

The logo features a stylized orange flame on the left. To its right, the word "Heat" is written in a large, orange, cursive font. Below "Heat", the word "to" is written in a smaller, grey, sans-serif font. Below "to", the word "Fuel" is written in a large, green, cursive font.

Heat to Fuel

EXPERT WORKSHOP

Potential of Hydrothermal Liquefaction
(HTL) routes for biofuel production

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RE-CORD, Renewable energy consortium for R&D

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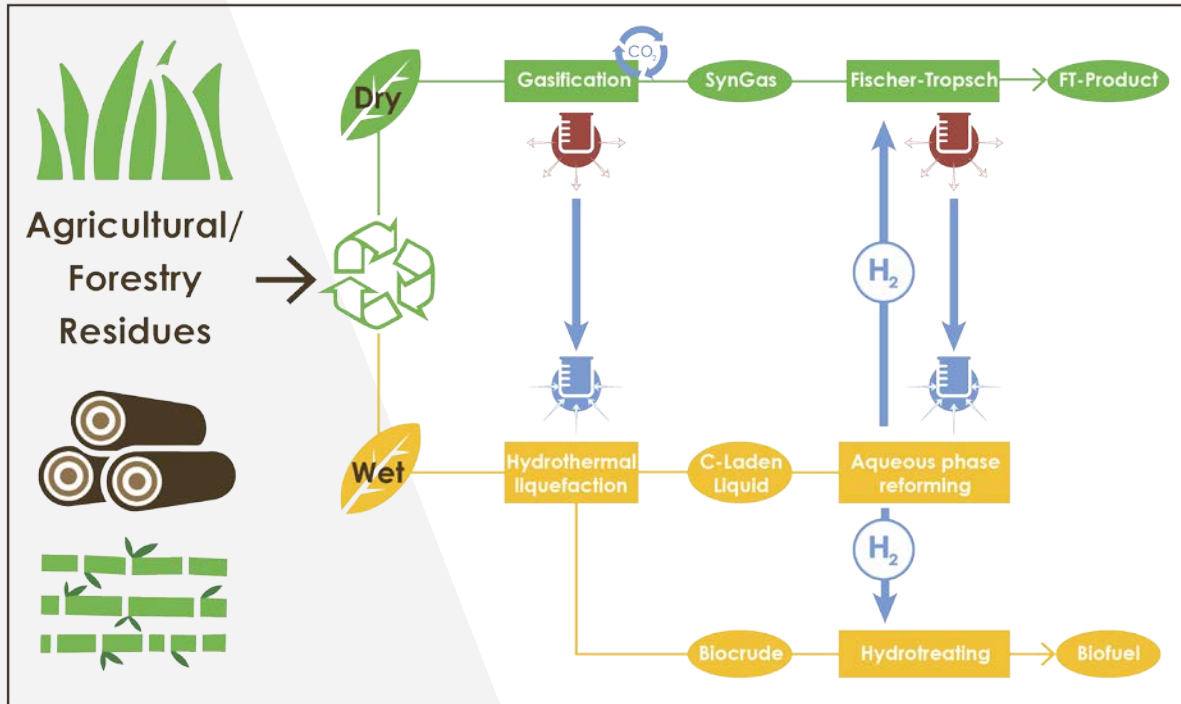


Outline of the project



Heat to Fuel concept at a glance

Project Acronym: **HtF** Project Number: **764675** Call: **H2020-LCE-2016-2017**
 Topic: **LCE-08-2016-2017** Project title: **Heat to Fuel**

