



SUCCESSFUL EXPERT WORKSHOP

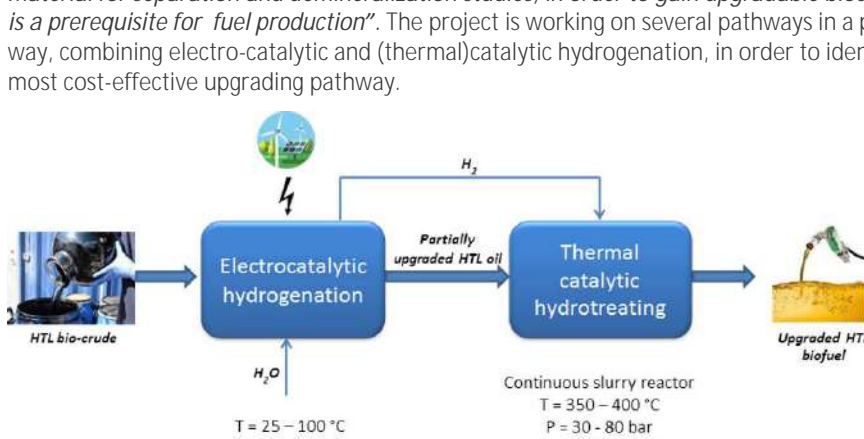
POTENTIAL OF HYDROTHERMAL LIQUEFACTION (HTL) ROUTES FOR BIOFUEL PRODUCTION

19TH NOVEMBER 2019, BRUSSELS

More than **90 participants** from universities, research institutes and industries gathered together last **November 19th 2019** at the **Expert Workshop on "Potential of Hydrothermal Liquefaction (HTL) Routes for Biofuel Production"** in Brussels. The workshop is the great result of a synergic cooperation started some time ago among five Horizon 2020-funded projects and a Norwegian research centre, all counting on HTL as one among of the key conversion technology that, within a virtuous circular economy pattern, can guarantee the production of novel, cost-effective biofuels. Under the leading moderation by Sonja van Renssen, energy journalist, the workshop started with the presentations of **HyFlexFuel**, **WASTE2ROAD**, **4refinery**, **NextGenRoadFuels**, **Heat to Fuel** projects and the **Norwegian National Centre Bio4Fuels** (Norway).



Dr Lasse Rosendahl, Professor, Head of the Department of Energy Technology at Aalborg University (Denmark) and Coordinator of NextGenRoadFuels project, briefly showed the main concept, added-value as well as the latest updates after 12-month project implementation. *"The results till now are very promising"*, said Rosendahl: *"Around 1.5 tonnes of sewage sludge have been processed, which corresponds to more than 100 Kg biocrude. Such feedstock is a useful material for separation and demineralization studies, in order to gain upgradable biocrude which is a prerequisite for fuel production"*. The project is working on several pathways in a parallel way, combining electro-catalytic and (thermal)catalytic hydrogenation, in order to identify the most cost-effective upgrading pathway.



Besides, **several samples of organic municipal solid waste (MSW)** have been analysed and screened by project partners for continuous processing.



From urban waste also **protein extraction pathways** have been analysed and evaluated.



Finally, process flow sheets have been established for **techno-economic analysis and life-cycle assessment**.

Very promising in the perspective of the HTL process at the basis of the NextGenRoadFuels project is the potential in terms of available resources offered by the European Union. **Maria Georgiadou**, Senior Expert, EC DG RTD, gave a rich overview on current regulatory and legal framework on renewable energies and in particular on bioenergy and advanced sustainable fuels. Precious inputs on existing supporting measures within Horizon 2020 program, as well as the novel Innovation Fund (1st call is expected at the beginning of 2020), Structural Funds and other measures have been given as well. High-level inputs were provided also by **Jack Saddler**, Professor at the University of British Columbia (Canada), around the ATM project (on Forest-residues-to-biojet fuel and HTL-related results) and **Douglas C. Elliott**, Laboratory Fellow (retired) in PNNL (USA), who gave the audience a global perspective on HTL potential at commercialization level.

