



ARTIFICIAL
PHOTOSYNTHESIS:
FUEL FROM THE SUN

EIC HORIZON
prize

PRIZE WINNER

5 December 2022

University of Tokyo and INPEX Corporation

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 the €5 million Prize was awarded to the **University of Tokyo** and **INPEX corporation** for their prototype **'Artificial Photosynthesis Driven by Water-Splitting Particulate Photocatalyst (UTIAPS)'**. The prize was awarded to the winning team for the high degree of professional engineering and integration, resulting in a working prototype that produced a synthetic fuel, which in turn was able to fuel a Sterling motor.

A fully functioning prototype to convert sunlight into green fuel

The winning device represents a world-first innovative artificial photosynthesis system. The device splits water into hydrogen and oxygen by using fine photocatalyst particles and without external input, apart from sunlight energy. The purified hydrogen and carbon dioxide are then converted into methane. These technologies were designed and developed for high efficiency, energy-saving and safe automatic operation.



Accelerating the Clean Energy Transition

The aim of this research is to produce green fuel and to achieve the development of improved devices, as well as the means to achieve energy-, cost- and CO₂-savings and the means to simplify splitting water into hydrogen and oxygen. Elementary devices will thus seamlessly work together for huge-scale, safety-ensured operation. This way green fuels will be produced at a competitive cost compared to fossil fuels. This strategy will accelerate the world-wide clean energy transition.

How will this solution inspire other researchers and innovators?

The prototype was constructed on the novel foundation of a particulate photocatalyst that enables artificial photosynthesis for green fuel production. The key technological developments in this new system involve efficient photocatalytic powder, gas separation devices, green fuel synthesis reactors, storage systems, and equipment for safety. However, plenty of scientific and practical subjects remain for research on a world-wide basis. A wide range of scientists and professionals in chemistry, chemical engineering, and the energy sector will be stimulated and inspired to work with technological elements for highly cost-effective and large-scale systems.

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.