BioTheRoS

Collaborative actions to bring novel **BIO**fuels **THE**rmochemical **RO**utes into industrial **S**cale

WORKSHOP: ADVANCING INDUSTRIAL-SCALE BIOFUELS: INNOVATIVE PATHWAYS IN THERMOCHEMICAL CONVERSION

Introduction - BioTheRoS Overview

Dimitris Kourkoumpas (CERTH)

Online / BEST Promises (Vienna, Austria)

12th March, 2025

The BioTheRoS Project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101122212.

Agenda

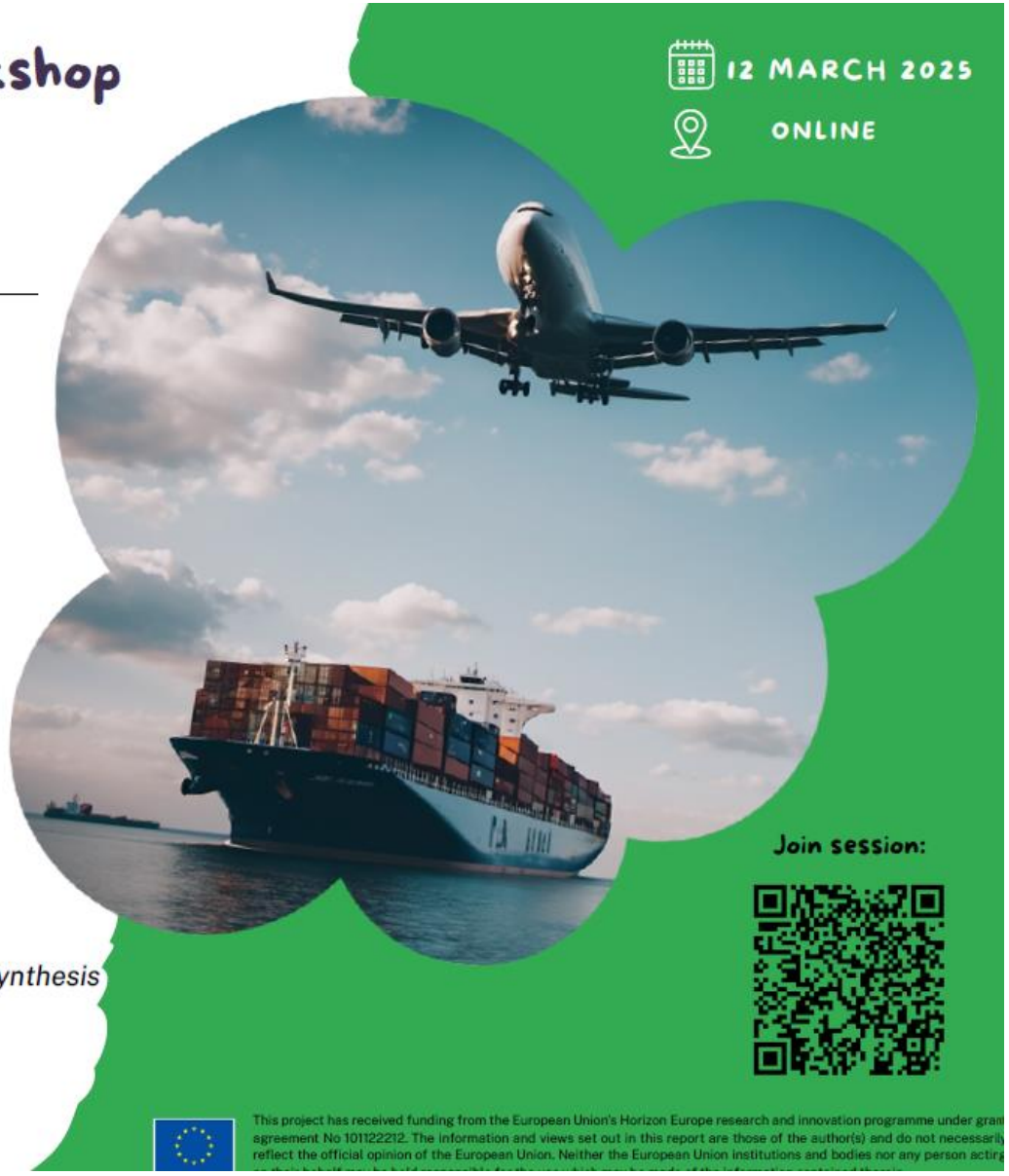
BioTheRoS

Technical Expert Workshop

Advancing Industrial-Scale Biofuels: Innovative Pathways in Thermochemical Conversion

