Advanced Biomass Catalytic Conversion to Middle Distillates in Molten Salts

Acronym: ABC-Salt

Duration: April 1st, 2018 – March 31st, 2022

Coordinator: Prof. dr. ir. H.J. Heeres

university of groningen

Partners:

Aston University Birmingham

btg biomass technology group

DLR Deutsches Zentrum für Luft- und Raumfahrt German Aerospace Center

Norwegian University of Life Sciences

RI.SE

GHENT UNIVERSITY

ayming

Centro Interuniversitario di Ricerca in Psicologia Ambientale

Sapienza Università di Roma

Project title: **Advanced Biomass Catalytic Conversion to Middle Distillates in Molten Salts**

Project Acronym: **ABC-Salt** Project Number: **764089** Call: **H2020-LCE-06-2017** Topic: **Sustainable Fuels**

Main Category of the Project: Biofuels from lignocellulosic waste stream.

TRL: 2.

Keywords: Molten salts, Biomass liquefaction, Hydropyrolysis, Hydrodeoxygenation, Biofuels.

Technological approach of the Project: Experimental research supported by system modeling on technology, environmental and social impact. The technology concept will be demonstrated in an integrated bench scale unit.

Expected Impact of the Project: Accomplish TRL 4; create and pursue new, out-of-the-box innovative ideas, to improve the conversion efficiency for sustainable fuels.

Contribution of the Project: Develop novel integrated technology for the efficient conversion of lignocellulosic waste streams to middle distillates using a unique concept. The concept will be investigated using a holistic approach, involving research activities towards a sound scientific understanding of the individual conversion steps as well as optimized process integration.

Highlights (technological): Biomass liquefaction in pumpable molten salts.
Highlights (non-technological): Summer School 2019 for Ph.D. students "Advanced thermochemical biomass conversion technologies"

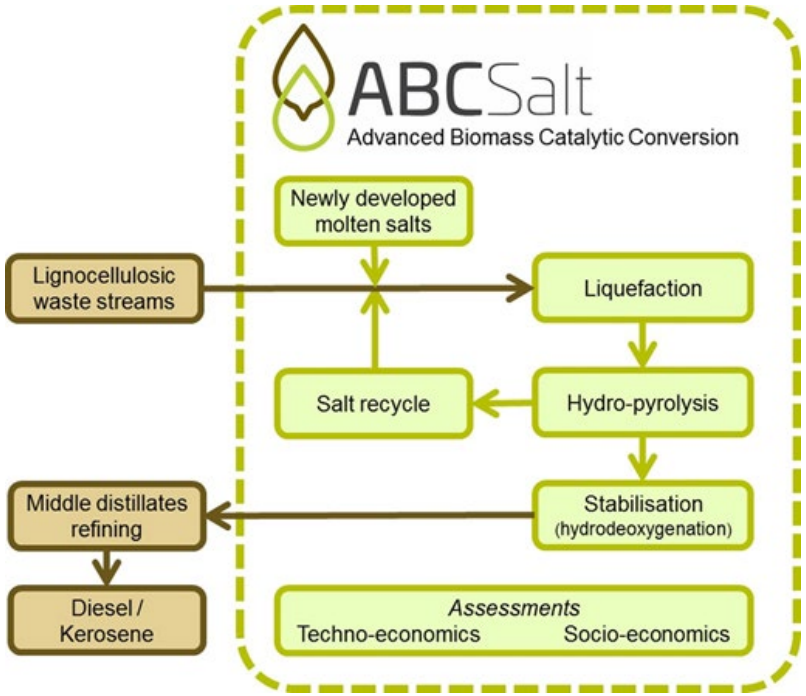
www.abc-salt.eu

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No. 764089

ABCSalt

Project Objective

Development of a novel route at **TRL level 4** to produce sustainable liquid biofuels from various lignocellulosic waste streams for the transport industry targeting a hydrocarbon yield ≥ 35 wt.% (2/3 in the middle distillates range).



Process Concept

Biomass → Biomass Liquefaction in molten salts → (Catalytic) Hydro-Pyrolysis → (Catalytic) Hydro-deoxygenation

Step 1: Dissolving biomass in novel media at ambient pressure and low temperature

Step 2: Vaporizing the biomass at elevated pressure and temperature

Step 3: Vapour-phase hydro-deoxygenation to produce middle distillates

Summer School 2019

This year the ABC-Salt consortium is organising its first Summer School:

"**Advanced thermochemical biomass conversion technologies**"

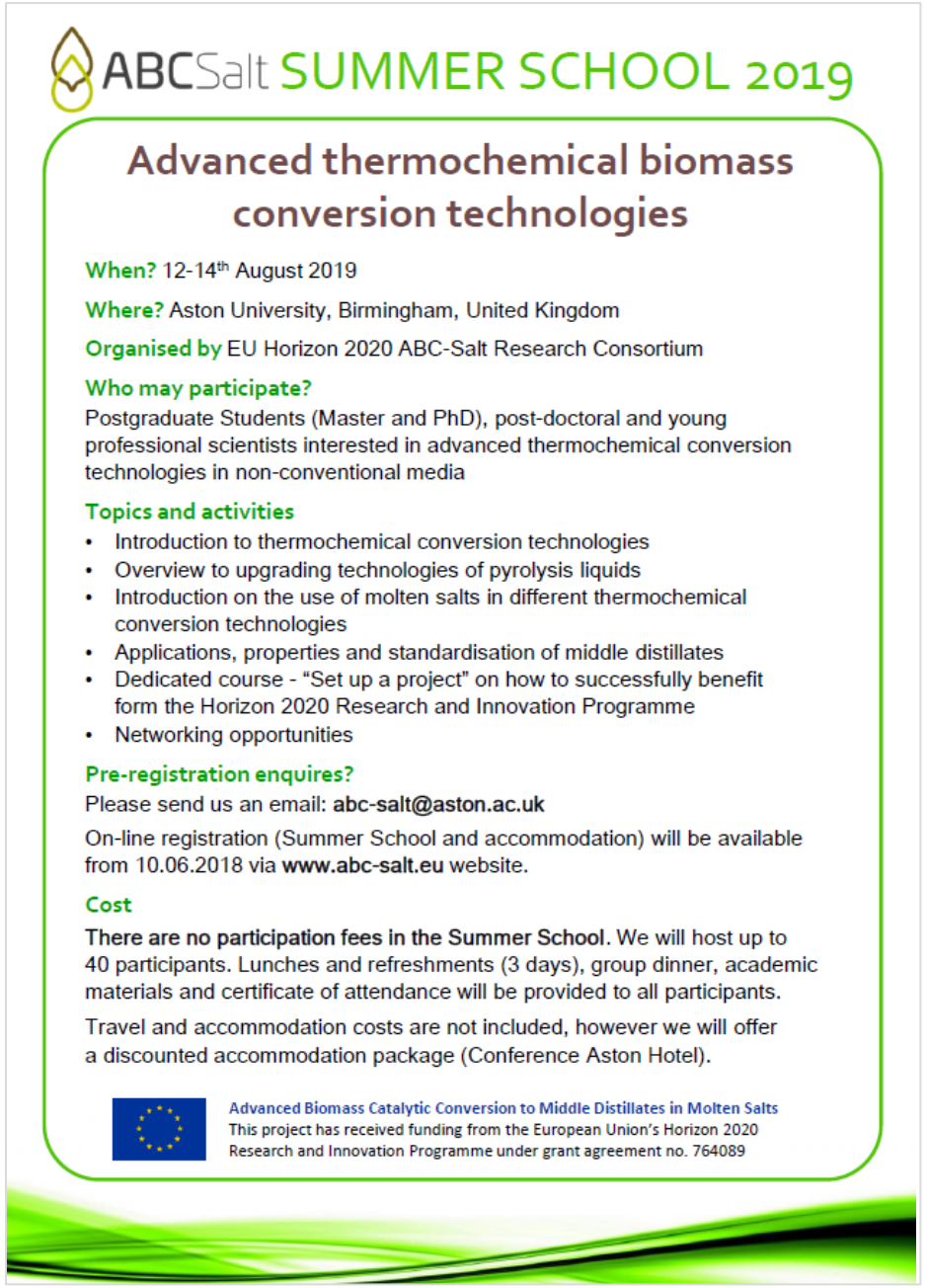
Birmingham (United Kingdom) - Aston University (Aston Conference)

12-14th August 2019

40 participants (young researchers and professionals)

Main topics and activities will include:

- Introduction to thermochemical conversion technologies
- Overview to upgrading technologies of pyrolysis liquids
- Introduction on the use of molten salts in different thermochemical conversion technologies
- Applications, properties and standardisation of middle distillates
- Networking opportunities (mini-conference and poster presentations by Summer School attendees)
- Dedicated course - "Set up a project" (MSCA, ERASMUS or ERC) on how to successfully exploit Horizon 2020 Research and Innovation Programme with winning proposals



ADVANCEFUEL

Paving the way towards clean energy and fuels in Europe

Advanced Biofuels and Renewable fuels

Kristin Sternberg

FNR

Congress Center CCL Lisbon 29th May 2019

OBJECTIVES

ADVANCEFUEL will generate **new knowledge, tools, standards and recommendations** aiming to overcome barriers to the commercialisation of advanced renewable transport fuels. Investigations will include the **entire value chain**, including

- (lignocellulosic-based) Biomass availability;
- Biofuels conversion processes and technologies;
- Advanced biofuels sustainability;
- End-use and social acceptance.

