

Virtual Workshop | 28th January 2021  
13:30 - 17:30 CET

**Hydrothermal Liquefaction (HTL) in the Green Energy Transition**

Research Updates - State of the Art and Market Potential in a 2050 Outlook

# 1ST NEXTGENROADFUELS CONFERENCE SAVE THE DATE!

## HYDROTHERMAL LIQUEFACTION (HTL) IN THE GREEN ENERGY TRANSITION

28TH JANUARY 2021

The aim of this issue is to provide an update on the progresses of the NextGenRoadFuels H2020 project happened in 2020 in a nutshell. The most exciting news is that at the end of next January the consortium is organizing a **virtual conference** with several premium guests for which you are all invited!

The European Commission's bold ambition to become the **first climate neutral continent by 2050** and **achieve a 55% reduction in greenhouse gas emissions by 2030** is key for a number of policy initiatives, which are also critical to the biomass and bioenergy industry. The latter is paying particular attention to the **hydrothermal liquefaction (HTL) process** that aims to use sewage sludge, food waste and construction wood waste as feedstocks for the production of bio-crude oil that, in turn, can be refined into biofuel. This innovative technology brings a twofold additional value in supporting the **SET-Plan Key Action 8 on bioenergy and renewable fuels for sustainable transport**. First, it provides biofuel that can be used in multiple transport sectors such as road, marine and aviation. Secondly, by using waste feedstock as main resource, it greatly contributes to the shift from a linear to a circular economy.

The dissemination conference aims to provide a **clear framework of HTL state of the art by addressing it from two perspectives**. Firstly, the **latest EU and global policy trends** are going to be taken into account and, subsequently, the **scientific community** directly displays the **research and technology advancements highlighting the results of multiple projects**.

There will be two sessions: **the first session** tackles **the policy outlook and latest scientific and technology advancements for HTL**. **The second session** is focused on **technology scale up and market uptake**: bringing together technology providers and end users.

In a context where new EU legislative strategies on renewable energies and the climate sector are in the pipeline, including greater attention to hydrogen, together with an ongoing Covid-19 pandemic impacting the **global economy**, the **business potential**, the **regulatory aspects**, and **exploitation needs** will be tackled considering the ongoing energy transition and decarbonization processes. The conference brings together a panel debate that will discuss **how current and future HTL plants can successfully close the loop between feedstock providers and end-users under different perspectives, both in Europe and globally** (Canada, USA, Japan).

[Check the agenda here](#)

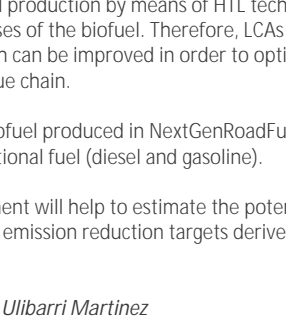
[Register here for S1](#) and [here for S2](#)

## ENVIRONMENTAL ASSESSMENT OF HTL IN NEXTGENROADFUELS

A key challenge is to make consumers aware that **biofuels will have a positive impact on energy and environment through the valorization of diverse wastes as a feedstock**. From one side this prevents waste of going to landfill with the negative consequences of it and on the other side it promotes the production of new sustainable products.

Evidence should be provided that the **production of biofuels is done in a safe and sustainable way, without compromising food security and threatening biodiversity**.

**CENER** is committed to evaluating environmental performances of NextGenRoadFuels value chain. **CENER will study the sustainability of the innovative solutions investigated in the project and compare it with current management and reference systems**. The project will set-up a **specific and robust methodology for GHG (Green House Gases) and sustainability analysis**.



