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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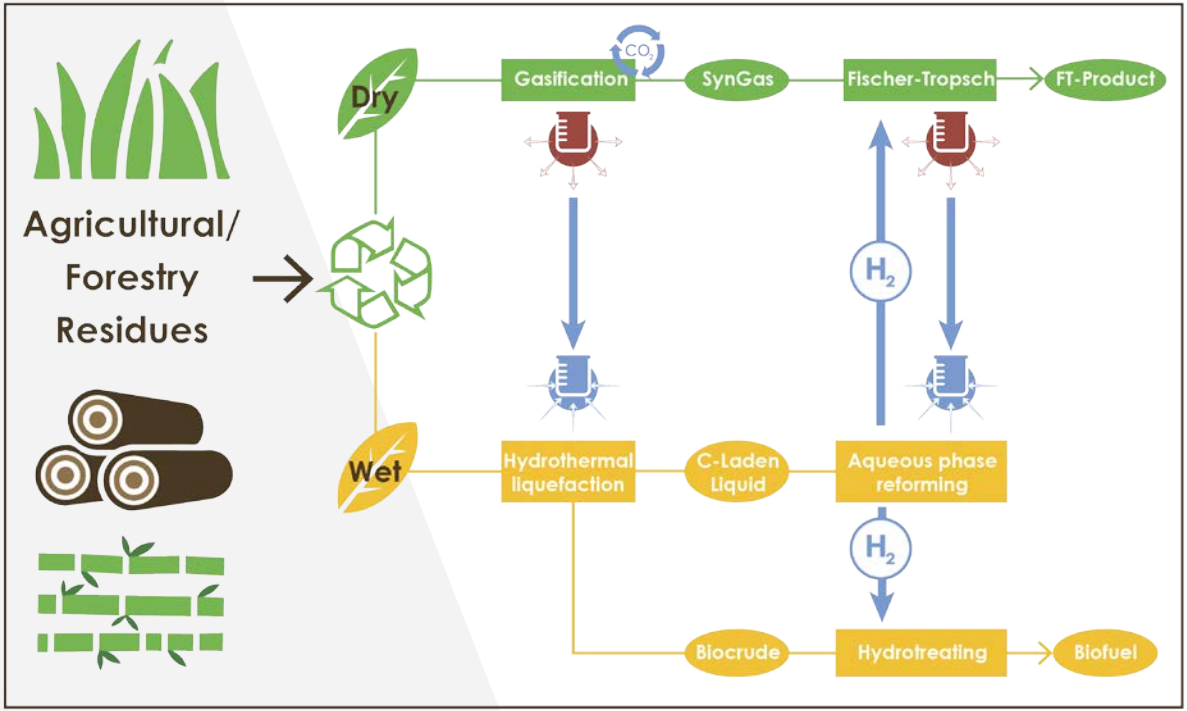
Outline of the project

Heat to Fuel concept at a glance

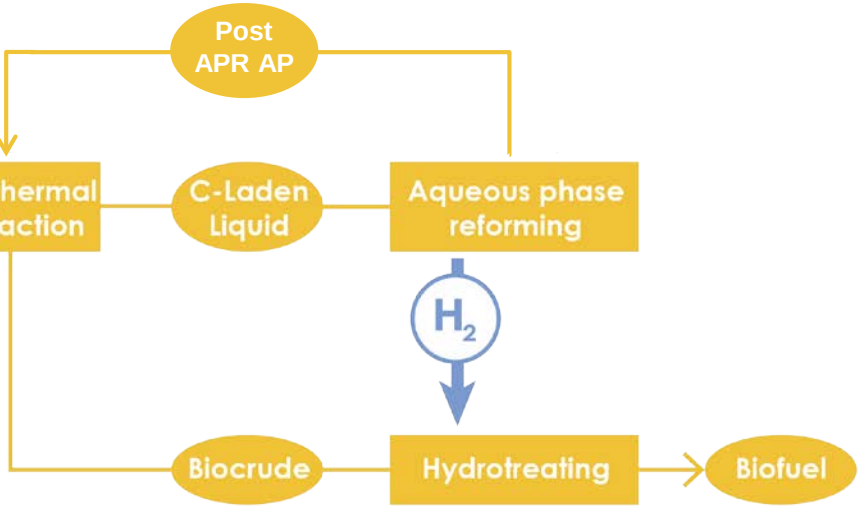
Project Acronym: **HtF** Project Number: **764675** Call: H2020-LCE-2016-2017
Topic: LCE-08-2016-2017 Project title: **Heat to Fuel**