To build and validate their results, ADVANCEFUEL partners will **engage stakeholders** from the biofuels value-chain and support actors to participate in the project through consultations, dedicated workshops and the ADVANCEFUEl **Stakeholder Platform (www.advancefuel.eu)**

Duration: 09/2017– 08/2020

Funding: Horizon 2020

Partner countries: DE, NL, BE, GB, SE, FI

Coordinator: FNR

Coordination of scientific content: ECN, TNO

ATB, Greenovate! Europe, Imperial College London, Vance, Aalto University, Universiteit Utrecht

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.° 764799.

Project Acronym: **ADVANCEFUEL** Project Number:764799 Call: H2020-LCE-2017-RES-CSA
Topic: LCE-21-2017-Market uptake of renewable energy technology
Project title: Facilitating market roll-out of RESfuels in the transport sector to 2030 and beyond

Main Category of the Project: Removing Barriers to Renewable Transport Fuels **TRL: 6-9**
Keywords: Biomass supply, conversion and technology upscaling, sustainability, Market analysis, advanced liquid biofuels
Technological approach of the Project: Coordination & Support Action
Expected Impact of the Project: To increase the share of sustainable advanced biofuels and renewable alternative fuels in the final EU transport sector or facilitate those increases in the future. In addition, contribution to market understanding for possible policy and regulatory development is anticipated.
Highlights (technological/non-technological): Advanced biofuels Key Performance Indicators monitoring tool to follow the progress in biofuels' market uptake; Supply chain analysis tool, to assess the social, economic and environmental performances of biofuels supply chains; Technology assessment tool with a roadmap for development and innovation; Numerical tool for prediction of fuel performance and fuel blend properties. ADVANCEFUEL addresses the whole value chain aiming at accelerating the market roll-out of RESfuels via four main guiding ideas: Engagement of key players during the development of supporting guidelines & tools, Support to decision makers by providing tools and recommendations based on validated R&I results, Modeling and assessment of useful scenarios and sensitivity analyses on the future of RESfuels, Communication displaying positive message on sustainability of RESfuels aiming to increase demand and public acceptance.
What is needed in future: The development of a set of innovative schemes and Best Practice scenarios that will be translated into a toolset, which is practicable for relevant stakeholders to assess the performance of different approaches for increasing the use of RESfuels. A complete overview of the possible future of RESfuels that includes impacts of innovation cases will also be established.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No764799

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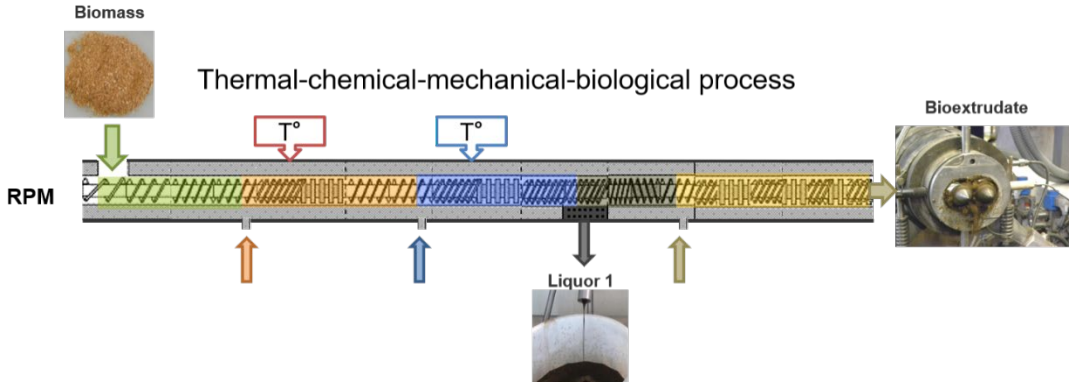
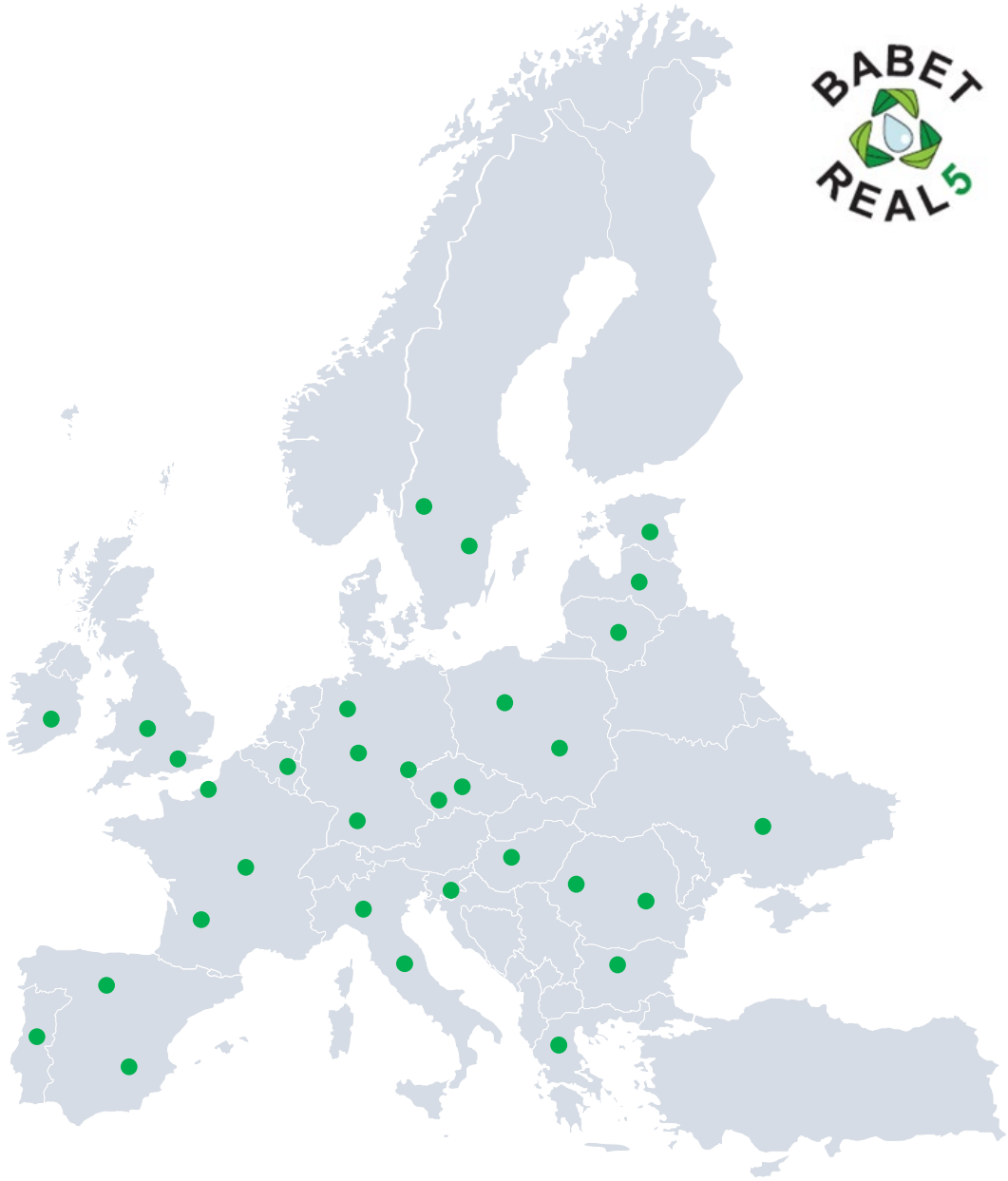
Talks with research, industry and EU Member States on bioenergy, advanced biofuels and renewable fuels

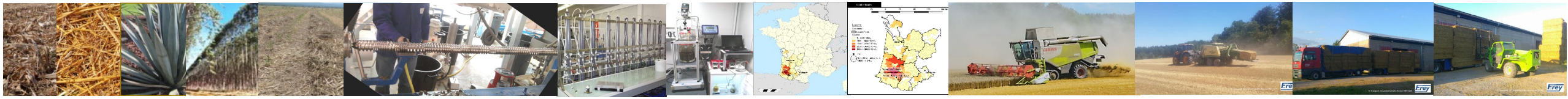
Novel technological approach



Working Groups

- **Development of new pretreatment and bioconversion processes (lab– and pilot-scale)**
- **Valorisation of sub-products of the bio-ethanol production via Anaerobic Digestion**
- **Techno-economical and ecologic evaluation of small-scale plant processing 30,000 t dm per year**
- **Identification and selection of sustainable lignocellulosic biomass for business cases**
- **Business case studies and elaboration of business plans in 4 countries: France, Germany, Argentina & Uruguay**





Project Acronym: **BABET-REAL5** Project Number: 654365 Call: H2020-LCE-2014-2015/H2020-LCE-2015-1-two-stage Topic: Research and Innovation action

Project title: **New technology and strategy for a large and sustainable deployment of second generation biofuel in rural areas**

Main Category of the Project: Biofuel

TRL: 5

Keywords: Bioenergy, Transport biofuels, Biofuels

Technological approach of the Project: 2nd generation bioethanol production from a new biomass pretreatment technology and with a small-scale industrial plant business model

Expected Impact of the Project: Deployment of sustainable 2nd generation bioethanol plants in rural areas and achieve the targets for more advanced biofuel in the EU and worldwide

