PHOTOFUEL

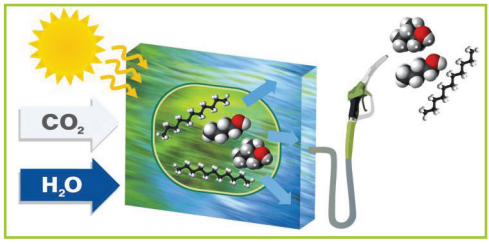
Biocatalytic solar fuels for sustainable mobility in Europe

MOTIVATION AND OBJECTIVES

The motivation is to promote the development of high quality, low impact transportation fuels. The challenge is to advance the base technology of microalgae cultivation in closed bioreactors by enabling phototrophic algae or cyanobacterial microorganisms to produce alkanes and alcohols, which are excreted to the culture broth for direct separation without cell harvesting. This thereby turns the microbial cells into self-reproducing biocatalysts allowing the process to directly convert solar energy, water and CO_2 into engine-ready fuel instead of being used to form biomass, as shown in the figure.

Objectives are:

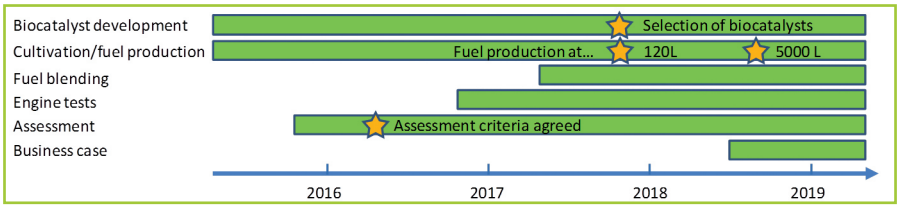
- Development of advanced biocatalysts for the direct production of solar fuels.
- Upscaling of cultivation volume and raw fuel production.
- Upgrading/purification to fuel for blending and engine tests.
- Analysis of risks, economics and environmental impact of the pathway.



Schematic representation of the Photofuel process.

PROJECT PLAN, MILESTONES AND DELIVERABLES

The final goal is to advance the solar fuel technology towards highly sustainable production of drop-in fuels on arid or marginal land. Economically and environmentally sustainable large-scale systems for geographically independent conversion of solar radiation into chemical energy would support rural communities and substitute significant shares of fossil energy for the benefit of Europe and many other regions.



TECHNICAL APPROACH

WP2 Biocatalyst development on base of two cyanobacterial strains and one microalgae. Targeted fuel compounds are butanol, medium chain alcohols and alkanes, sesquiterpenes. The best performing strain(s) are selected by the PHOTOFUEL consortium and jointly improved in the last 18 months of the project.

WP3 upscales cultivation volumes and assesses the biocatalyst. The final volume is 5m³ for outdoor production of fuel compounds. A control strategy and fuel separation process is developed. Options to recycle water, nutrients and energy as well as sanitation are studied.

WP4 analyses and upgrades the crude biocatalyst products from WP 3. These are blended with fossil fuels and other biofuels to on-spec, engine-ready solar diesel and gasoline fuels.

WP5 studies the engine performance of solar fuel blends, prepared in WP 4 according to expectations of both WP on the composition of fuels in the future. Tests are performed in gasoline- and diesel engines of the EURO6 norm, representing passenger vehicles and trucks.

WP6 assesses the techno-economic risks, economical performance and environmental impacts of the PHOTOFUEL pathway for comparison to other existing or developing processes for the production of fossil and renewable fuels.

WP7 summarises the project results for the preparation of a business development plan.

WP1 disseminates the project results in press, on conferences and workshops and includes project management and administration.

ACHIEVEMENTS

A biocatalytic pathway to solar transportation fuels ready for pilot scale application.

Budget	6 M€	**Funding**	6 M€
Duration	48 months	**Start**	May 2015
DG	Research & Innovation	**Contract n°**	640720
Coordinator	Hilke Heinke, Volkswagen AG	**Contact**	hilke.heinke@volkswagen.de
Partners	VW, CRF, Volvo, IFPEN, UU, UniBi, Imperial, UniFi, A4F, Neste, KIT, SYNCOM		
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