European Commission

ARTIFICIAL PHOTOSYNTHESIS: FUEL FROM THE SUN

EIC HORIZON prize

PRIZE FINALIST

5 December 2022

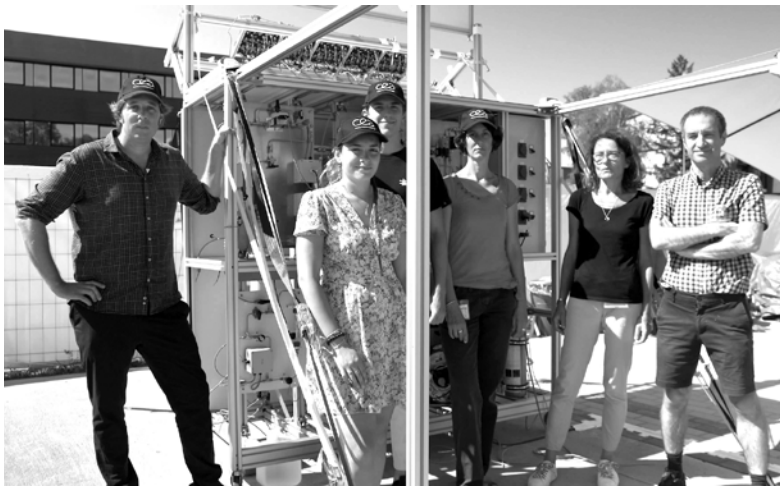
Commissariat à l'énergie atomique et aux énergies alternatives (CEA)

The EIC Horizon Prize **'Fuels from the Sun: Artificial Photosynthesis'** promotes new direct solar conversion technologies that deliver green fuels as a sustainable alternative to fossil energy as well as feedstocks for a range of industrial processes.

On 5 December 2022, during the Award Ceremony of the Prize, the finalist **'Commissariat à l'énergie atomique et aux énergies alternatives (CEA)'** was acknowledged for the achievements of their prototype **'European Autonomous Solar Integrated fuel station (EASI-Fuel)'**. Notably, their invention was innovative because of the high standard of device integration of the processes.

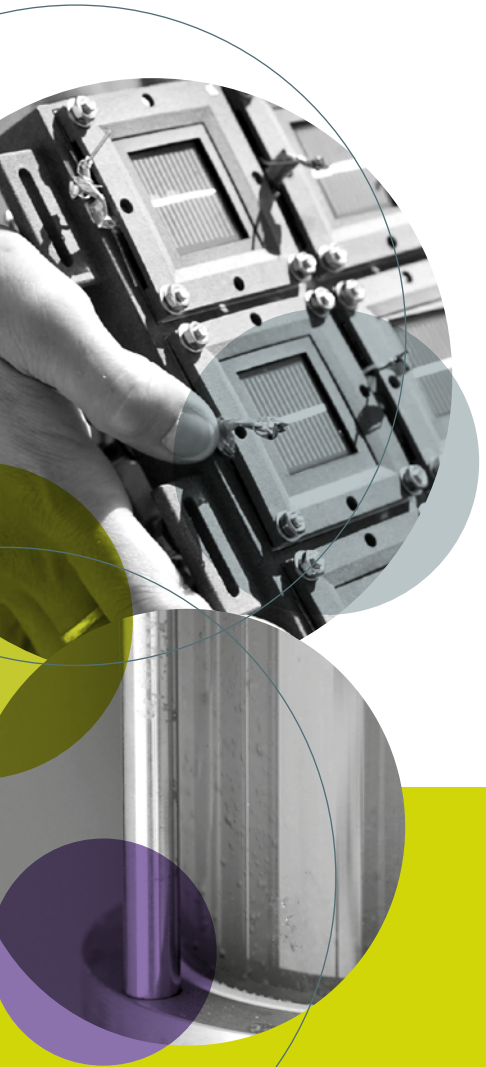
A fully functioning prototype to convert sunlight into green fuel

The European Autonomous Solar Integrated fuel station (EASI Fuel) converts CO_2 into methane - a fuel with high calorific value - by using micro-organisms. It couples this bioreactor to a series of integrated photo-electrochemical cells (IPEC) which continuously supply hydrogen via electrolysis of water. Each IPEC integrates a state-of-the-art tandem solar cell. The key feature of EASI-Fuel prototype is the enhanced integration between the different processes in the device. This enables the continuous, selective and almost total conversion of CO_2 into methane without the need for intermediate hydrogen and energy storage.



Accelerating the Clean Energy Transition

The concept developed in EASI Fuel is particularly interesting for the upgrading of biogas, a mixture of CO_2 and the green fuel methane, which are produced through the anaerobic digestion of organic biomass. Methane production could be increased by up to 50%, and CO_2 emissions completely transformed, in a plant equipped with EASI-Fuel technology, with the sole addition of water and sunshine and at minimal energy cost.



How will this solution inspire other researchers and innovators?

The Horizon Prize experience was a unique opportunity for researchers and engineers from different and generally disconnected fields of research to pool their expertise for the development, integration and testing of a demonstrator in real conditions. This transdisciplinary project allowed all participants to enrich and enhance their knowledge thanks to a broader and more global approach and it was also a great way of improving skills in the challenging area of solar fuels production and a real source of innovation.

There is no doubt that this experience will open up new perspectives for innovation and collaboration to quickly decarbonise our society.

BACKGROUND:

The **Horizon Prize 'Fuel from the Sun: Artificial Photosynthesis'** was launched in December 2017 as one of six European Innovation Council (EIC) Horizon Prizes and is also a European Union contribution to the activities under the Mission Innovation Challenge 'Converting Sunlight to fuels and chemicals'. The prize was open to the world, as it presents a good example of how the solutions of global challenges can be addressed by supporting the international research and innovation efforts in this area.

The prize rewarded the successful development of a fully functional, bench-scale prototype device of an artificial photosynthesis synthetic fuel production system, integrating the whole artificial photosynthesis process from light capture to fuel production that generates a fuel capable of powering a small engine.

Achieving the prize aim and objective takes current research out of the laboratory and into the realms of an engineering challenge, with a view to accelerating research and innovation in the field. Artificial photosynthesis is considered one of the most promising breakthrough technologies in the field due to its ability to use a combination of sunlight, water and carbon from the air to capture and store solar energy in an efficient and transportable form.

Publications Office
of the European Union

ISBN 978-92-76-59152-8, doi:10.2777/18380, KI-04-22-205-EN-N