2synfuel Newsletter

Turning sewage sludge into fuels and hydrogen

Issue 5 / April 2022

The TO-SYN-FUEL consortium is delighted to introduce its fifth newsletter edition

This newsletter reports the latest news and developments of the project that have occurred up to March 2022 and that will be presented at the EUBCE 2022.
The H2020 To-Syn-Fuel project will demonstrate a new integrated process combining thermo-catalytic reforming (TCR®), with hydrogen separation through pressure swing adsorption (PSA), and hydrodeoxygenation (HDO), to produce a fully equivalent gasoline and diesel substitute. This technology promoted by To-Syn-Fuel will contribute to decarbonize the transport sector.

Contents

1. Demonstration Days of the integrated plant

The current phase of the To-Syn-Fuel project is the integrated operation of the systems and production of liquid fuels and green hydrogen from sewage sludge.
The first testing campaigns with TCR® have shown a very satisfying performance. Within over 500 operation hours more than 200 tonnes of dried sewage sludge have been converted into 20,000+ litres of TCR®-oil. The yield and the quality of the products achieved are within expectations (November 2021).

Within the last step of the project, further campaigns are planned to process 12 tonnes of dried sludge per day and to gain more long-term experience with the technology. Alongside the production of the fuel, comprehensive engine tests will be performed to evaluate if these drop-in fuels have comparable engine performance and emissions to fossil-derived fuels.
Within the To-Syn-Fuel project, plant Demonstration Days are foreseen as the perfect environment to enable efficient matching of new ideas with the necessary expertise.
The first plant Demonstration Day was held in Hohenburg, Germany, on the 22nd of September 2021 and it was hosted by Fraunhofer UMSICHT.
The event was held via an online platform, where presenters and attendees were able to join virtually, and where the plant site visit was streamed live.
The second project plant Demonstration Day is planned as a virtual event in order to give a live demonstration of the working plant, also presenting feedstock and main products.

Complete process chain of To-Syn-Fuel-demonstrator: Hydrotreatment. PSA. Product gas train. TCR Auger reactor + Post reformer.
Credits: Fraunhofer UMSICHT