Focus on Gasification

10:00	Introduction - BioTheRoS Overview *Dimitrios Kourkoumpas, CERTH*
10:10	Presentation of BioTheRoS logistics *Sebastian Zapata Habas, CIRCE*
10:25	Presentation of BioTheRoS pyrolysis technology *Patrick Reumerman, BTG*
10:40	Presentation of BioTheRoS gasification technology *Gerald Weber, BEST*
10:55	**Coffee break**
11:10	International trends in gasification – IEA Bioenergy Task 33 *Jitka Hrbek, BOKU, IEA Bioenergy Task 33*
11:30	Advanced Bioenergy Lab in Zeltweg & barriers in gasification *Richard Zweiler GET, ABL*
11:50	The need for platform technologies in industrial-scale applications *Christoph Ponak, Wienenergie*
12:10	IEA Advanced Motor Fuels TCP – Projects on SAF research *Doris Matschegg, BEST*
12:30	*Sustainable Aviation Fuel via Biomass Gasification and Fischer-Tropsch Synthesis* *Christian Aichernig, Repotec*
12:50	**Short lunch break**
13:20	Discussion & round table
14:00	End of the meeting



BioTheRoS

BioTheRoS Overview

Project Details

BioTheRoS is an EU Horizon Programme under Grant Agreement No 101122212 running from 2023

Consortium Members

The project is made up of 6 consortium members from several European countries

CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS

btg biomass technology group

BEST Bioenergy and Sustainable Technologies

circe

MOTOR OIL

WIP RENEWABLE ENERGIES

Demonstration Cases

Application in pyrolysis and upgrading units in Netherlands & gasification unit in Austria

BioTheRoS Objectives

BioTheRoS aims to develop a **comprehensive approach** that will accelerate the production of sustainable biofuels. **Synergies** are foreseen to maximize the circular economy-based scale up of thermo-chemical advanced biofuels.

BioTheRoS Goal: Transfer biomass into an opportunity

1. Development of cost-effective & sustainable technologies for thermochemical conversion of biomass to produce biofuels to TRL5

2. Selection and assessment of several biomass feedstocks suitable for scaled-up sustainable pyrolysis & gasification biofuel value chains employing predictive biomass demand AI models

3. Development of scale-up rules of biofuels production based on advanced modelling techniques and lab/pilot-scale trials.

4. Development of an LCSA framework, integrating technical, environmental, economic & social parameters via multi-criteria decision analysis techniques

5. Identification of concrete measures to improve the sustainability of thermochemical conversion of biomass to biofuels via pyrolysis and gasification

6. Provide clarity into the market dynamics of scaled-up pyrolysis and gasification biofuel value chains

BioTheRoS Breakthrough

BioTheRoS develops **innovative** & cost-competitive **Fast Pyrolysis-to-biofuels** and **Gasification-FT-Synthesis value chains**, combining **Carbon Capture Utilization (CCU)** and **fuel upgrading** for accelerating the scale-up of sustainable biofuels.

Breakthroughs are elaborated as follows:

Demonstration of the **full pyrolysis value chain** from biomass to high quality jet/marine fuel

Demonstration of the full **gasification-FT-synthesis value** chain from biomass to jet/marine fuel

Novel **carbon capture unit** of gases from fast pyrolysis and gasification

Utilization of **renewable hydrogen** as add-in options to advanced biofuel pathways

Development of **holistic guidelines** for scale-up & increased market uptake of advanced biofuels in aviation & shipping from a CE perspective

Development of a **novel LCSA-MCDA framework** to optimize the development of biofuels