Highlights (technological/non-technological): high throughput and compact technology (2 steps from biomass pretreatment to fermentation); valorisation of the liquors (by-products) for the production of biomethane (100% of the organic matter converted to biofuel); lignocellulosic biomass feedstock investigation in 4 countries (Europe and South-America)

What is needed in future: technological progress, stable political conditions, realistic economical frameworks

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No *654365*

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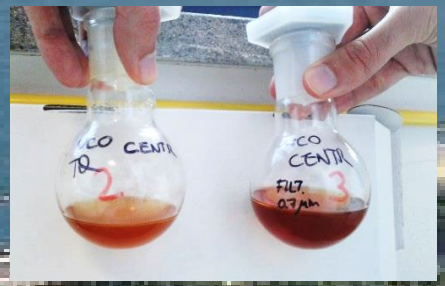
Bio4A
Advanced Sustainable Biofuels for Aviation

Residual lipids to SAF (Industrial scale)



Camelina oil from recovered EU MED marginal soil with biochar

Residual biomass (agri-woody)

CARBONIZATION (Innovative Oxidative Slow Pyrolysis System)

Biochar & Compost (COMBI)

ENERGY

INCREASED SOIL RESILIENCE TO CLIMATE CHANGE
→ SUSTAINABLE AGRICULTURE
High-added Value Agriculture
Drought Resistant Crops

CAMELINA oil

SAF Biojet

Project Acronym: **BIO4A** Project Number: **789562** Call: LCE-20-2016-2017 Topic: Aviation Biofuels

Project title: **Advanced sustainable BIOfuels for Aviation**

Main Category of the Project: Biofuel

TRL: 6-7 (end of the project)

Keywords: Sustainable Aviation Biofuels, HEFA, Marginal Land, Biochar

Technological approach of the Project: 1) HEFA production at full commercial scale in new plant using residual lipids (UCO); **2)** R&D on **sustainable feedstocks in biochar-recovered EU MED marginal land for drought resistant crop production**; **3) Test of the entire chain and logistic at industrial scale (5 kt)**, and **assess environmental performances**.

Expected Impact of the Project: respond to the EU FlightPath objectives for commercial deployment of aviation biofuels and the **2 million tons** aviation biofuel target by 2020. **Positive energy and GHG balances**. Demonstrated industrial concepts ensuring the techno-economic feasibility of the entire value chain. Significant **social and economic** impact.

Highlights (technological/non-technological): New Aviation Biofuel plant producing HEFA (hundreds thousands t/y capacity) in non-segregated mode, and use in commercial flights. Camelina production in EU MED marginal land recovered by biochar/compost addition and scenario analysis. Dedicated Dissemination, Communication and Exploitation action

What is needed in future: Supply of **sustainable lipids**, adequate and coordinated **policies**.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No *789562*

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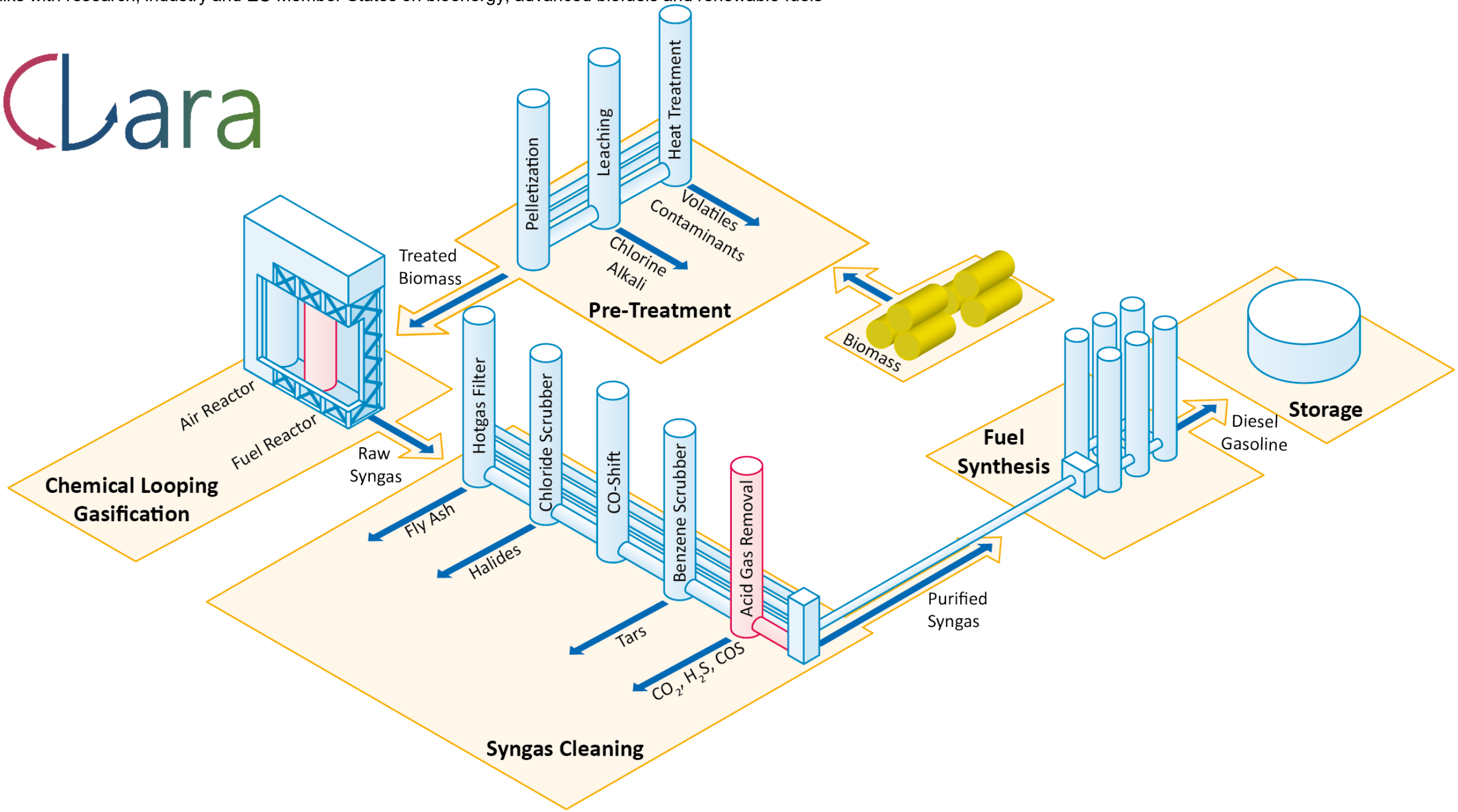


Project Acronym: CLARA Project Number: SEP-210486610
Call: H2020-LC-SC3-2018-2019-2020 Topic: LC-SC3-RES-21-2018
Project title: Chemical Looping gAsification foR sustainAble production of biofuels (CLARA)

Main Category of the Project: Biofuel **TRL:** Current: 3, Project Goal: 5-6

Keywords: Chemical Looping Gasification (CLG), Syngas Purification, Full Process Chain, Pilot Scale (1 MW_{th})

Technological approach of the Project:
- develop and test selected innovative technologies:
  - Chemical looping gasification of biomass in dual connected fluidized bed reactor system
  - Syngas purification using a novel cleaning technology and subsequent fuel synthesis
- demonstrate and assess the full process chain of biofuel production in pilot scale (1 MW_{th})

Expected Impact of the Project:
- significant reduction in biofuel production costs compared to state-of-the-art technologies (0.70 €/L)
- alleviation of negative impacts on environment (e.g. GHG emission, pollution, land use)

Highlights (technological/non-technological):
- de-carbonization of fuel & chemical industry
- facilitation of net-negative CO_2 emissions (BECCS/U)

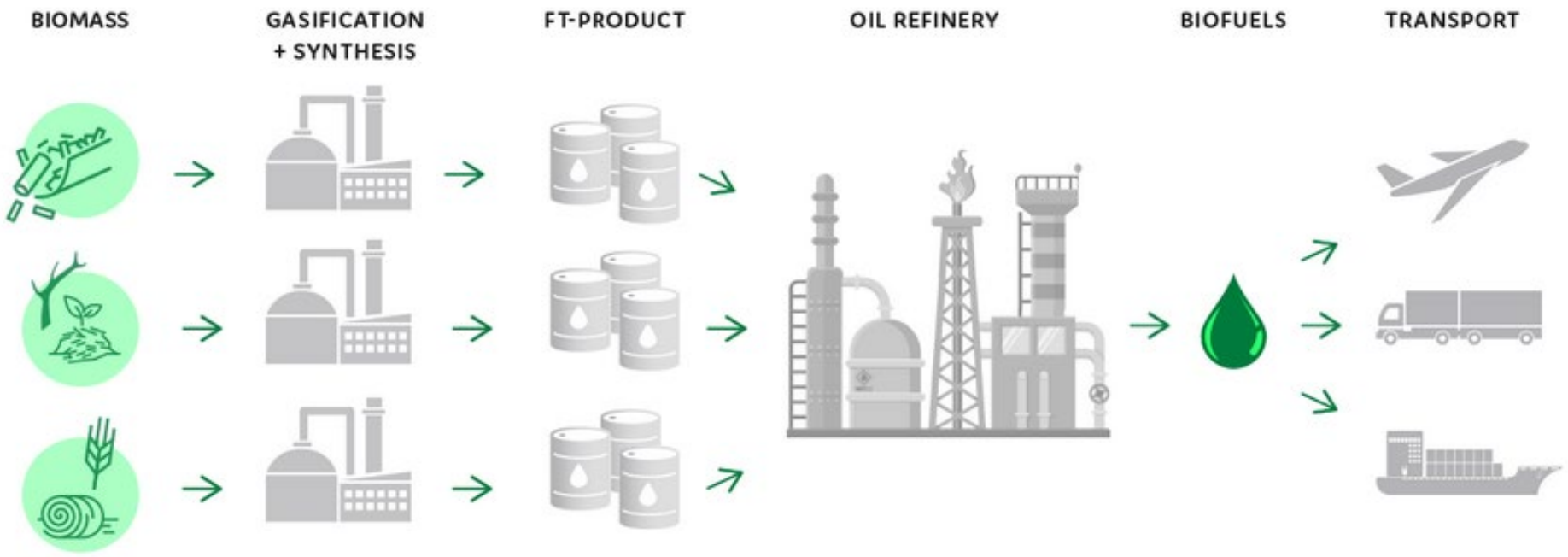
What is needed in future:
- political framework encouraging scale-up to industrial scale
- Full implementation in industrial scale

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No *817841*

COMSYN

www.comsynproject.eu

Compact Gasification and Synthesis process for Transport Fuels



PROJECT FACTS

2017 – 2021

7 partners

5.1 M€ budget

3 pilot campaigns from biomass to biofuels

~200 - 400 kg of biofuels produced for research and demonstration.