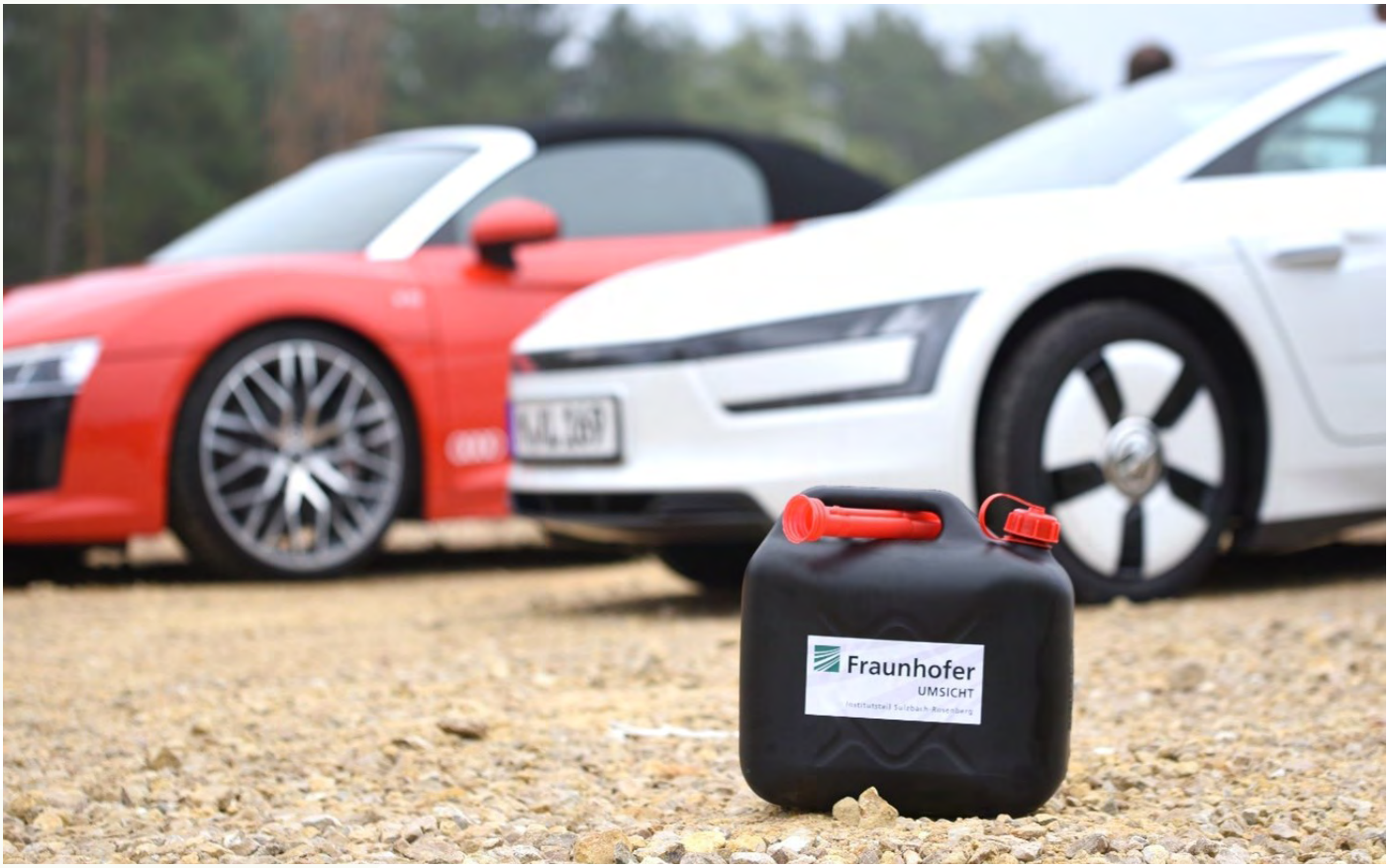
2. Biofuels production and testing

Concerning the overall efficiency of the plant, it is known from pre-tests of small-scale experiments that up to 90% of the energy can be transferred from the feedstock to the products, and that around 10% of energy from feedstock is needed as heating energy. Specifically, the liquid bio-oil produced by TCR® has a high heating value (LHV: ≈35 MJ/kg).
The bio-oil is also thermally stable, with a low water and oxygen content, and it therefore represents an excellent precursor for hydrotreatment. In fact, due to the hydrotreatment process, the TCR®-oil is upgraded using the hydrogen from the plant process. This leads to a high-quality product: hydrotreated TCR® bio-oil (HBO).

The HBO has an LHV of >42 MJ/kg, a H/C ration of around 2,05 and can be separated by distillation into Diesel fraction and Naphtha fraction. The Diesel fraction can directly reach the EN590 for Diesel fuel and the Naphtha fraction is comparable with raw gasoline in the refinery process.
Current project activities comprise of the distillation of the upgraded TCR®-oil to produce gasoline and diesel fractions that will be tested through performance, combustion and emission characteristics. Testing will also evaluate suitability of this oil for blending with conventional fossil fuels.

‘A promotional Car Tour across Europe will also promote the importance of advanced biofuels’

A promotional Car Tour across Europe is planned for September 2022, stopping in key locations around Europe to publicise the technology. This initiative will also promote the importance of advanced biofuels as critical contributors to greener transport and the needs for a “solutions mix”, by engaging with industry and influencers to increase such awareness.



The TCR® fuel complies with standards and can be used in diesel and gasoline engines without modification.
Credits: Fraunhofer UMSICHT

3. Project deliverables

Ten public reports have been produced so far in the project framework.

The full list of To-Syn-Fuel deliverables can be retrieved in the Docs section of the project website, as well as on CORDIS Results section.

D2.1 Feedstock composition and mass/energy balance
This report describes the result of the feedstock characterisation campaign intended for use in the TCR®, which have been used for further specification of the HDO and PSA unit operations. Hence the first set of heat and mass balance data for the integrated plant are presented.

D2.7 Fully assembled and integrated plant
The assembly of the overall To-Syn-Fuel demonstration unit is illustrated here, including all the components and utilities, the supporting equipment and their connection.

D5.1 Description of consumer perceptions towards synthetic fuel products
This report presents the results of the research study that was conducted to gain a better understanding of public perceptions about production and consumption of synthetic fuel products.

D6.1 State of the art LCA model for TCR® application
The state of the art of LCA approaches applied to biorefinery systems and to the main products and co-products related to the TCR® is established. Additional information is provided on current use of digestate and sewage sludge and on LCA approaches applied to the study of these applications.

