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EUROPE'S TECHNOLOGY INDUSTRIES

Synhelion

TECHNOLOGY IN ACTION

Using solar heat to produce sustainable fuel

Orgalim's Technology in Action series showcases how the technology industries we represent are shaping a future that's good for Europe's economy and society – and how the right policy framework can help them do even more.

Challenge

The decarbonisation of the transport sector, which is responsible for 27% of total greenhouse gas emissions in the EU, needs to accelerate. Aviation is not the biggest contributor (road transport is) but it is a rapidly growing one, and particularly difficult to decarbonise, especially long-haul flights.

Flights of over 1,500 kms account for around 80% of aviation CO2 emissions and electrification of this long-haul aviation is currently not an option because the batteries needed would be too heavy.[1] Hydrogen technology is a promising alternative, but it requires designing aircraft differently.

The strategy that holds the most promise for reducing emissions in the short to medium term is scaling up the use of sustainable aviation fuels, or SAF. SAF is a drop-in technology that is compatible with conventional jet engines and infrastructure for storage and refuelling.

The challenge is to rapidly improve the availability and affordability of SAF to increase its uptake. Currently SAF costs more than double conventional jet kerosene and its use is estimated at less than 0.1% of EU jet fuel consumption. The EU regulation on ensuring a level playing field for sustainable air transport aims to mandate at least 2% SAF in aviation fuel by 2025 and 5% by 2030, gradually increasing to 63% in 2050.[2]

Solution

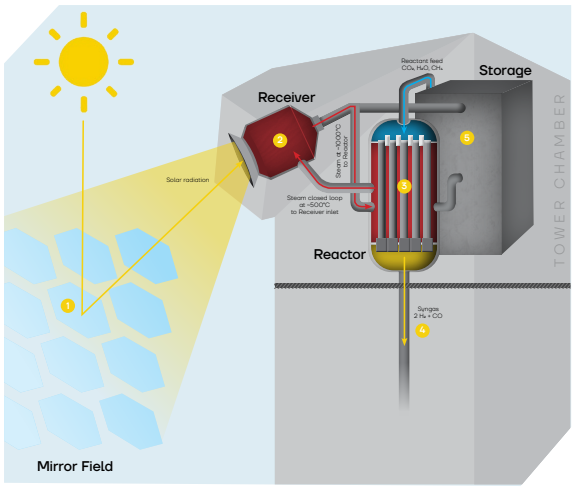
Swiss clean energy company Synhelion has successfully scaled up a unique solar thermal process to produce sustainable fuel using only solar heat as an energy source. It is now building its first industrial plant in Germany which will be commissioned in 2023. The first commercial plant is planned for 2025 in Spain.

As Philipp Furler, CEO and Co-Founder of Synhelion, explains: "We have based our technology on solar heat because the sun is the most abundant, most distributed, and cheapest renewable energy source. Thanks to our thermal energy storage, we can produce fuels around the clock. Our solar fuel

> "Our solar fuel plants don't compete with agricultural demand for arable land and work independently from the electrical grid.

Philipp Furler, CEO & Co-Founder, Synhelion

[1] ATAG facts & figures
[2] EU regulation on ensuring a level playing field for sustainable air transport



Synhelion's solar fuel technology: how it works

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The company aims to produce 875 million litres of fuel per year using this Sun-to-X process within the next ten years – equivalent to half of Switzerland's annual aviation fuel needs – and to produce enough to cover half of the European jet fuel demand by 2040. It is targeting a production cost below €1 per litre by 2030, competitive with other sustainable fuel technologies and ultimately with fossil fuel pricing.

How does it work? Essentially by reversing the combustion process. A field of mirrors reflects solar radiation onto a receiver at the top of a tower, where it is converted into high-temperature process heat in excess of 1.500°C. This heat drives a thermochemical reaction to convert water, methane and CO_2 into syngas which can then be made into synthetic fuel using existing technology. Excess heat can be stored during the sunny hours to power the process round the clock.

The CO_2 and methane currently come from biowaste from the paper industry, but the CO_2 can also be obtained through direct air capture or recycled from industrial processes. Indeed, Synhelion is collaborating with CEMEX on the prospect of capturing CO_2 from cement production, which gives off CO_2 in the process of calcination of limestone. Therefore, a solar fuel production plant could theoretically be located next to a cement plant and recycle its CO_2 emissions.

Policy implications

Synhelion sees conditions improving for its technology roll-out and scale-up, with the necessary funds becoming ever more available. It counts SWISS, ENI, Cemex, SMS group, AMAG Group and other among its investors.

But, says Mr Furler, to establish a market for synthetic fuels, governments must set the right incentives. The EU's ReFuelEU Aviation package will accelerate the demand in the future and defining binding, increasing quotas for the use of SAF is definitely the right way to go, he says. This quota should include a sub-quota for e-fuels and solar fuels and not just for biofuels.

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About Synhelion

Synhelion

Based in Lugano, Switzerland, Synhelion is a global pioneer in the field of carbon-neutral solar fuels. The company spun off from the Swiss Federal Institute of Technology (ETH Zurich) in 2016 to decarbonise the transportation sector. Industrial solar fuel production will start in Germany in 2023/2024 and the first commercial production facility is planned for commissioning in Spain by 2025. Synhelion sustainably generates high-temperature process heat beyond 1'500°C with solar radiation. This makes it possible to drive industrial processes such as fuel production and cement manufacturing with solar heat for the first time.

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