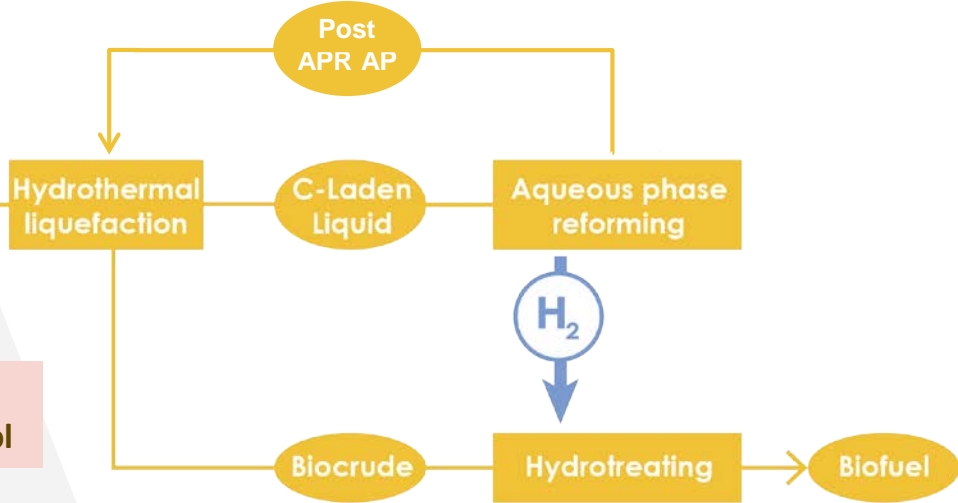


Heat to Fuel wet route: HTL + APR

- Aqueous phase management:
 - H₂ production for biocrude hydrotreating by **Aqueous Phase reforming**

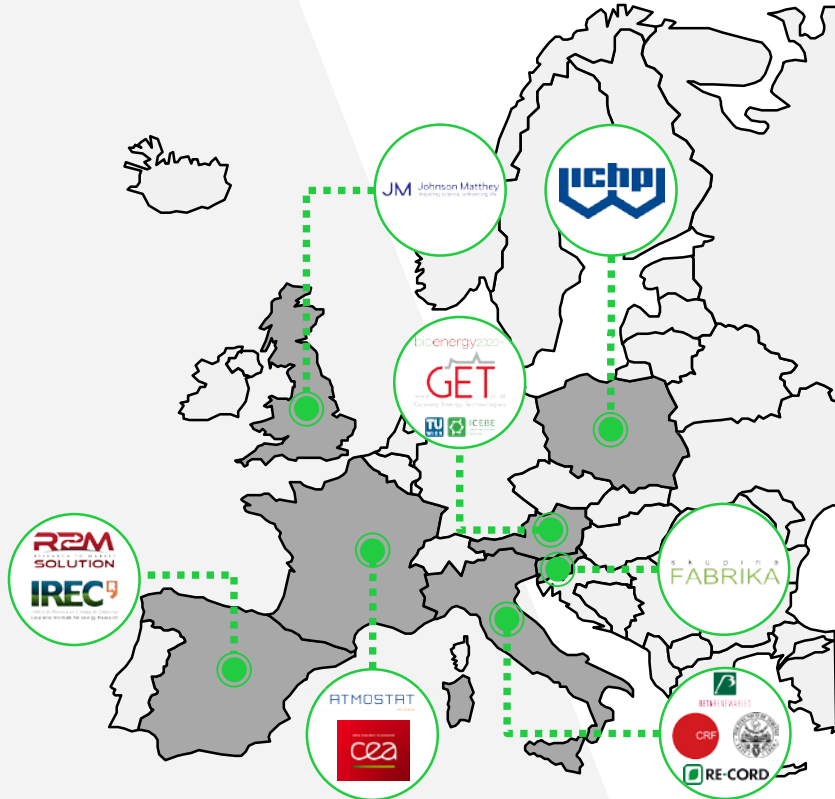


**Lignin-rich Stream (LRS)
From lignocellulosic ethanol**



- T3.3 - Lab-scale **batch HTL** studies (more than 100 exp. in a custom-made test bench and 2 collection procedures)
- T6.3 - Design and build a **continuous HTL lab-scale plant** and perform continuous HTL tests

Consortium map

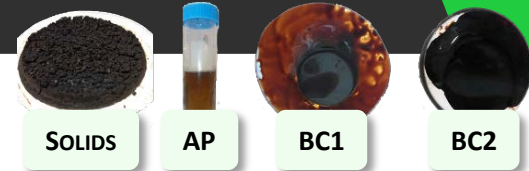


Coordinator - Güssing Energy Technologies (Austria)
Fundacio Institut de Recerca de l'Energia de Catalunya (Spain)
Consorzio per la Ricerca e la Dimostrazione sulle Energie Rinnovabili (Italy)
Commissariat à l'Énergie Atomique et aux Énergies Alternatives (France)
Johnson Matthey (UK)
Skupina Fabrika Raziskave in Razvoj (Slovenia)
Politecnico di Torino (Italy)
Technische Universität Wien (Austria)
Bioenergy 2020+ (Austria)
Instytut Chemicznej Przeróbki Węgla (Poland)
Beta Renewables (Italy)
Atmostat (France)
Centro Ricerche Fiat (Italy)
R2M Solution Spain (Spain)



