amount of them available for extraction. We clearly need to transition to a renewable and low-greenhouse-gas energy infrastructure, and renewable hydrogen is expected to play an important role."

Photovoltaic solar cells are currently used to convert sunlight directly into electricity but solar hydrogen has the advantage that it is easily stored, so it can be used as and when needed.

Hydrogen is also very flexible, making it highly advantageous for remote communities. It can be converted to electricity in a fuel cell, or burnt in a boiler or cooker just like natural gas. It can even be used to fuel aircraft.

More information: S. Harrison et al, Photoelectrolysis Using Type-II Semiconductor Heterojunctions, *Scientific Reports* (2017). DOI: 10.1038/s41598-017-11971-x

Provided by Lancaster University