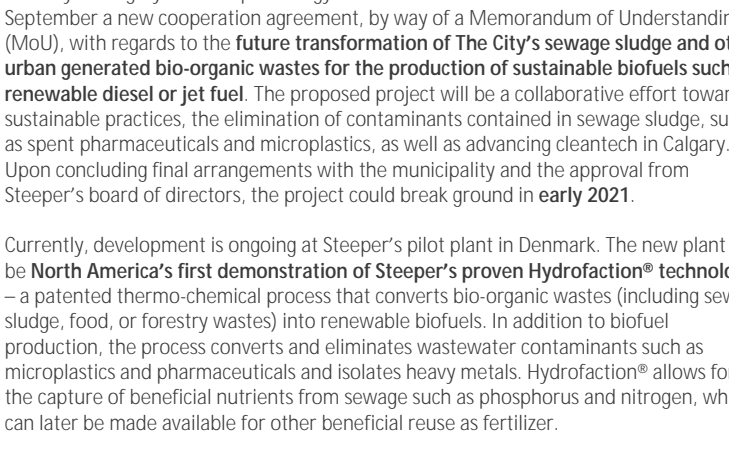
The sustainability of the NextGenRoadFuels integrated value chain will be analyzed by means of LCA according to ISO 14040 and ISO 14044 and comparison of GHG emission savings according to Renewable Energy Directive (RED) II. The system boundaries analyzed include the entire life cycle of the biofuel from source to usage, which considers feedstock collection, biofuel production by means of HTL technology and upgrading, and its distribution and use phases of the biofuel. Therefore, LCAs will help to identify key aspects of the process which can be improved in order to optimize the sustainability of the product and the full value chain.

Besides GHG emission of biofuel produced in NextGenRoadFuels value chain is evaluated and compared with conventional fuel (diesel and gasoline).

This environmental assessment will help to estimate the potential contributions to renewable energy and GHG emission reduction targets derived from the implementation of this innovative process.

*Text by: CENER – Blanca de Ulibarri Martinez*

## MEMORANDUM OF UNDERSTANDING SIGNED BY THE CITY OF CALGARY WITH STEEPER ENERGY CANADA LTD.



The City of Calgary and Steeper Energy Canada Ltd. have announced on the 8th of September a new cooperation agreement, by way of a Memorandum of Understanding (MoU), with regards to the **future transformation of The City's sewage sludge and other urban generated bio-organic wastes for the production of sustainable biofuels such as renewable diesel or jet fuel**. The proposed project will be a collaborative effort towards sustainable practices, the elimination of contaminants contained in sewage sludge, such as spent pharmaceuticals and microplastics, as well as advancing cleantech in Calgary. Upon concluding final arrangements with the municipality and the approval from Steeper's board of directors, the project could break ground in **early 2021**.

Currently, development is ongoing at Steeper's pilot plant in Denmark. The new plant will be **North America's first demonstration of Steeper's proven Hydrofaction® technology** – a patented thermo-chemical process that converts bio-organic wastes (including sewage sludge, food, or forestry wastes) into renewable biofuels. In addition to biofuel production, the process converts and eliminates wastewater contaminants such as microplastics and pharmaceuticals and isolates heavy metals. Hydrofaction® allows for the capture of beneficial nutrients from sewage such as phosphorus and nitrogen, which can later be made available for other beneficial reuse as fertilizer.

Read the full press release [here!](#)

## SPECIAL ISSUE ON PROCESSES OPEN FOR SUBMISSION

A Special Issue of the international peer-reviewed open access Journal Processes (ISSN 2227-9717) is open for submission, with focus on **Catalytic Liquefaction Processes of Biomass for Fuels and Chemicals**.

"Gathering recent, high-quality research contributions in the field of catalytic liquefaction processes for biomass, for the production of sustainable biofuels and/or chemicals" is what **Dr Daniele Castello** (Department of Energy Technology, Aalborg University) is looking for, in its role of Guest Editor for this Special Issue.

Topics will include, but will not be limited to, experimental studies on catalytic pyrolysis or catalytic hydrothermal liquefaction; comparison between catalytic and non-catalytic biomass liquefaction processes; case studies on pilot or demonstration scale plants and modelling studies and techno-economic evaluations.

The deadline for manuscript submission is **31 May 2021**.

[Additional information can be found online here and in the flyer.](#)

## THE IMPORTANCE OF THE PRETREATMENT PHASE ON HTL OF SEWAGE SLUDGE

On the 18 September 2020, **M.Sc. Joscha Zimmermann** (KIT, Institute of Catalysis Research and Technology – IKFT) took part in the **3rd edition of the Doctoral Colloquium BIOENERGY**, organized by DBFZ, as a virtual web conference.

The Doctoral Colloquium BIOENERGY, chaired by **Prof. Dr.-Ing. Daniela Thrän**, covered the full **biomass conversion chain**, from the feedstock to different conversion pathways and their technological implementation, up to the resulting products and services.

The needed system analysis and measures for system integration were also addressed and tackled.