*RE-CORD - Hydrothermal
liquefaction activities in HtF*

Batch exp. - HTL products distribution



SOLIDS

AP

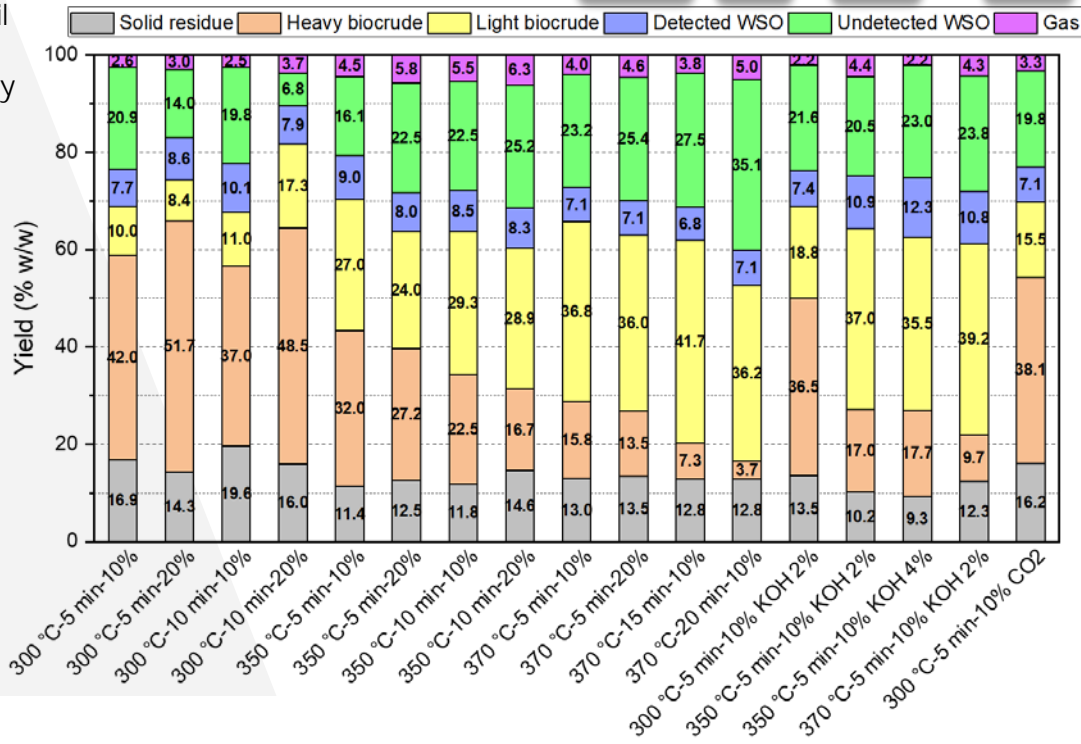
BC1

BC2

➤ Total biocrude yield from 44.1 to 65.7 wt%

➤ With severity:

- Increase of light oil (BC1)
- Decrease of heavy oil (BC2)
- Solids \approx constant



➤ Relatively low solid yields (even w/o capping agents)