D6.2 Definition of scope of sustainability metrics
In this deliverable, the system boundaries and functional unit of the TCR/PSA/HDO system are determined. Alternative scenarios are identified in order to compare their environmental impact with those of TCR/PSA/HDO system.

D6.4 Map of scenarios for alternative use of feedstocks
The report maps and describes the processes included in the system boundaries of the alternative scenarios of feedstocks use, which will be compared to TCR/PSA/HDO integrated system in order to evaluate their environmental sustainability.

D8.4 Catalogue of Regulatory Issues
Which fulfilments are expected for a To-Syn-Fuel installation? Which permitting routes are required as for authorisations and permits? The catalogue addresses the EU environmental law and regulation concerning To-Syn-Fuel technology and installations, encompassing principles, key provisions and permitting routes.

D9.2 Branding material
The project Visual Identity and its set of branding materials to maximize impact and engage with the general public. Project communication and dissemination material, including the project logo, are addressed.

D9.3 Website and social media feeds online
To-Syn-Fuel media presence and engagement is ensured by its website and social channels, the most powerful online platforms to communicate and disseminate activities and results.

D9.5 Hosted To-Syn-Fuel demonstration days
This is a detailed report of the To-Syn-Fuel Plant 1st Demonstration Day, held in pilot site of Hohenburg (Germany) and streamed online in September 2022. It includes a description of the event organization and promotion activities and the highlights of the event.

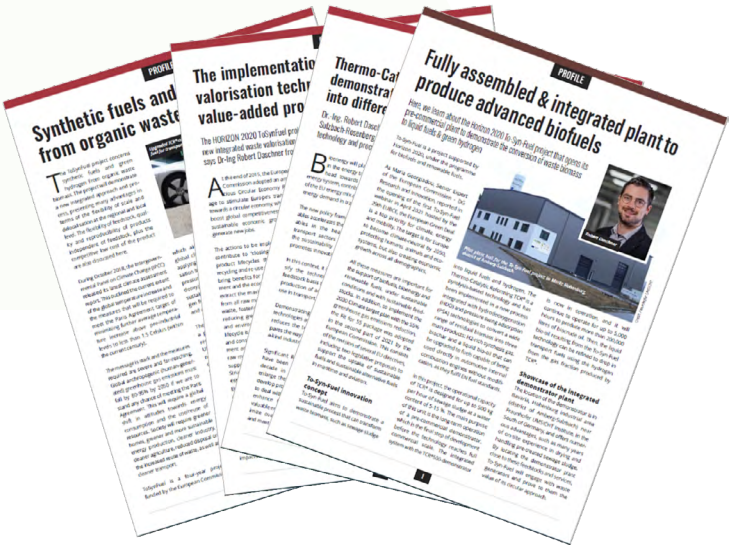
Sample of dried sewage sludge and TCR Auger reactor + Post reformer.
Credit: To-Syn-Fuel project

4. New article on Open Access Government

An article entitled "Fully assembled & integrated plant to produce advanced biofuels" has been published on the latest issue of Open Access Government (April 2022), a digital publication providing an in-depth perspective on key public policy areas from all around the world.

The article focuses on the current phase of the To-Syn-Fuel project describing the integrated operation of the demonstrator plant, its systems and the production of liquid fuels and green hydrogen from sewage sludge.

Read it



Four published articles on To-Syn-Fuel.
Credits: Open Access Government

Other articles published by To-Syn-Fuel on previous issues of Open Access Government:

- Thermo-Catalytic Reforming (TCR®) in demonstration scale to convert biogenic residues into different products for a low carbon economy, January 2020, n. 25 (pp. 306-307)

- The implementation of a green waste valorisation technology to produce value-added products from sewage sludge, April 2019, n. 22 (pp. 388-389)

- Synthetic fuels and green hydrogen from organic waste biomass, January 2019, n. 21 (p. 252)

5. To-Syn-Fuel at EUBCE 2022

For the fourth time over five years, the To-Syn-Fuel project is attending the **European Biomass Conference and Exhibition (EUBCE)** in May 2022. In this year's virtual edition, the project's results and activities will be illustrated in **two oral presentations**:

- "To-Syn-Fuel - The Demonstration of Waste Biomass to Synthetic Fuels and Green Hydrogen", given by Robert Daschner (Fraunhofer UMSICHT, Project Coordinator) on Wednesday 11 May;

- "Evaluating the Environmental Sustainability of a Commercial TCR/PSA/HDO Integrated System for the Conversion of Municipal Sewage Sludge into Value-Added Products in the Bioenergy Sector", given by Virginia Lama (UniBo) on Thursday 12 May.