Heat to Fuel wet route: HTL + APR

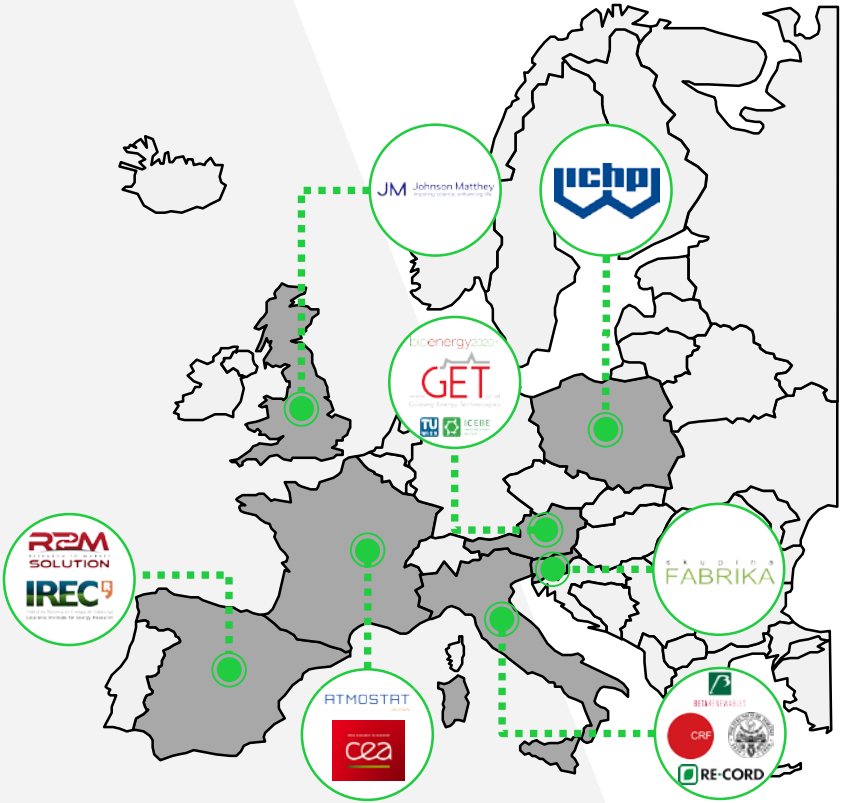
- Aqueous phase management:
  - H_2 production for biocrude hydrotreating by **Aqueous Phase reforming**

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)
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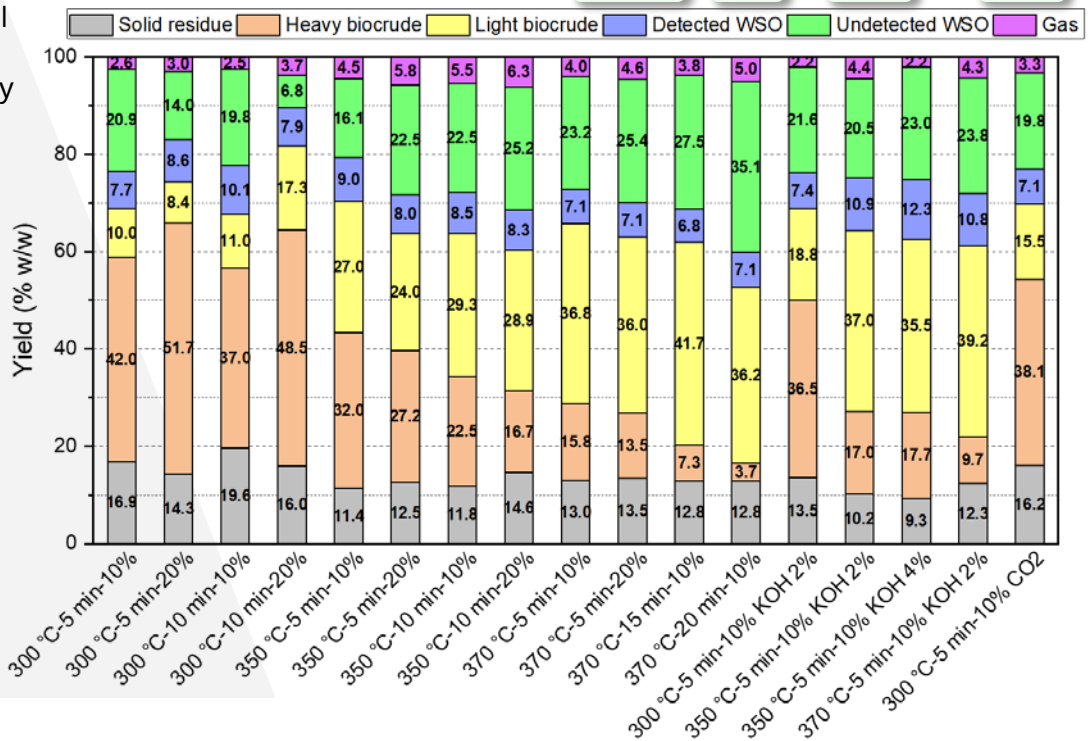
Bioenergy 2020+ (Austria)
Instytut Chemicznej Przeróbki Węgla (Poland)
~~Beta Renewables (Italy)~~
Atmostat (France)
Centro Ricerche Fiat (Italy)
R2M Solution Spain (Spain)