In the afternoon, 5 market leadders intervened on industrial status and development of HTL worldwide. In particular, **Perry Toms**, CEO of Steeper Energy (partner of the NextGenRoadFuel project) presented Hydrofaction®, a leading technology for an efficient conversion of sustainable biomass into renewable transportation fuels.

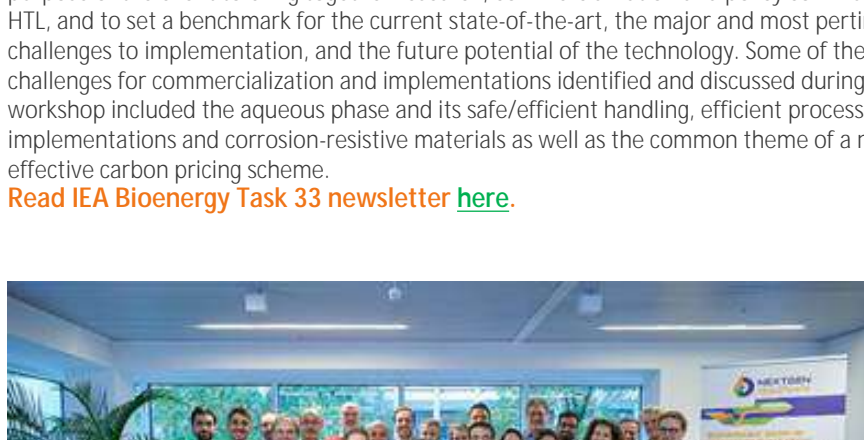


Thanks to this workshop, experts from universities, research institutes and industrial sectors got data on HTL technology maturity compared to other existing technologies for biofuel production; the existence of legal, regulatory or market issues still hindering the commercialisation of HTL and way outs: most of all, they pave the way continuing the cooperation among different actors, by building an operative platform on most promising HTL routes in the near future.

Access to the agenda, presentations, take-home messages, pictures and video of the event by clicking here.

The event was also featured on **IEA Bioenergy Task 33** on its latest **newsletter** underlying the purpose of the event to bring together research, commercialization and policy communities on HTL, and to set a benchmark for the current state-of-the-art, the major and most pertinent challenges to implementation, and the future potential of the technology. Some of the major challenges for commercialization and implementations identified and discussed during the workshop included the aqueous phase and its safe/efficient handling, efficient process implementations and corrosion-resistant materials as well as the common theme of a need for an effective carbon pricing scheme.

Read IEA Bioenergy Task 33 newsletter here.



3° PROJECT MEETING AND GENERAL ASSEMBLY

20TH-21ST NOVEMBER 2019, BRUSSELS

The NextGenRoadFuels partners gathered together at the SINTEF office in Brussels for the **3rd Project Meeting and General Assembly Meeting on November 20-21, 2019**. On November 20, **Prof Ing Lasse Rosendahl**, **Anne Bock** (Aalborg University Team) and **Ing Gonzalo del Alamo Serrano** (SINTEF and meeting host) delivered a welcome speech. The meeting opened with a presentation of the agenda and a focus on administrative and financial reporting according to the EC rules. Hereafter Prof Ing Rosendahl (Coordinator of the Project) gave the status on the ongoing project activities and reported about the Expert Workshop 'Potential of Hydrothermal Liquefaction (HTL) Routes for Biofuel Production' held the day before (access here for a dedicated news). Then the floor was opened to all partners, providing the latest updates of project activities after the first 12 months within each Work Package. There was a very fruitful exchange of information and opinions at consortium level. The day closed with a well-deserved consortium dinner. On November 21, before the General Assembly, an open discussion including risks and mitigation measures was organized. The coordinator provided a follow-up presentation, where he highlighted the main focus areas of each WP in order for all WP leaders and partners to plan the work in the next 6 months.

Some pictures of the 3rdProject meeting here.

