

FAQ: Sun-to-Liquid

How much kerosene can be produced per hour or per day?

So far, only small amounts of kerosene have been produced (less than one litre). The Sun-to-Liquid facility has just started producing kerosene as an end product using synthesis gas, also referred to as syngas. Prior to that, the tests concentrated on producing the gaseous precursor product – syngas. Over the coming weeks, the focus of the work will shift to processing the gas into liquid products, including kerosene. It is not yet possible to predict maximum production volumes.

There are no quantitative objectives regarding the target quantity set out in the project description.

How efficient is the system?

We currently estimate the efficiency of the solar reactor to be approximately five percent. We are looking to increase this to more than 10 percent by the end of the project. An increase to 20 percent is planned for the future. The efficiency of the entire chain would then be approximately four to five percent.

Is such a system realistic? When can we expect large amounts of kerosene to start being produced?

“We think that it will be possible to build an industrial-scale SUN-to-LIQUID solar plant within 10–15 years,” says Professor Christian Sattler of DLR.

How large are the areas that need to be developed?

A commercial plant covering 38 square kilometres could produce 300,000 litres of fuel per day. That corresponds to almost 30,000 litres per year for each hectare of land.

What is the cost per litre for the production of kerosene?

According to a study by Bauhaus Luftfahrt e.V., such a plant could produce one litre of solar kerosene at a cost of 2.23 euro. Under the most favourable conditions it could even be produced at 1.28 euro per litre. (Link to the study: <https://pubs.acs.org/doi/10.1021/acs.est.5b03515>)

Are there any plans for specific plants, and if so, in which countries and deserts will they be located?

No, not yet.

How does the production process differ from that of 'green hydrogen'? Why are we mentioning kerosene?

The extraction of 'green' – in other words, solar thermal – hydrogen is actually very similar, but different precursor products are used.

Water is the precursor product for hydrogen. Water and carbon dioxide are the precursor products for kerosene and other liquid fuels.

Hydrogen is a potential fuel for many vehicles, but in the aviation sector the prevailing view is that, in future, aviation fuel (in other words, kerosene) will continue to be needed in order to provide the necessary power density. In the future, however, this kerosene will not come from fossil sources, but rather from water, carbon dioxide and renewable energy.

What is going to happen at the plant in future? Is there a follow-up project?

A long-duration test is currently being conducted to determine whether the process is stable over the longer term. The work is due to be continued in a follow-up project.

What will be the subject of this further research?

How to improve the process, how to improve the structure of the redox material, and how to achieve more precise and stable focusing of sunlight. The work is aimed at improving efficiency and reducing costs.

When do you expect aircraft to be able to fly using solar kerosene?

If we have a commercial facility within 10–15 years, we will also be able to use it for aviation. Producing the kerosene is the challenge, rather than finding an application for it.

Links

- ◆ Project website: <https://www.sun-to-liquid.eu/>
- ◆ Flyer for the SUN-to-LIQUID facility: https://www.sun-to-liquid.eu/media/articles/files/S2L_Flyer_read_version_28032018.pdf

Scientific paper by Bauhaus Luftfahrt:

- ◆ Water Footprint and Land Requirement of Solar Thermochemical Jet-Fuel Production/Christoph Falter and Robert Pitz-Paal: <https://pubs.acs.org/doi/abs/10.1021/acs.est.7b02633>
- ◆ Climate Impact and Economic Feasibility of Solar Thermochemical Jet Fuel Production, Christoph Falter,* Valentin Batteiger and Andreas Sizmann, Bauhaus Luftfahrt e.V., Willy-Messerschmitt-Strasse 1, 85521 Ottobrunn, Germany: <https://pubs.acs.org/doi/10.1021/acs.est.5b03515>

Interview with Christian Sattler (DLR) on Germany radio:

<https://www.deutschlandfunknova.de/beitrag/kerosin-aus-der-sonne-alternativer-klimaneutraler-treibstoff>