Decentralized primary conversion of biomass in 30 – 150 MW units.

Technology development for primary conversion, Fischer-Tropsch synthesis and oil refinery feeding systems.

Target reduction of the biofuel production cost is up to 35% compared to alternative routes.
=> Less than 0.80 €/l production cost for diesel.

Project Acronym: **COMSYN** Project Number: **727476** Call: **H2020-LCE-2016-RES-CCS-RIA**
Topic: **LCE-08-2016-2017 Development of next generation biofuel technologies**
Project title: **Compact Gasification and Synthesis process for Transport Fuels**

Main Category of the Project: Biofuel **TRL:** 4-5
Keywords: Biodiesel, biogasoline, biomass, gasification, gas cleaning, Fischer-Tropsch synthesis

Technological approach of the Project: Develop a concept for competitive bio-based fuels by means of a compact gasification and synthesis process. The concept is based on conversion of diverse biomass residues to liquid intermediate products at 30–150 MW (biomass feed) units located close to distributed biomass resources. Subsequent product upgrading in central refineries is investigated and designed for future roll out.

Expected Impact of the Project: Improvement of economic, environmental and social benefits of biofuels; optimization of energy and GHG balances; significant cost reduction; ensured secure and affordable energy supply using diversified, cheap feedstock; enhance Europe's competitiveness.

Highlights (technological/non-technological): The syngas cleaning efficiency is improved by developing filtration, reforming and sulfur removal technologies. The synthesis process utilizes an advanced Fischer-Tropsch reactor, specially designed for decentralized biofuel production.

What is needed in future: Renewable fuel technologies that are suitable for different European locations, biomass feedstocks and weather conditions. Technologies should be easy to implement into current systems to allow quick commercialization. Public funding is needed to cover the gap between TRL 6 and 8.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727476.

COMSYN
www.comsynproject.eu

Compact Gasification and Synthesis

Project tasks and responsibilities

DFB PILOT @ VTT

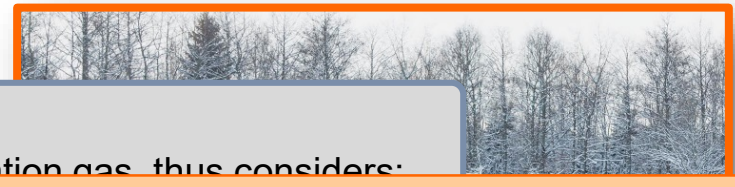
DFB Gasifier
- Finalized: 2015
- Biomass feed: ca. 50 kg/h
- Gasifier temperature: 750 – 820 °C
- Oxidizer temperature: ca. 900 °C
- Bed material: Dolomite/sand mixture

VTT

Ultracleaning concept:
- Specifically for biomass-based gasification gas, thus considers:
  - Low to medium sulphur c
  - Residual hydrocarbons (t
- Wet scrubbing acid gas proces
  - Simpler dry bed desulphu
  - No removal of CO_2 or par
  pressure water scrubbing

VTT

MOBILE SYNTHESIS UNIT



Fischer-Tropsch microreactor*:
- Compact and modula
- High efficiencies
- Load flexible

INERAT

Product upgrading
- Co-processesing of FT-waxes or
- Stand-alone treatment
(incl. a new hydroisomerisation unit)

UniCRE

DFB GASIFIER → FILTER → REFORMER → ULTRACLEANING STEPS → FISCHER-TROPSCH SYNTHESIS → Product Upgrading

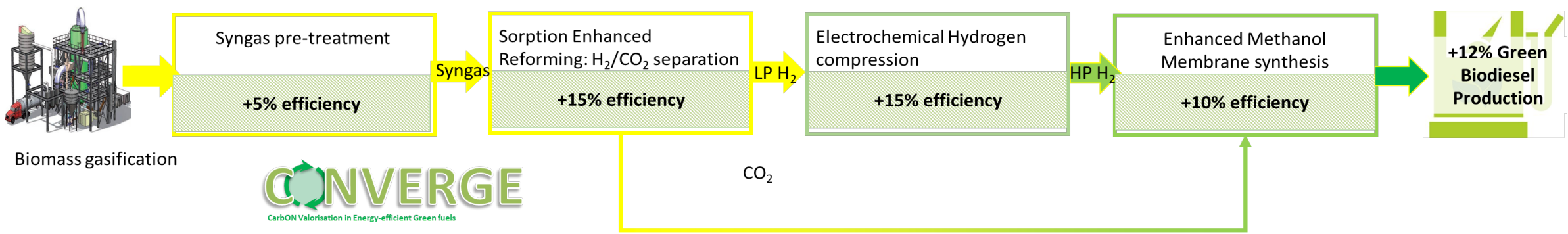
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727476.

CONVERGE

CarbON Valorisation in Energy-efficient Green fuels

The **CONVERGE project will validate an innovative process** which will **increase the biodiesel production by 12%** per secondary biomass unit used and **reduce the CAPEX by 10%**

The **CONVERGE technologies will be validated** for more than **2000 cumulated hours** taking these from the discovery stage (TRL3) to development stage (TRL5).



The project started 7 months ago on November 1st 2018 and will last for 42 months

Project Acronym: **CONVERGE** Project Number: **818135** Call: LC-SC3-2018-RES Topic: LC-SC3-RES-21-2018

Project title: CARBON VALORISATION IN ENERGY-EFFICIENT GREEN FUELS

Main Category of the Project: Biofuel

TRL: 5

Keywords: biodiesel, green methanol, CO2 negative emissions, process intensification

Technological approach of the Project: The CONVERGE project will demonstrate 5 unit operations in 3 grouped processing steps (pre-processing, valorization & enhanced methanol), taking these new combinations from the discovery stage (TRL3) to development stage (TRL5).

Expected Impact of the Project: The combination of these technologies will increase the biodiesel production from secondary biomass by 12% together with biodiesel production will be reduced by up to 2100 M€ across Europe.

Highlights (technological/non-technological):
Validation of the technologies for more than 2000 hours
Process optimization accounting for energy, economic, environmental and societal aspects.
Identification of the secondary biomass supply chain for four different geographical regions

What is needed in future: Higher TRL project and favorable regulatory framework

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No *818135*

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FLExible Dimethyl ether production from biomass Gasification with sorption enhancED processes

DEMONSTRATION AT TRL5:

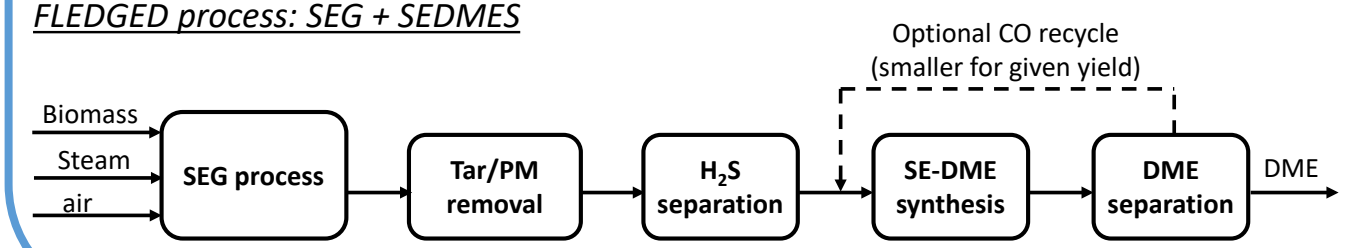
Flexible sorption enhanced gasification (SEG) process