FIRST-OF-A-KIND COMMERCIAL HTL BIO-OIL PLANT TO BE CONSTRUCTED IN AALBORG (DK)

A group of 13 companies and organisations have launched a new initiative in Aalborg (DK), which holds vast potential for developing tomorrow's sustainable cities – locally, nationally and internationally. The partners are working toward the **construction and operations of first-of-a-kind commercial HTL facility**. The plant is envisioned to be located near a large, modern wastewater treatment plant close to Limfjorden, owned by Aalborg Forsyning and to be in operations by **1 January 2024**.

Research indicates that **HTL can play a key role in developing sustainable societies**, making the proposed project a potential key contribution to Aalborg's fulfilling the 17 UN Sustainable Development Goals.

The project proponents hope that, within a short timeframe, the results of their efforts will inspire other companies and organisations – or citizens – to consider HTL technology for treatment plants across the world.

With that in mind, anyone interested is invited to contribute to the dialogue about this proposed development and the application of HTL technology. The aim is to share knowledge, experience and ideas and, not least, take action.

Indeed, regardless of its location, an **HTL plant can play a key role in creating new, valuable circular flow of historically undervalued resources** – to the benefit of citizens and a wide range of local actors.

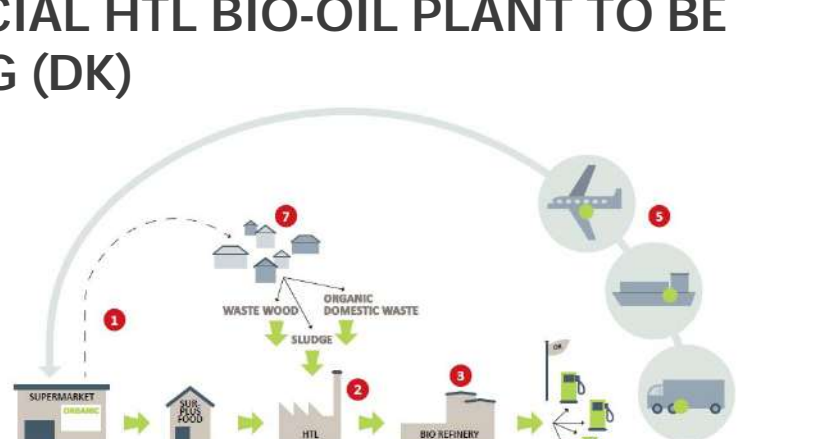
Part of **NextGenRoadFuels project research and innovation activities** will be directly related to the development of this innovative facility.

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ABOUT NEXTGENROADFUELS PROJECT

NextGenRoadFuels is a Research and Innovation Project funded by the Horizon 2020 programme to develop a cost-effective valorisation 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**.

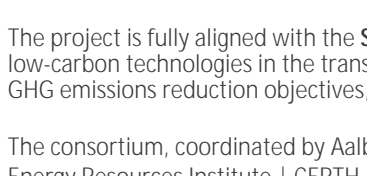
The project is fully aligned with the **SET Plan Key Action 8 on renewable fuels**, which calls for an acceleration of the development and deployment of low-carbon technologies in the transport sector. NextGenRoadFuels will also contribute to the renewable-energy-in-transport target, as well as to the 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 (DK), counts on 11 beneficiaries from 7 countries: Steeper Energy ApS (DK), Chemical Process and Energy Resources Institute | CERTH (GER), CENER National Renewable Energy Centre of Spain(E), Technical University of Munich (D), Karlsruhe Institute of Technology (D), SINTEF Energi (NO), HaldorTopsoe A/S (DK), ENI S.p.A. (IT), Goodfuels (NL), ETA-Florence Renewable Energies (IT).

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

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 818413.

Follow the project on:



FIRST PROJECT'S RESULTS:

HIGH DEGREE OF DEMINERALIZATION OF THE BIOCRUDE ACHIEVED

During the summer, the **NextGenRoadFuels team** successfully tested the **continuous bench scale 1 HTL plant for conversion of sewage sludge**. Almost 3-4 ton sludge was processed, giving valuable information about slurry design, process conditions and product separation. The primary purpose was to deliver **early-stage, upgradable HTL biocrude** to upgrading partners CPERI and HTAS, as well as **HTL aqueous phase product** to KIT.

