Biorefinery combining HTL and FT to convert wet and solid organic, industrial wastes into 2nd generation biofuels with highest efficiency

NEWSLETTER

Heat to Fuel

October, 2020 - Third Issue

INSIDE

STATUS OF HEAT-TO-FUEL

Heat-to-Fuel is advancing quite well, despite some delays due to the COVID-19 pandemic crisis, which has affected us all, the Consortium has made a risk assessment and has taken measures in place to overcome the difficulties, making sure that the project progresses according to the work plan.

This past year Heat-to-Fuel partners have made a great contribution to the creation of knowledge in the biofuel production sector, with the publication of 15 open access papers, most of them peer-reviewed. We are committed to Open Science.

The project's partners have also organized two important dissemination events: the Heat-to-Fuel dedicated workshop within ICPS19, and the HTL Expert Workshop (see page 2).

Lastly the reader will find interviews with the partners: IREC, POLITO, RE-CORD, TU Wien.

Heat-to-Fuel workshop at ICPS19

Consortium partners Technical University of Vienna (TU Wien) and Bioenergy and Sustainable Energies (BEST) organized the International Conference on Polygeneration Strategies 2019, from 18th to 20th November 2019 in Vienna, Austria.

The conference covered issues on the topics: gasification; gas upgrading and gas cleaning for synthesis application; syngas applications; modelling and simulation; industrial implementation; and commercial applications.

A dedicated Heat-to-Fuel workshop was organized within this conference on the afternoon of the first day. The different technologies being developed in the project were discussed:

- Aqueous Phase Reforming of Fischer-Tropsch Water Fraction (POLITO)
- Modeling, Design and Assessment of a Milli Structured Reactor for Fischer Tropsch Reaction (CEA Liten)
- Parameter Variation Using Cobalt Based Catalyst and Slurry Bubble Column Reactor for Fischer-Tropsch Synthesis (BEST)
- Influence of Pressure and CO_2 in Fluidized Bed Gasification of Waste Biomass (ICHPW)
- Hydrothermal Liquefaction integration in the Heat-to-Fuel process (RE-CORD)

Richard Zweiler as Project Coordinator was the chair of this event.

The organization of the workshop was supported by GET and R2M Solution.

iCPS 19 International Conference on Polygeneration Strategies

Potential of Hydrothermal Liquefaction routes for biofuel production

The expert workshop Potential of Hydrothermal Liquefaction (HTL) routes for biofuel production was co-organized by five European H2020 projects and a Norwegian research center: Heat-to-Fuel, 4Refinery, HyFlexFuel, NextGenRoadFuels, Waste2Road and Bio4Fuels. The event took place in Brussels on November 19th, 2019.

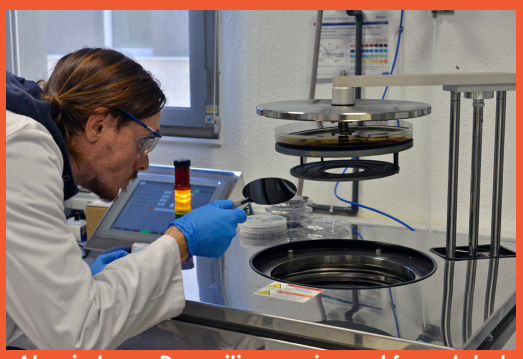
The workshop brought together different stakeholders from science and industry working on implementation and commercialization of HTL in order to join forces for market penetration.

Almost 100 participants attended from industry, SMEs, EC, research organizations, universities, and other organizations.

INTERVIEW WITH IREC

The Catalonia Institute for Energy Research (IREC) is a centre of excellence in applied energy research. IREC is a public institution created in 2008 based in Barcelona with about 120 employees. The main objective of the centre is to develop disruptive energy solutions and bring them to society. We carry out an intensive research program as a national and international point of reference in energy transition. We are committed to boosting the translation of our research outputs into products and technologies that benefit industry and the public. Our scientific and technological priorities are addressed to three challenges for a sustainable future: Energy and Environment, Smart Energy and Energy Storage. In numbers, we are currently working on 24 ongoing European projects, publishing 86 scientific articles per year, holds more than 30 patents and supported the creation of 3 spin-off companies.

Reactor equipment for catalyst testing



Atomic Layer Deposition equipment for catalyst pasivation

Jordi Guilera,
R&D Project Engineer

Role of IREC in the project:

IREC works on the catalyst development for the production of liquid fuels. In particular, our activities are focused synthesis and characterization of cobalt based catalysts containing promoters, and stabilization of catalyst particles over alumina by means of atomic layer deposition for Fischer-Tropsch synthesis. As well, experimental investigation of organic waste pyrolysis and char gasification kinetics by using a wire mesh reactor.