Zimmermann presented a poster on the **influence of thermochemical pre-treatments on hydrothermal liquefaction (HTL) of sewage sludge**, a work done in team with **Dr. Klaus Raffelt** and **Nicolaus Dahmen** as part of the activities performed in NextGenRoadFuels project.

The **poster** showed the results from the application of different pre-treatment methods to sewage sludge prior to its conversion, as foreseen in the hydrothermal liquefaction (HTL) process.

Since sewage sludge has a relatively high content of inorganics (mostly alkali and alkaline earth metallic species) and it is rich in nitrogen and sulphur, the goal is to develop an efficient and doable pre-treatment method for HTL of sludge without losing carbon, therefore with limited impact on resulting bio-crude yields and quality.

## MAXIMIZING SUSTAINABLE AVIATION FUELS BENEFITS BEYOND CO2 REDUCTION JETSCREEN PROJECT WORKSHOP

On 26 November 2019, a workshop targeted to policy makers on the H2020 JETSCREEN project was organized at the Press Club Brussels Europe. Started on June 2017, JETSCREEN ("Jet fuel screening and optimization") developed a screening and optimization platform for alternative fuels. The platform integrates distributed design tools and generic experiments able to assess the risks and benefits of alternative fuels. Among its goals, the platform contributed to optimize alternative fuels for a maximum energy per kilogram of fuel and a reduction of pollutants' emissions. The workshop addressed several viable strategies for getting the maximum number of benefits from alternative fuels, which are of interest also for NextGenRoadFuels project. In fact, a pillar around which the project is built around is the delivery of premium biocrude to the refineries. The latter is then able to upgrade it to premium biofuel for the desired specific sector such as aviation, maritime or road.

Lasse Rosendahl, Head of department of Energy Technology at Aalborg University (AAU) in Denmark and project coordinator of NextGenRoadFuels, intervened at Session 2 on "Promising fuel production pathways and how screening tools can support their", by delivering a presentation on "Hydrothermal liquefaction: Sustainable fuel from wastes, residues, and advanced energy crops".



After attending the conference, Professor Lasse Rosendahl commented: "The JETSCREEN workshop was a very good event, with very good and relevant presentation on new developments within ASTM certification of sustainable aviation fuels, fuel production technologies and the impact from aviation fuel emissions on global warming".

His observations and the participation in the conference highlight the necessities and efforts of each and every transport sector, including aviation, in seeking sustainable alternatives to traditional and current practices through the adoption of innovative technologies.

[The leaflet can be found here and more information on the project here.](#)

## ABOUT NEXTGENROADFUELS PROJECT

**NextGenRoadFuels** is a Research and Innovation project funded by the Horizon 2020 programme to develop a cost-effective valorization pathway for **multiple urban waste streams** such as sewage sludge from treated wastewater, food waste and construction wood waste. These waste streams will be converted into **renewable fuels, fertilizers, and proteins**, thus fostering the urban transition towards a circular economy.

Started in 2018 with a consortium of thirteen partners coordinated by the University of Aalborg, the 4-years project will prove the **Hydrothermal Liquefaction pathway (HTL)** as an efficient route to **produce high-volume, cost-competitive, drop-in synthetic gasoline and diesel fuels**, as well as **other hydrocarbon compounds**.

The project is fully aligned with the **SET Plan Key Action 8 on renewable fuels**, which calls for an acceleration of the development and deployment of low-carbon technologies in the transport sector. NextGenRoadFuels will also contribute to the renewable-energy-in-transport target, as well as to the GHG emissions reduction objectives, in line with the Renewable Energy Directive (RED II) and the European Energy Roadmap 2050.

The consortium, coordinated by Aalborg University (Denmark), counts on 11 beneficiaries from 7 countries: Steeper Energy ApS (Denmark), Chemical Process and Energy Resources Institute | CERTH (Germany), CENER (National Renewable Energy Centre of Spain) (Spain), Technical University of Munich (Germany), Karlsruhe Institute of Technology (Germany), SINTEF ENERGI (Norway), HaldorTopsoe A/S (Denmark), ENI S.p.A. (Italy), Goodfuels (The Netherlands), ETA-Florence Renewable Energies (Italy).

**Further information:** <https://www.nextgenroadfuels.eu/>

Follow the project on:



## THE FUEL FOR THOUGHT PODCAST: A FOCUS ON HTL

NextGenRoadFuels has been introduced in a podcast series held by Haldor Topsoe called **"The Fuel for Thought Podcast"**. The podcast series is structured in episodes, each hosting an expert for a conversation about **renewables for the refinery industry**. In here **Lasse Rosendahl**, project coordinator and Head of Department of Energy Technology at Aalborg University (AAU), has presented his team's research into **hydrothermal liquefaction (HTL) technology and the potential for future applications**.