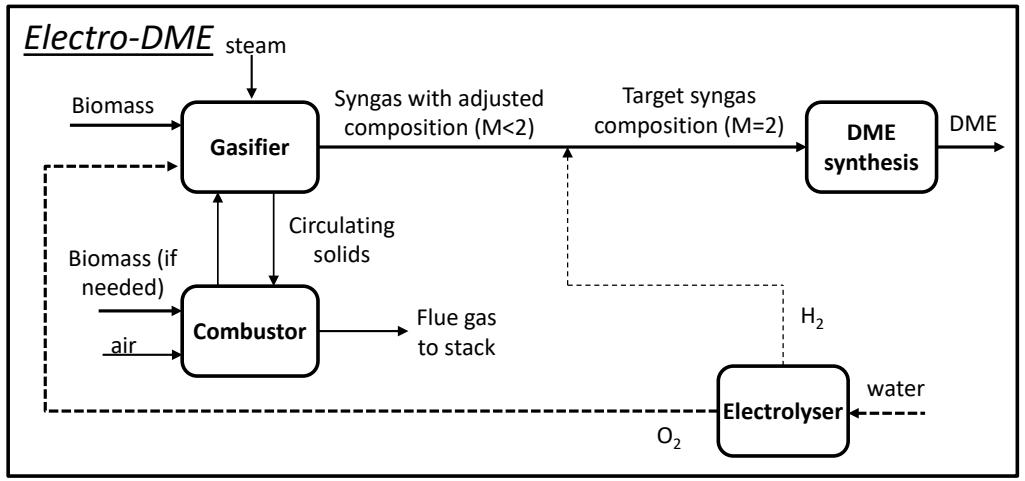
+

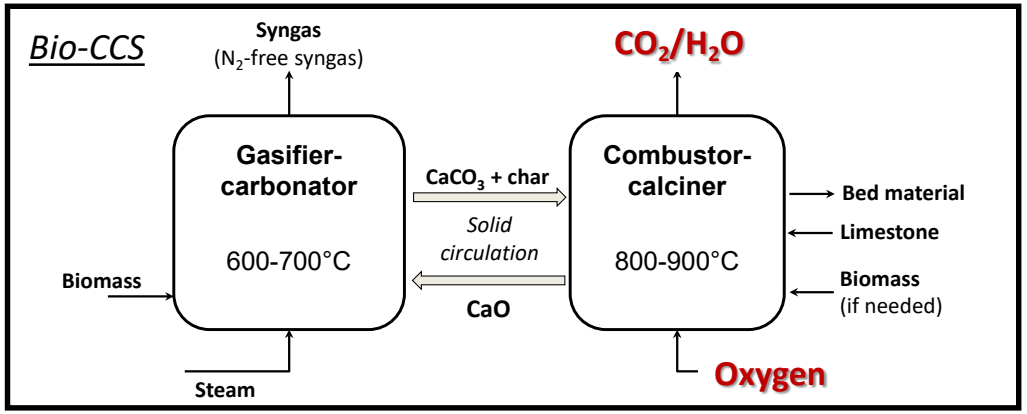
Sorption enhanced DME synthesis (SEDMES) process

- Process intensification
- Efficiency improvements
- Cost reductions
- Process flexibility

FLEDGED process: SEG + SEDMES







Project Acronym: **FLEDGED** Project Number: **727600** Call: LCE-2016-RES-CCS-RIA Topic: LCE-08-2016-17

Project title: **FLExible Dimethyl ether production from biomass Gasification with sorption enhancED processes**

Main Category of the Project: Biofuel

TRL: 5

Keywords: Gasification, DME, Flexibility, Power-to-X, Bio-CCS

Technological approach of the Project: FLEDGED project aims at developing sorption enhanced gasification (SEG) and sorption enhanced DME synthesis (SEDMES), leading to a new intensified process with high efficiency, improved flexibility and economically competitive.

Expected Impact of the Project: Decarbonization of the transport sector: provision of renewable transportation fuel with possible negative WTW CO_2 emissions (if coupled with CCS) and favoring diffusion of intermittent electric renewables thanks to power to liquid conversion (electrofuels).

Highlights (technological/non-technological):

- TRL5 demonstration of two key sorption-enhanced processes for biomass gasification and DME synthesis
- Overall process characterized by process intensification and flexibility in feedstock and operation.
- Thermodynamic and economic analysis, WTW LCA, risk analysis, socio-economic analysis.

What is needed in future: Large scale demonstration projects and favorable regulatory framework

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727600

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project FLEXJET

Sustainable Jet Fuel from Flexible Waste Biomass

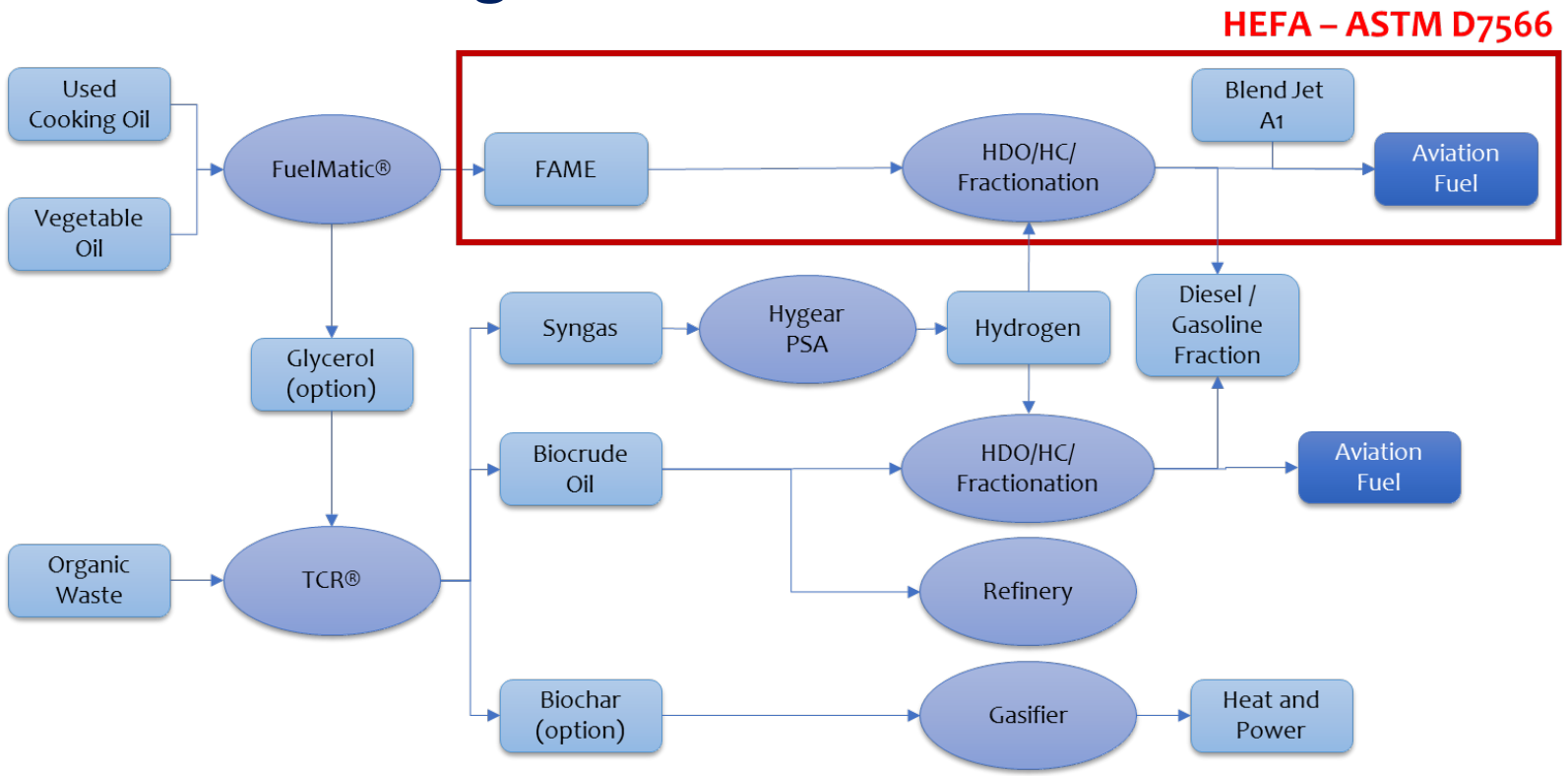
Project overview

- Total costs: 15 M Euro
- EU financing: 10 M Euro
- H2020 LCE-20 Programme
- Duration: 48 Months (2018-2022)
- 13 partners from 5 EU countries

Aim

To build a **pre-commercial demonstration plant** for the production of **SAF** derived **from food waste** and **waste vegetable oil** while mapping the full **economic, social** and **environmental** impact of the technology.

Process Flow Diagram



Kick –off	Plant Design	Demo Plant	SAF Delivery	End of Project
April 2018	Mid 2019	Mid 2020	End 2021	Mid 2022

Project Acronym: **flexJET** Project Number: **792216** Call: **H2020-LCE-2017-RES-IA**
Topic: **LCE-20-2016-2017** Enabling pre-commercial production of advanced aviation biofuel
Project title: **Sustainable Jet Fuel from Flexible Waste Biomass**

Main Category of the Project: Biofuel **TRL:** 5-6

Keywords: Sustainable transport - general, Bioenergy, Transport biofuels, Fuel Production & Distribution

Technological approach of the Project: "Sustainable Aviation through Biofuel Refining" (SABR) process from Green Fuels Research (UCO to SAF) combined to the "Thermo-Catalytic Reforming" (TCR®) technology from Susteen Technologies (organic waste to biocrude oil, syngas and biochar). The hydrogen required for the refining steps will be separated from the syngas (an output of the TCR process) using a Pressure Swing Adsorption (PSA) from Hygear.

Expected Impact of the Project: To enable commercial availability of jet fuel at large scale, producing fossil jet fuel substitute at a competitive cost in accordance to the international standards (ASTM).
Plant demonstration scale by 2020 and SAF produced by 2022.
Direct Impacts: GHG reduction, destination for waste biomass and UCO, decarbonisation of different sectors, jobs creation, innovation potential.