Expectations from HtF:

We expect that the catalysts co-developed in the project will succeed in their activity in milli-structured reactors, by increasing the liquid fuel efficiency from 35% to 50%. Our strategy is to design innovative catalyst formulations based on cobalt, including rare earth metals as promoters and by the deposition of thin layer shells by Atomic Layer Deposition techniques. Besides, we are willing to determine the specific role of the presence of carbon dioxide in syngas mixtures for the synthesis. During the course of the project, we will be able to supply 1 kg-batches of innovative FT catalysts for pilot and demo plant applications. We are willing to exploit the catalyst development results commercially for the next generation of reactor technologies.

https://irec.cat/

INTERVIEW WITH POLITO

Politecnico di Torino (POLITO)

The research unit involved in this project is Politecnico di Torino (POLITO), Italy. The Politecnico di Torino was founded in 1857, and it has more than 35000 students, 700 Ph.D. students and more than 3000 employees.

Samir Bensaid

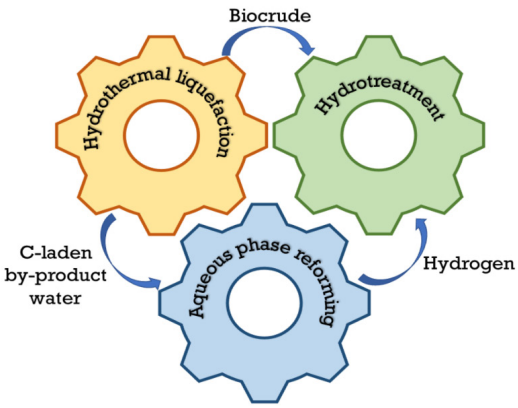
Full Professor of Industrial Chemistry; Coordinator of the PhD Programme in Chemical Engineering at Politecnico di Torino.

Role of POLITO in the project:

POLITO is mainly involved in the development of the Aqueous Phase Reforming (APR) of industrial waste waters to produce renewable hydrogen.
Organic-laden aqueous streams deriving from several biorefinery contexts, such as biomass hydrothermal liquefaction, sugar-rich secondary streams originated in a 2nd generation bioethanol plant, and Fischer-Tropsch are the targets of the APR in the Heat-to-Fuel project.
APR of oxygenated organics was selected as it produces pressurized hydrogen and/or alkanes, through a process at mild temperature (<300°C) and entailing negligible water evaporation (which is mandatory if very diluted aqueous streams are addressed).
The activity at POLITO entails the investigation of suitable catalytic systems, active and selective towards hydrogen production and able to withstand the contaminants present in real aqueous streams.
As a final target, an APR demo-unit will be manufactured and interfaced with a Fischer-Tropsch reactor, aiming at supplementing hydrogen to a biomass gasification-derived syngas having a starting H2/CO ratio lower than 2.
POLITO has also the role of designing an industrial scale plant based on the Heat-to-Fuel concept and evaluating its sustainability via Life Cycle Assessment.

Expectations from HtF:

APR will be brought at a demo-scale, with the aim of challenging this technology in an industrially relevant environment. The waste waters of lignin hydrothermal liquefaction will be processed in order to produce hydrogen for the Fischer-Tropsch reactor, as well as reducing the organic content in the waste waters to allow the maximization of water internal recycle back to hydrothermal liquefaction. Operating condition flexibility and catalyst durability will be assessed to evaluate the sustainability and reliability of the APR technology for renewable hydrogen production from organic wastes, in the perspective of a circular economy.



Aqueous phase reforming

www.polito.it

INTERVIEW WITH RE-CORD

The Renewable Energy Consortium for research and Demonstration (RE-CORD), funded in 2010 under the initiative of CREAR/Department of Industrial Engineering of the University of Florence, carries out scientific and technological research in the field of Renewable Energies and specifically Bioenergy. RE-CORD is a non-profit independent research body and participated to many R&D and Demonstration projects in the field of biomass, bioenergy, biofuels and bioproducts. RE-CORD and CREAR members participated to International Networks in Bioenergy (as IEA Task 39-Liquid Biofuels), provided consultancies to the EU Commission, national Ministries, Regions and local actors in carrying out assessment studies or evaluating/monitoring proposals/projects. RE-CORD owns and operate a state-of-the-art analytical laboratory fully devoted to biomass, biofuels and bioliquids characterization. The laboratory, which carries out also contract research and analyses for third party, has a broad range analytical capability, mostly for thermochemical process development. Along with the laboratory, another prominent asset is the Experimental Area, a 500 m2 facility where several pilot and demo installations are installed and operated.