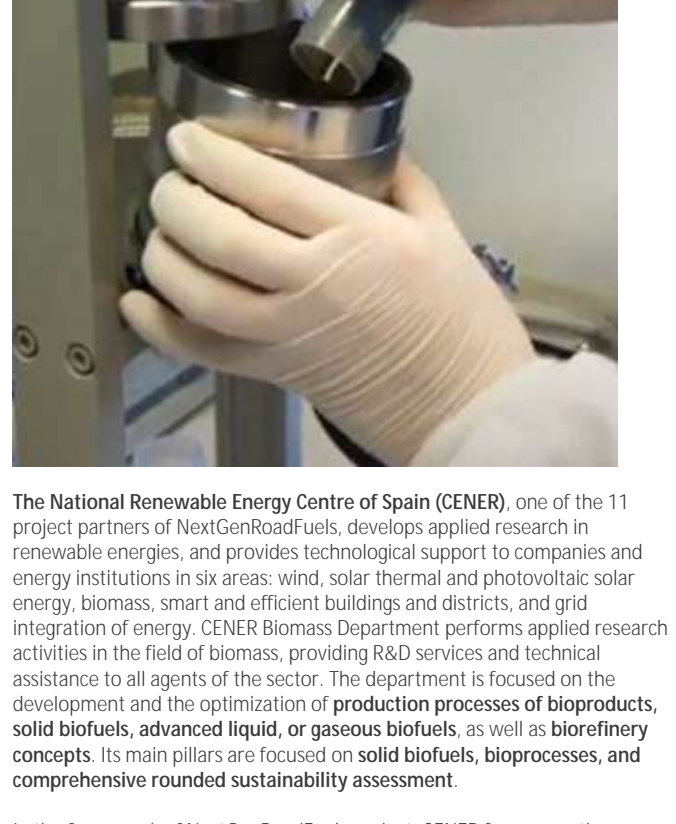


In the context of emerging technologies within the refining industry, one way to future-proof a refinery against legislative demands is to expand the capabilities in order for a plant to process any type of feedstock to produce on-spec transport fuel. **But how mature is the technology for processing alternatives to fossil feedstocks? And, more pressing still, can it turn a profit?** It is around these two boiling questions that the conversation developed, addressing not only the technical perspective of HTL but also its feasibility in terms of financial figures taking into account the environmental and social benefits of switching to biofuels.

After the discussion, the hosts Sylvain and Mikala, share their views on the technologies and discuss realistic timeframes for their commercialization.

[Listen to the podcast here!](#)

## PRE-TREATMENT PROCESS OF SEWAGE SLUDGE



**The National Renewable Energy Centre of Spain (CENER)**, one of the 11 project partners of NextGenRoadFuels, develops applied research in renewable energies, and provides technological support to companies and energy institutions in six areas: wind, solar thermal and photovoltaic solar energy, biomass, smart and efficient buildings and districts, and grid integration of energy. CENER Biomass Department performs applied research activities in the field of biomass, providing R&D services and technical assistance to all agents of the sector. The department is focused on the development and the optimization of **production processes of bioproducts, solid biofuels, advanced liquid, or gaseous biofuels, as well as biorefinery concepts**. Its main pillars are focused on **solid biofuels, bioprocesses, and comprehensive rounded sustainability assessment**.

In the framework of NextGenRoadFuels project, CENER focuses on the **reduction of organic nitrogen content in sewage sludge prior to the HTL process**. This activity is being implemented, on one hand, by pre-treating sewage sludge at mild conditions by employing enzymes as catalysts for proteins removal and, on the other, by studying the best mixture, in terms of total solid content of sewage sludge with other urban wastes, for the HTL process. As a demonstration tool for a larger audience, CENER made an **explanatory video** of the steps that are undertaken during the pretreatment phase of sewage sludge before it goes into the HTL reactors.

[Watch the video here!](#)

## MID-TERM CONSORTIUM MEETING



Despite the geographical and travel restrictions caused by the pandemic of Covid-19, the entire consortium managed to stay on schedule. **On the 17th and 18th in November 2020**, all the partners joined a purposely organized an online meeting for a fruitful discussion.