Highlights (technological/non-technological): High feedstock flexibility, green Hydrogen, side and end products flexibility, highly scalable (small scale decentralised facilities can be built), it can be integrated into existing infrastructure.

What is needed in future: Testing other feedstocks at this scale, certification of the TCR route, commercial plant.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 792216

MACROFUELS

MacroFuels

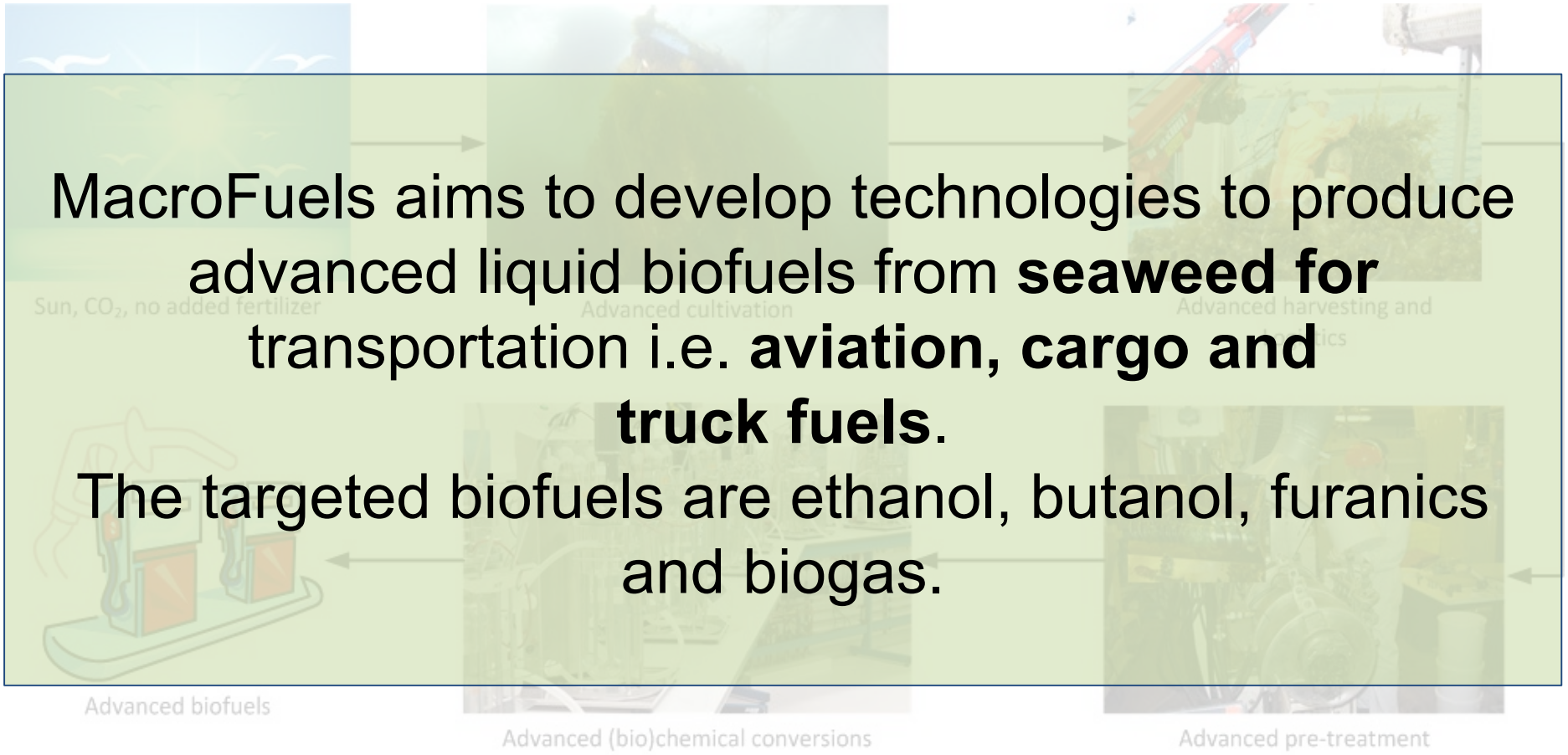
Presenter: Jaap Kiel (ECN part of TNO)

Lisbon 29/5/2019

Main Objective

MacroFuels aims to develop technologies to produce advanced liquid biofuels from **seaweed for transportation i.e. aviation, cargo and truck fuels**.

The targeted biofuels are ethanol, butanol, furanics and biogas.



MacroFuels seaweed to biofuels chain

Sun, CO_2, no added fertilizer

Advanced cultivation

Advanced harvesting and Logistics

Advanced pre-treatment

Advanced (bio)chemical conversions

Advanced biofuels

Fuel test on the way…

TEKNOLOGISK INSTITUT

MACROFUELS

PSA 1.6 HDI
Furanic fuels
Engine available

VW 1.4 TSI
ABE & Ethanol
New Engine Purchased

Real Drive Emission
All fuels
PEMS equip. available

Engine dynamometer bench-test

On-road test

Acknowledgement

This presentation is part of the MacroFuels project. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654010

macrofuels@dti.dk

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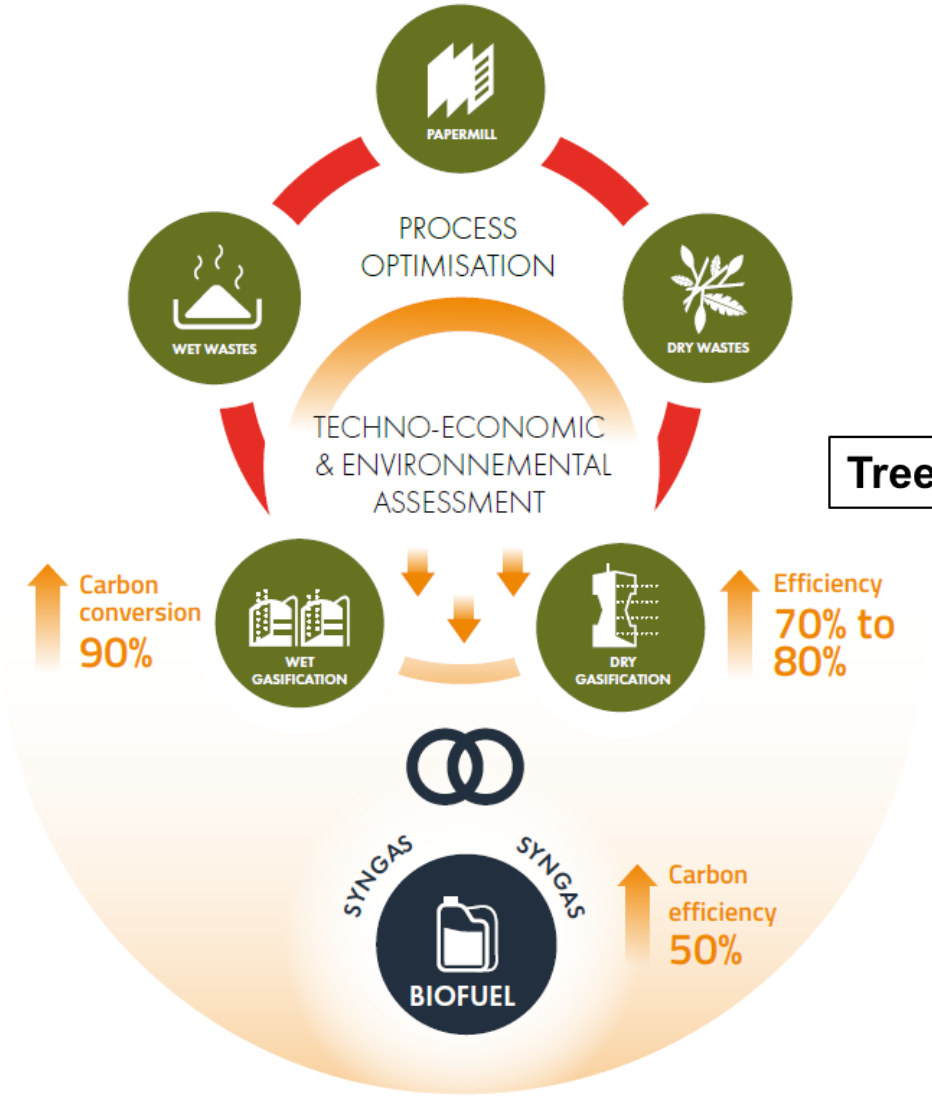
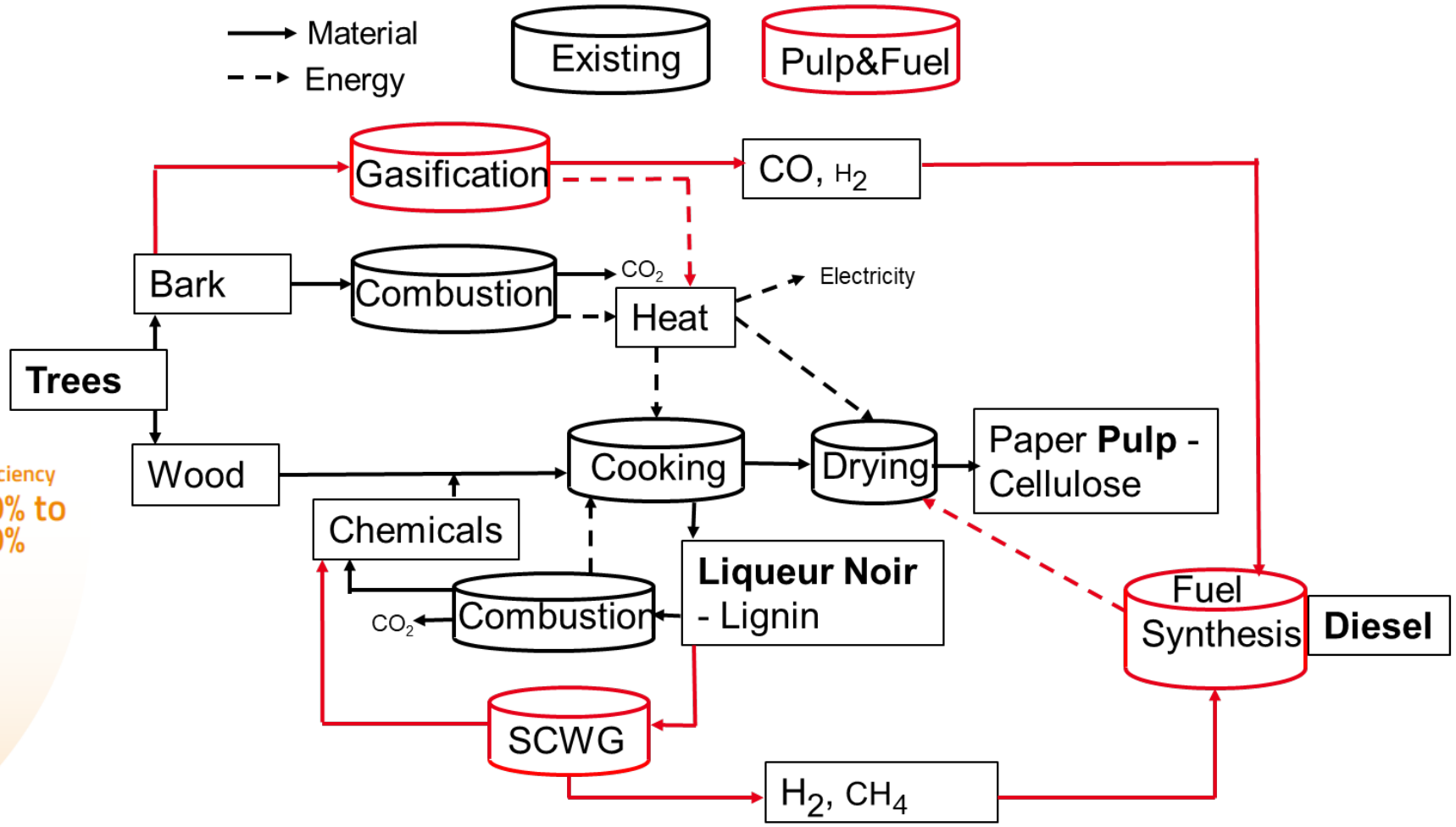