Edoardo Miliotti
(R&D engineer)
Role in Heat-to-Fuel
Edoardo is the team leader of hydrothermal liquefaction experimental activities

Role of RE-CORD in the project:

RE-CORD is the task leader of the hydrothermal liquefaction activities within HTF.
Firstly, a thorough batch experimental campaign was carried out in order to investigate the influence of operating conditions on yields and characteristics of HTL products from cellulosic ethanol lignin. This was the starting point for the design of a TRL5 continuous hydrothermal liquefaction unit. RE-CORD had successfully achieved the challenging task of commissioning and operating a continuous HTL unit with lignin-rich slurry. Hydrotreating experiments of the produced biocrude will be carried out to improve its characteristics, while the produced aqueous phase has been used as feedstock in the following aqueous phase reforming step by POLITO. The project allowed for the investigation of a novel approach to the treatment of this secondary HTL product, coupling different technologies and generating a fruitful collaboration between the two partners.

Expectations from HtF:

Hydrothermal liquefaction is one of the most promising yet technically challenging technology for biocrude production from residual feedstock and few continuous pilot units are currently in operation worldwide. The project offered to RE-CORD the unique opportunity to strengthen its competencies on analytical protocols for characterization of hydrothermal liquefaction products, namely biocrude and water-soluble organic streams, and, moreover, to design and operate its own continuous HTL unit.

www.re-cord.org

HTL unit

INTERVIEW WITH TU WIEN – ICEBE

Role of TU Wien in the project:

Within the project, we are responsible for the modelling, simulation and validation of the separate units constituting the overall Heat-to-Fuel process based on the results of the experiments carried out by our partners. In addition, we bring in our expertise in the field of biomass gasification. This includes experiments of selected biogenic residues in our 100 kWth dual fluidized bed gasification plant with the use of CO_2 as gasification agent.

Expectations from HtF:

Within the HtF project, we want to contribute to defossilize the transportation sector and in parallel reduce CO_2 emissions. The Heat-to-Fuel project will allow us to strengthen our competences in utilizing CO_2 as well as biogenic fuels within our biomass gasification process to produce a high-value synthesis gas. Additionally, we can improve our expertise in the field of the simulation of the HtF biofuel production route.

www.tuwien.at

Biomass gasification plant

TU WIEN – ICEBE

Under the motto "Technology for People", research, teaching and learning is taking place at TU Wien over 200 years. Over 5000 researchers and employees as well as around 26.500 students at the respected technical university in Austria provide valuable knowledge to solve current social issues.
The Institute of Chemical, Environmental and Bioscience Engineering combines scientific excellence with a pioneering spirit to develop new technologies in the field of sustainable and ecological energy and fuel production from biomass and a broad range of residues. The guideline "imagineering nature" forms the basis of its research, which is close to natural cycles and aims to reduce the CO_2 in the air, to provide sustainable and renewable energy and to use raw materials and resources in an intelligent and economic way. To contribute to the development of a climate-neutral energy system, we use our core competencies in the field of Fuel and Energy System Engineering and our more than 30 years of experience in the development of fluidized bed systems and usage of thermochemical processes.

DI Dr. Anna Mauerhofer

(Leading Project Engineer)

Anna Mauerhofer is specialist in the field of biomass gasification utilizing CO_2 within the process and the simulation of biofuel production routes.

DI Dr. Stefan Müller

(Senior Research Expert)

Stefan Müller is expert in the field of fuel and energy system engineering focused on industrial plant design by application of advanced digital methods.

CONSORTIUM

- Gussing Energy Technologies GMBH
- Bioenergy and Sustainable Technologies (BEST)
- Beta renewables Spa
- Commissariat à l'Energie Atomique et aux Energies Alternatives
- Centro Ricerche FIAT
- Skupina Fabrika
- Instytut Chemicznej Przeróbki Węgla
- Institut de Recerca en Energia de Catalunya
- Johnson Matthey PLC
- Politecnico di Torino
- R2M Solution Spain
- Consorzio per la Ricerca e la Dimostrazione sulle Energie Rinnovabili
- Atmostat
- TU WIEN

Heat-to-Fuel is a Horizon 2020 EU-funded project carried out by 14 partners from across Europe that aims to deliver the next generation of biofuel production technologies supporting the decarbonisation of the transportation sector.

NOVEL TECHNOLOGIES + COMPLEMENTARY ACTIVITIES DESIGN MODELLING

TESTING | ANALYSIS INTEGRATED HEAT TO FUEL SYSTEM + DEVELOPMENT HARDWARE PROCESSES

REPRESENTATIVE OF NEXT GENERATIONS OF SUSTAINABLE BIOFUELS TECHNOLOGIES

At the end of the project, the technology will be market ready in around 7 years.
The know-how acquired will allow scalability at a demonstration level before commercialisation.

PROJECT FACTS

Title:
Biorefinery combining HTL and FT to convert wet and solid organic, industrial wastes into 2nd generation biofuels with highest efficiency

Acronym:
Heat-to-Fuel

Budget:
€ 5.896.987,50

Type of action:
Research and Innovation Action

Duration:
48 months

This project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement n° 764675