A project workshop on the process technologies is being organized on the third day of the Conference, Wednesday 11 May. For more details about this workshop, keep informed at EUBCE 2022 website.

The Scientific Programme of the EUBCE includes several other presentations and sessions dedicated to conversion processes and technologies for advanced biofuels production.

EUBCE 30th

EUBCE 2022
30th European Biomass Conference & Exhibition
9 – 12 May 2022, online
eubce.com

Oral presentations:

To-Syn-Fuel - The Demonstration of Waste Biomass to Synthetic Fuels and Green Hydrogen
Session code: 5CO.13

Evaluating the Environmental Sustainability of a Commercial TCR/PSA/HDO Integrated System for the Conversion of Municipal Sewage Sludge into Value-Added Products in the Bioenergy Sector
Session code: 2DO.5

Other upcoming events:

RRB 2022
RENEWABLE RESOURCES & BIOREFINERIES

Renewable Resources & Biorefineries Conference – RRB 2022

Thursday 2 June

Session 5C
Horizon 2020/Horizon Europe

Sustainable fuels made from biobased residues – Demonstration on long-term operating plant
Jan Grunwald, Fraunhofer UMSICHT, DE

6. Clustering Biofuel projects

To-Syn-Fuel activities were illustrated by project representatives during the 5th Horizon Biofuels workshop organized by CINEA on 14-15 of October 2021. Many other EU projects on bioenergy and biofuels were presented during this virtual meeting outlining their objectives, available results and planned actions. Among these, there were Phy2Climate and GreenFlexJET, which share with the To-Syn-Fuel project the application of TCR® technology to produce renewable fuels from biogenic residues.

Phy2Climate

Phy2Climate is consists of 16 partners from 9 countries aiming to combine soil remediation solutions and clean biofuel production from contaminated sites. The method using specific crops and their associated microbes to remediate soils in a period of approximately 20 years is known as phytoremediation. Crops grown on pilot sites in different regions of Europe and South America will be tested as feedstock for biomass conversion through TCR® to produce advanced biofuels for road and shipping transport, as well as bio-coke for the metallurgical industry.

green FLEXJET PROJECT

GreenFlexJET project uses a diverse range of organic waste feedstocks for sustainable aviation fuel (SAF) production. Its innovative process combines Sustainable Aviation through Biofuel Refining (SABR) technology for the refining of biodiesel from organic waste fats with the Thermo-Catalytic Reforming (TCR®) technology for the production of biocrude oil from organic solid waste.
The GreenFlexJET project delivers a blueprint for the production and distribution of this novel SAF technology.

This Horizon Biofuels workshop was a very successful event that fostered synergies, and can help pushing the adoption of biofuels production technologies. In this context, European policy-near actions such as SET4BIO were presented.

SET4BIO

SET4BIO project aims at supporting the implementation of the SET Plan Action 8 – Renewable Fuels and Bioenergy. The objective is making a step change in the build-up of a cost-competitive bioenergy and renewable fuels market in Europe and globally, by bringing together private and public actors in a joint effort to mobilize the resources and to stimulate the investments.

‘This Horizon Biofuels workshop was a very successful event that fostered synergies’

Pilot plant for the To-Syn-Fuel project in Markt Hohenburg, district of Amberg-Sulzbach.
Credit: Fraunhofer UMSICHT

About the project

The consortium with 11 partner organisations has brought together some of the leading researchers, industrial technology providers and renewable energy experts from across Europe, in a collaborative, committed and dedicated research effort to deliver the overarching ambition. Partners include: Engie Services Netherlands NV, HyGear Technology and Services BV (The Netherlands), Fraunhofer UMSICHT, Verfahrenstechnik Schwedt GmbH, Martech GmbH (Germany), Alma Mater Studiorum – University of Bologna, Eni SpA, ETA–Florence Renewable Energies (Italy), University of Birmingham, WRG Europe Ltd (UK) and LEITAT (Spain). The project has a total duration of 65 months from May 2017 to September 2022 and will be funded by the European Union under the Horizon 2020 programme.

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Disclaimer

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