Project Acronym: **Pulp&Fuel** Project Number: **818011** Call: H2020-RES21 Topic: LC-SC3-RES-21-2018

Project title: **Pulp and paper industry waste to fuel**

Main Category of the Project: Biofuel

TRL: 3->5

Keywords: Biogenic wastes, Gasification, Fischer-Tropsch

Technological approach of the Project: The project studies the integration of gasification and fuel synthesis technologies into the pulp industry. The project will show how biofuels can be a side product of the paper industry creating synergy with the existing process.

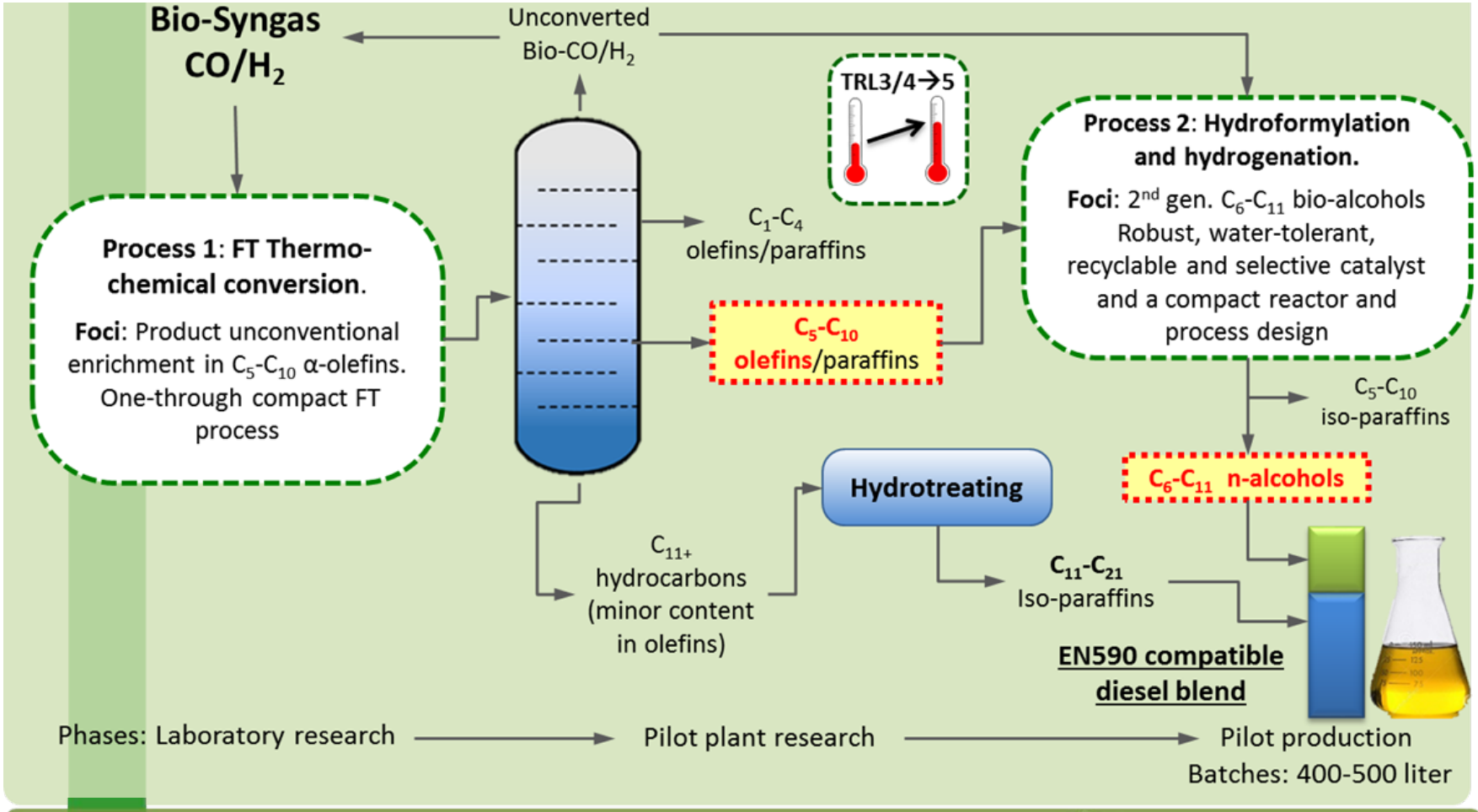
Expected Impact of the Project: The project will show how with modern technologies the paper industry can deliver second generation biofuels and a competitive cost <1€/L

Highlights (technological/non-technological): Black liquor (supercritical water gasification) and bark (fixed bed gasification) is converted to syngas

What is needed in future: The project will prepare the ground for a demonstration project.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No *818011*

REDIFUEL CONCEPT



Overall process design, technical and economic evaluation incl biofuel cost assessment

Conversion efficiency evaluation (Biomass-toWheel), socio economic assessment and Life Cycle Analysis

EN590 with a high biofuel content (up to 100%)

Combustion optimisation (CFD, single cylinder), emission optimisation, use case and cycle evaluation

Low/zero CO_2 footprint
Compliance with emission standards

Follow-up
Scale: 1-5 kt biofuel/a

Project Acronym: REDIFUEL Project Number: 817612 Call: LC-SC3-RES-21-2018 Topic: Drop-in fuel

Project title: Robust and Efficient processes and technologies for Drop-In renewable FUELs for road transport

Main Category of the Project: Biofuel

TRL: 4-9 (depending on feedstock)

Keywords: Biofuel, Drop-in, EN590, Biomass, Hydroformylation, Fischer-Tropsch

Technological approach of the Project: Biomass gasification, bio-syngas gas cleaning, catalyst and process development (Fischer-Tropsch with high shares of alpha-olefins C_5-C_{10}, hydroformylation and hydrogenation); Fuel blending strategies with engine efficiency and emission aspects; Conversion efficiency Biomass-to-Wheel, LCA

Expected Impact of the Project: New technologies, solutions and processes to be integrated to reach high conversion efficiencies for renewable fuel production; EN590 compatible advanced biofuel with reduced pollutant emissions

Highlights (technological/non-technological): The proposed drop-in biofuel contains high-cetane C_{11}+ bio-hydrocarbons and C_6-C_{11} bio-alcohols and has exceptional combustion and emission performance at low cost ~1€/liter; Pilot plant operation with ~500 liter output; Showcase the suitability with a test drive on a dyno and real roads (Euro VI truck)

What is needed in future: Tax on CO_2 emitted from fossil fuels to further promote renewable energies