Each member actively participated by presenting the proceedings of their respective tasks and by promptly providing the necessary feedback to identify the challenges to be faced in the coming months.

## PUTTING EUROPEAN TRANSPORT ON TRACK FOR THE FUTURE

On the 12th of December, the European Commission (EC) linked up to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions concerning the **future plans for smart mobility for the years to come by "putting European transport on track"**.

The Article 20 of the Sustainable and Smart Mobility Strategy highlights the crucial role of biofuels in the coming decade and it states: "Air and waterborne transport have greater decarbonisation challenges in the next decades, due to current lack of market ready zero-emission technologies, long development and life cycles of aircraft and vessels, the required significant investments in refuelling equipment and infrastructure, and international competition in these sectors".

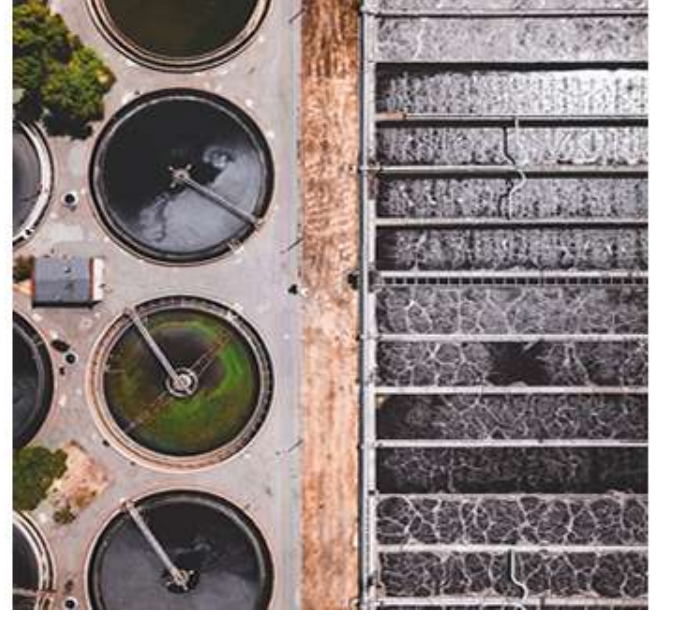
EU international emissions from navigation and aviation have grown by more than 50% since 1990. Action in these sectors is urgently needed, including as they recover from the current crisis. These modes must have priority access to additional renewable and low-carbon liquid and gaseous fuels since there is a lack of suitable alternative powertrains in the short term.

The **RefuelEU Aviation and FuelEU Maritime** initiatives will boost the production and uptake of sustainable aviation and maritime fuels and address this issue. Furthermore, the Commission will consider establishing a Renewable and Low-Carbon Fuels Value Chain Alliance, within which public authorities, industry, and civil society will cooperate to boost the supply and deployment of the most promising fuels, complementing action under the European Clean Hydrogen Alliance and building on the success of the European Battery Alliance".

The above statements are stressing out the need of projects such as NextGenRoadFuels that are aiming to implement and scale up the adoption of premium biofuel.

Check out the full EC paper [here!](#)

## HTL FOR THE DECARBONIZATION OF AVIATION TRANSPORT



The Danish TV service by DR – Denmark's Radio (dated 06 July 2020), dedicated a program to the **potential of sustainable advanced fuels as a bioenergy carrier in Denmark** and it involved NextGenRoadFuels.

The project coordinator **Lasse Rosendahl**, Professor and Head of Department of Energy Technology at Aalborg University (AAU) was invited to represent the project together with **Claus Uhrenholt Jensen**, Senior Process Specialist & Department Manager at Steeper Energy APS. The two teams work together at the continuous bench scale 1 HTL plant, at Aalborg University and first biofuels batches have been filmed for the records by the television network.

NextGenRoadFuels project is proving the **HTL technology pathway** as a viable, sustainable, and efficient route for production of **liquid drop-in fuels for road transportation from urban organic residuals**.

The outstanding feedstock upgrading techniques HTL technology and the crucial role of biofuels in the coming decade and it states: "Air and waterborne transport have greater decarbonisation challenges in the next decades, due to current lack of market ready zero-emission technologies, long development and life cycles of aircraft and vessels, the required significant investments in refuelling equipment and infrastructure, and international competition in these sectors".

Check out the video [here!](#)