Batch exp. – Biocrude characterization

LIGHT
BIOCRUDE

HEAVY
BIOCRUDE

Elemental analysis

ICP

GC-MS

GPC

FT-IR

^1H NMR

HPLC

ICP

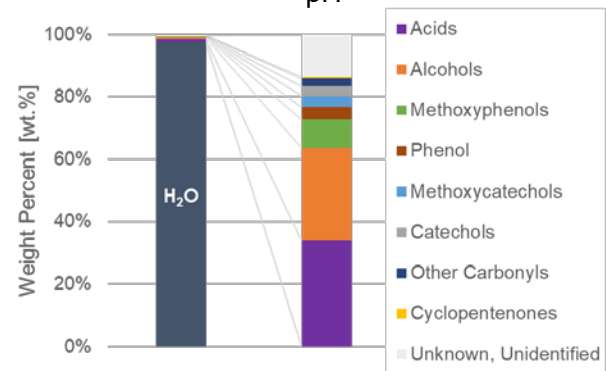
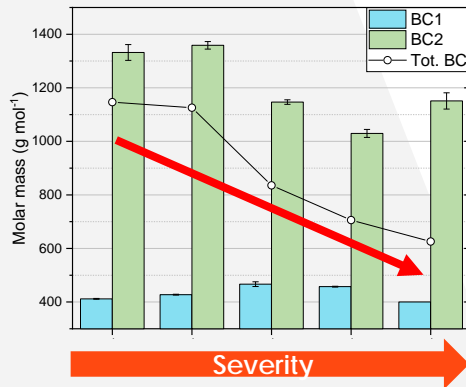
GC-MS

Karl Fischer titr.

TOC

pH

AQUEOUS PHASE



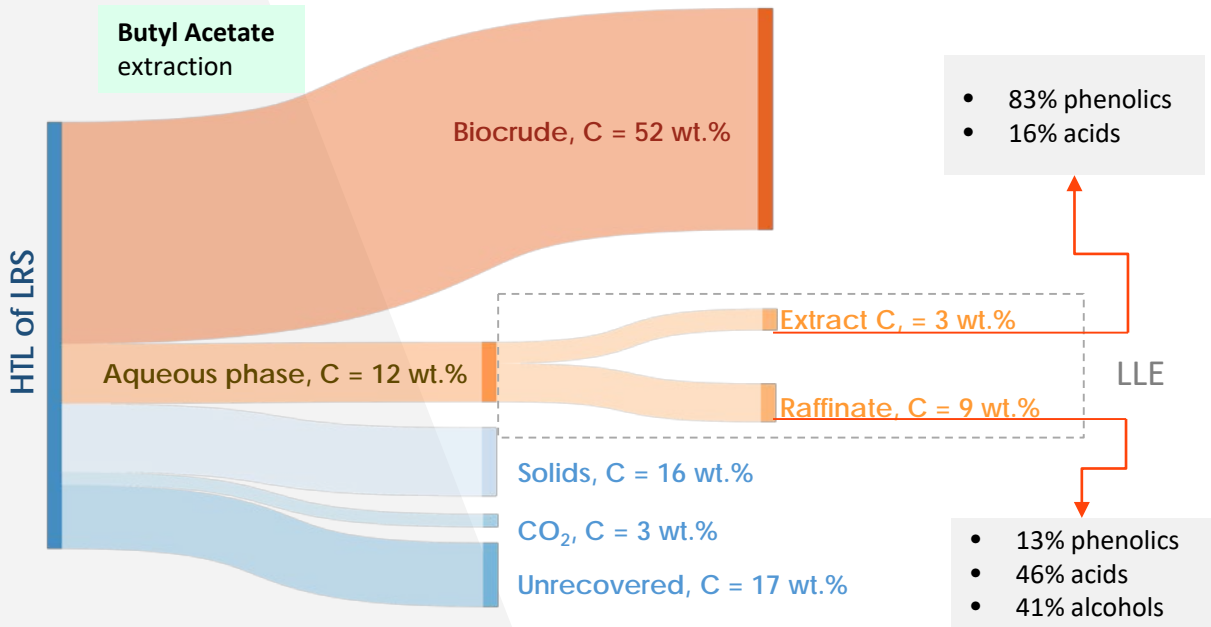
- WSO in aqueous phase mass balance closure → **83-86 %**

- Acids (34 wt.%) and Alcohols (30 wt.%)
- Phenolics (20 wt.%) and Carbonyls (3.0 wt.%)

• Biocrude was mainly composed by aromatic oxygenated compounds, originating from lignin depolymerization

Batch exp. - Liquid-liquid extraction: Carbon balance

- Liquid-Liquid Extraction (LLE) → Selective separation of phenolics compounds
 - Extract rich in phenolics: **Biocrude** yield enhancement
 - Raffinate poor in phenolics: **Aqueous Phase Reforming** (POLITO)



Construction of pilot HTL continuous plant

- Plant capacity: 1.5-2 l/h
- Residence time in the reactor: 5-25 min
- Slurry solid load: 5-10 wt%
- Commissioning in progress



THANK YOU

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