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817612.

graanul invest

Feedstock sourcing

WOOD RESIDUALS

Sekab

HYDROLYSATE

GLOBAL BIOENERGIES

ISOBUTÈNE

NESTE

GASOLINE, JET FUEL

REPSOL

SkyNRG

LIGNIN

PEAB

BITUMEN

AJINOMOTO

AJINOMOTO ANIMAL NUTRITION GROUP

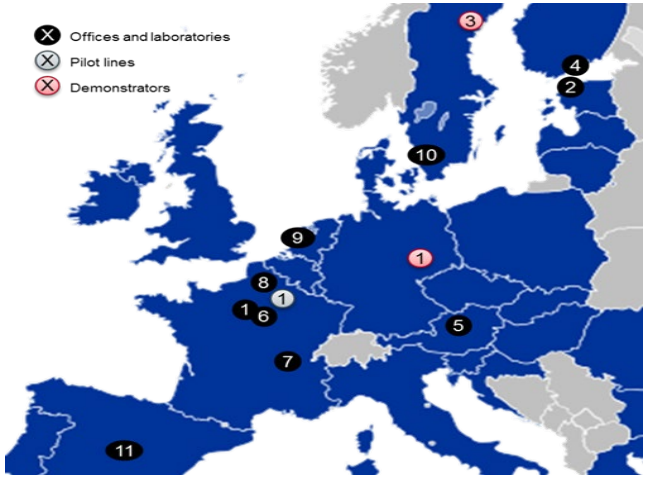
AJINOMOTO ANIMAL NUTRITION EUROPE

Microbial Biomass for feed
Biogas & Fertilizer

Process integration

IPSB
Ingénierie de Procédés Sucres et Biotechnologies

TechnipFMC



ENERGIE INSTITUT
an der Johannes Kepler Universität Linz

JKU
JOHANNES KEPLER UNIVERSITÄT LINZ

Global sustainability analysis of value chain

Project Acronym: **REWOFUEL** Project Number: **792104** Call: **H2020-LCE-2016-2017** Topic: **LCE-19-2016-2017**

Project title: **REsidual soft WOod conversion to high characteristics drop-in bioFUELs**

Main Category of the Project: IA - COMPETITIVE LOW-CARBON ENERGY - BIOFUEL

TRL: TRL5-6 to TRL6-7

Keywords: Second generation Biofuels, bio-isobutene, sustainable aviation fuel, bio-gasoline, residual wood hydrolysates,, fermentation, lignin, bitumen, microbial proteins, circular economy.

Technological approach of the Project:
Wood residues deconstruction followed by direct fermentation to gaseous bio-isobutene and subsequent chemical conversion to liquid biofuels. Valorization of byproducts as bitumen, animal feed, biogas and fertilizers.

Expected Impact of the Project:

1. Demonstration of an advanced biofuels value chain in view of scale-up to First of a kind commercial
2. Over 70% of production is bio-energy
3. Targeted energy balance of 5,3 renewable MJ per fossil MJ input
4. GHG emissions savings of 7kg CO2eq / liter of biofuel compared ro fossil fuels
5. 60 direct and 300 indirect jobs per plant
6. Residual wood capacity in the EU sufficient for hundreds of plants

Highlights (technological/non-technological):

Combination of innovative and mature technologies, direct fermentation to a gaseous hydrocarbon, drop-in biofuels from platform molecule, valorization of all byproducts, complete value chain represented in consortium.

What is needed in future:

Technological demonstration, ASTM certification of SAF, EU level mandates on SAF, stable or improving road biofuels mandates, financing for first of kind CAPEX.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No *792104*

Paving the way towards clean energy and fuels in Europe
Talks with research, industry and EU Member States on bioenergy, advanced biofuels and renewable fuels

FLExible Dimethyl ether production from biomass Gasification with sorption enhancED processes

DEMONSTRATION AT TRL5:

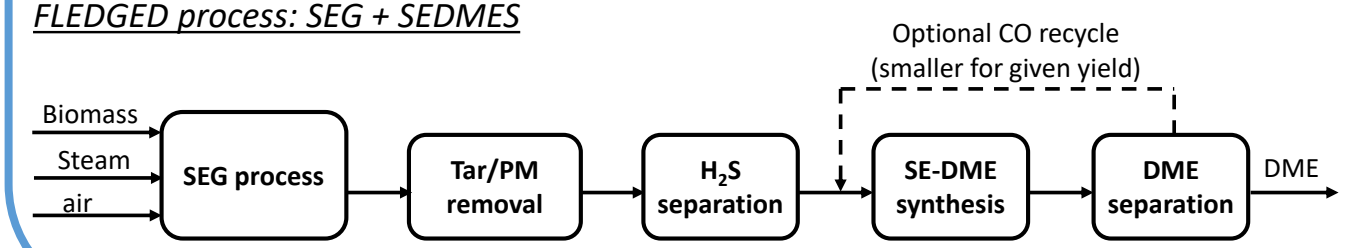
Flexible sorption enhanced gasification (SEG) process

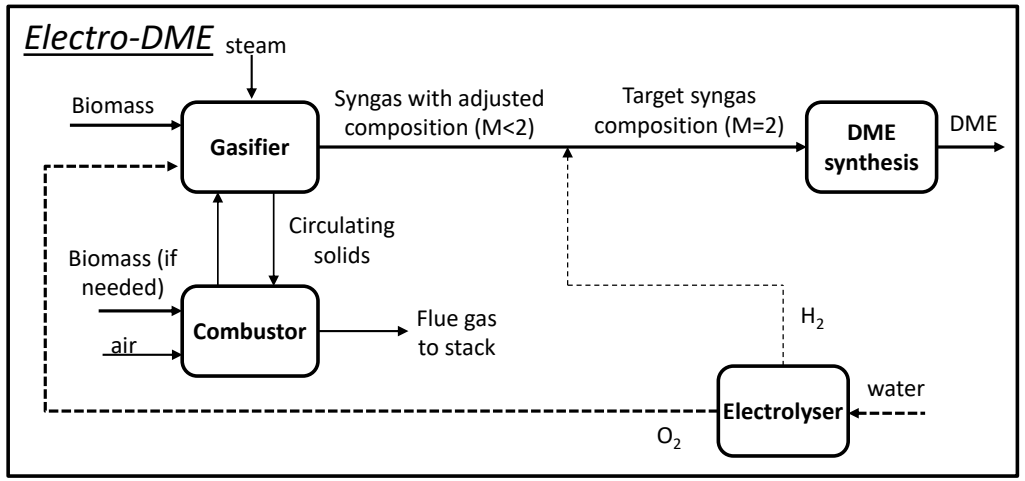
+

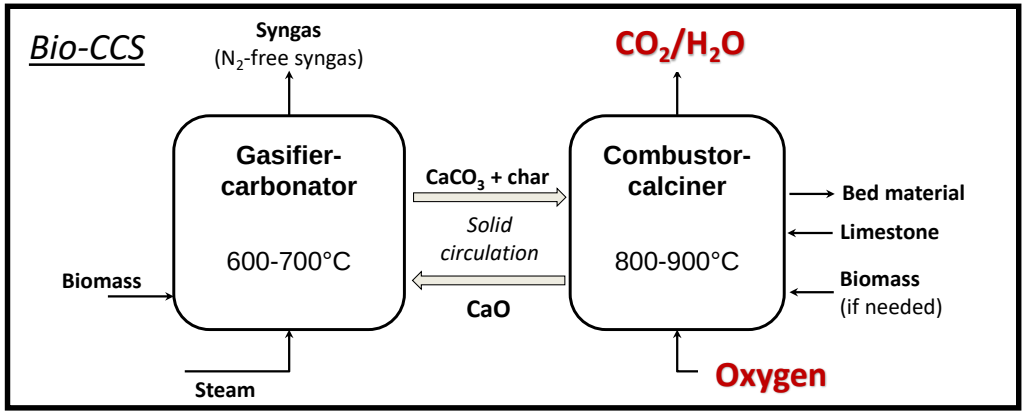
Sorption enhanced DME synthesis (SEDMES) process

- Process intensification
- Efficiency improvements
- Cost reductions
- Process flexibility

FLEDGED process: SEG + SEDMES







Project Acronym: **FLEDGED** Project Number: **727600** Call: LCE-2016-RES-CCS-RIA Topic: LCE-08-2016-17

Project title: **FLExible Dimethyl ether production from biomass Gasification with sorption enhancED processes**

Main Category of the Project: Biofuel

TRL: 5

Keywords: Gasification, DME, Flexibility, Power-to-X, Bio-CCS

Technological approach of the Project: FLEDGED project aims at developing sorption enhanced gasification (SEG) and sorption enhanced DME synthesis (SEDMES), leading to a new intensified process with high efficiency, improved flexibility and economically competitive.

Expected Impact of the Project: Decarbonization of the transport sector: provision of renewable transportation fuel with possible negative WTW CO_2 emissions (if coupled with CCS) and favoring diffusion of intermittent electric renewables thanks to power to liquid conversion (electrofuels).

Highlights (technological/non-technological):

- TRL5 demonstration of two key sorption-enhanced processes for biomass gasification and DME synthesis
- Overall process characterized by process intensification and flexibility in feedstock and operation.
- Thermodynamic and economic analysis, WTW LCA, risk analysis, socio-economic analysis.

What is needed in future: Large scale demonstration projects and favorable regulatory framework

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727600