RE-CORD - Hydrothermal liquefaction activities in HtF

Batch exp. - HTL products distribution

- **Total biocrude** yield from 44.1 to 65.7 wt%
- With severity:
  - Increase of light oil (BC1)
  - Decrease of heavy oil (BC2)
  - Solids ≈ constant
- Relatively low solid yields (even w/o capping agents)



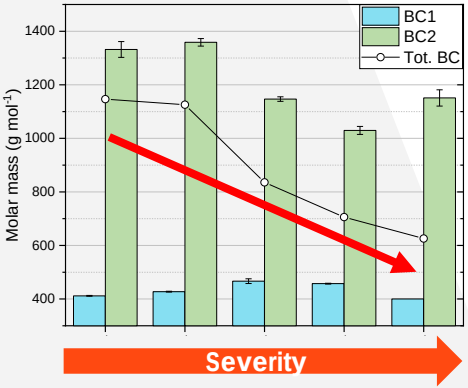
Batch exp. – Biocrude characterization

LIGHT BIOCRUDE

HEAVY BIOCRUDE

Elemental analysis

- ICP
- GC-MS
- GPC
- FT-IR
- ^{1}H NMR

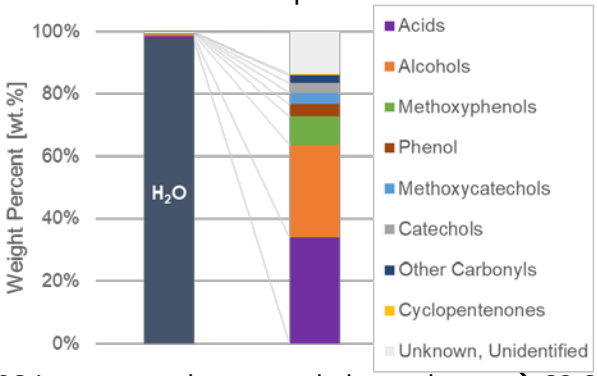


- Biocrude was mainly composed by aromatic oxygenated compounds, originating from lignin depolymerization

AQUEOUS PHASE

HPLC

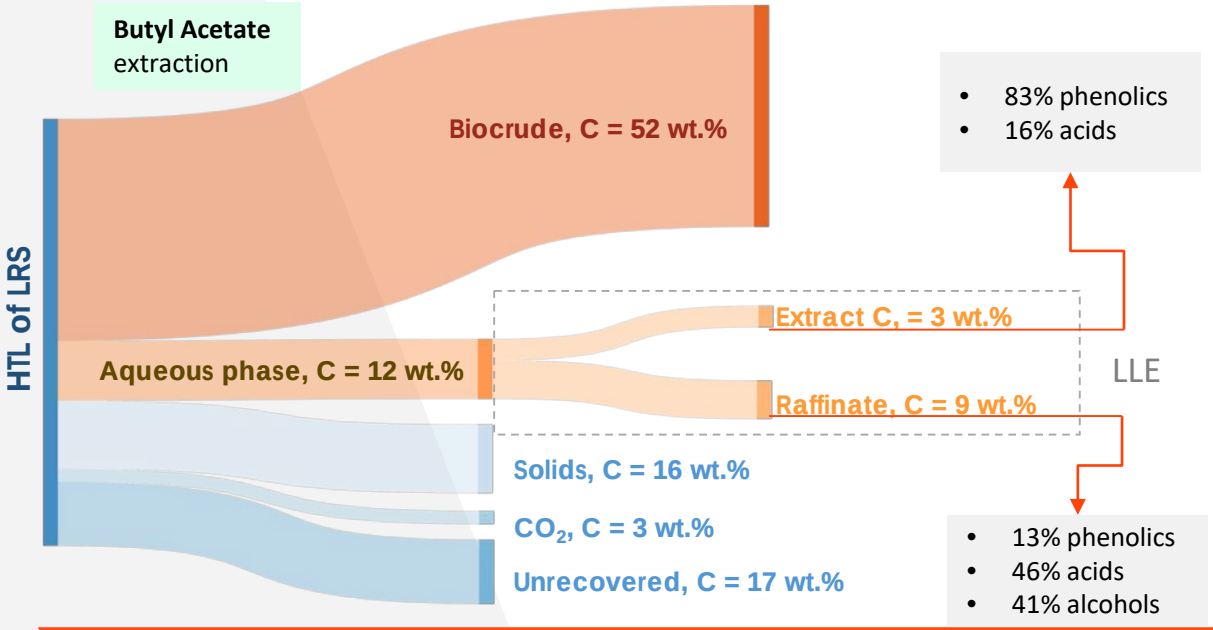
- ICP
- GC-MS
- Karl Fischer titr.
- TOC
- pH



- WSO in aqueous phase mass balance closure → **83-86 %**
  - Acids (34 wt.%) and Alcohols (30 wt.%)
  - Phenolics (20 wt.%) and Carbonyls (3.0 wt.%)

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