More than 98 % demineralization of the biocrude was achieved for this early deliverable, spurring optimism that even higher degrees of demineralization can be achieved in order to ensure a smooth transfer to the catalytic upgrading.



Efforts on demineralization and further HTL processing of sewage sludge and food waste will ensue (AAU, SEA), in parallel with upgrading (CPERI, HTAS) to **transport grade drop-in biofuels and HTL byproduct** (aqueous and solid phase) **analysis and valorisation** (KIT, AAU).

As a part of this, **recovery of phosphorous** is a key issue due to stringent requirements following EU legislation. Results indicate that **>99% phosphorous** is caught in the aqueous and solid product phases, with only trace amounts in the biocrude. Full recovery from the aqueous phase has been shown possible in a very recent study, and the next work will be focused on the **applicability of the solid product as a fertilizer or soil improver**, due to the content of phosphorous in this product phase, ensuring complete **circularity and reuse of the phosphorous**.

[Learn more](#)

PRE-TREATMENT ACTIVITIES ON SEWAGE SLUDGE

7TH NOVEMBER 2019 – PAMPLONA

Last 30th October 2019, the project partner **CENER (National Renewable Energy Centre)** published an article on ASEBIO (The Spanish Association of Bio-Companies) on the work currently under implementation within the **NextGenRoadFuels project**. The article, entitled **"New Bioproducts from Sewage Sludge"**, is focused on the relevance of feedstock pre-treating for its use in the hydrothermal liquefaction (HTL) processing order to produce drop-in biofuels for the road transport.



Indeed, raw materials such as the organic fraction of urban waste as well sewage sludge have proteins and other Nitrogen-containing compounds. Especially high organic Nitrogen content is detrimental to fuel production and must be removed before starting the HTL as it may create problems.

The expertise of CENER is precious, since its role is to perform processes and methodologies based on enzymatic treatment of sewage sludge, through hydrolysis with enzymes at mild conditions. Afterwards, CENER carries out extraction and purification processes. This permits the recovery of amino acids and peptides, which are useful in several contexts (just as in sustainable agriculture, chemical industry, etc.).

Discover the promising results already collected at NextGenRoadFuels level and the full potential of this process in urban circularity paradigms by accessing to the full article here.



EIGHT RESOURCES ABOUT HTL -EUBCE 2019

The 27th European Biomass Conference and Exhibition held in May 2019 in Lisbon (P) featured more than 941 presentations from 4020 authors. **Find here 8 presentations about HTL**, many others are available (in Open Access) in the Conference Proceedings:

- [Valorisation of Waste Lignin for Phenol Derivative Compounds Using Hydrothermal Liquefaction](#), Marais, H.B., Marx, S. et al.
- [Modelling of the Integration of HTL with CCS for the Production of Drop-in Biofuels](#), Lozano, E.M., Pedersen, T.H., Rosendahl, L.A.
- [The Effect of Hydrothermal Liquefaction of Black Liquor in Bio-oil Quality](#), Melin, K. Välimäki, A. et al.
- [Standardization Needs in HTL](#), Iversen, S., Rodriguez, J.K., Rosendahl, L.A.
- [Utilizing Digested Wastewater Sludge in Hydrothermal Conversion to Produce Bio-oil](#), Hegdahl, S.H., Ødegaard, M.L et al.

- [Component Decomposition during Simultaneous Hydrothermal Milling Pretreatment for Lignocellulosic Biomass](#), Yokoyama, H., Matsumura, Y.
- [Hydrothermal Liquefaction of Valuable-Extracted Microalgae with Help of Pulsed Electric Field Treatment](#), Guo, B., Yang, B. et al.
- [Sustainable Drop-in Transport Fuels from Hydrothermal Liquefaction of Low Value Urban Feedstocks](#), Rosendahl, L.A., Cocchi, M. et al.