Demo sites & related technologies

The Netherlands – pyrolysis and upgrading units

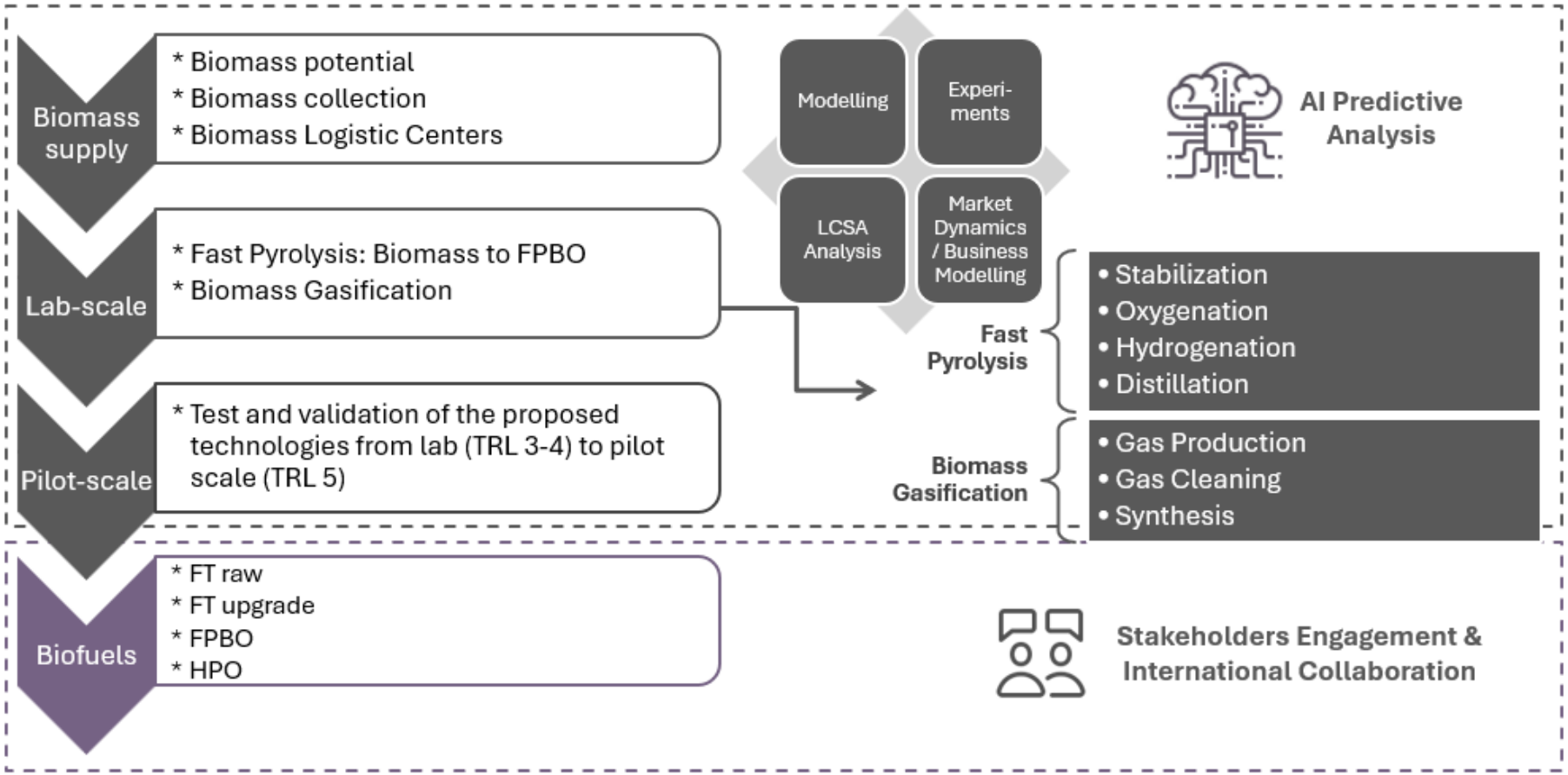
BTG operates in its lab a pyrolysis bench scale unit (2-5 kg/h), as well as a larger-scale pilot plant (80-200 kg/h) – see picture.
For the upgrading of pyrolysis oil to transport fuel, a 0.8 – 1.5 kg/day continuous upgrading unit will be utilized.

Austria – Gasification Unit

BEST operates in its plant, a 1 MW scale DFB reactor (200 kg/h) – see left picture, as well as a 250-kW pilot Fischer Tropsch synthesis unit (produced FT-raw product amount aimed at 15-20 L). For the upgrading of the FT waxes, a hydrocracking pilot plant unit in Greece, will be utilized.

BioTheRoS Methodology

- BioTheRoS will apply a **multidisciplinary stepwise approach** including feedstock selection, pilot experimental validation, scale up simulation and modelling, environmental, techno-economic and social assessments to contribute to global knowledge building for the sustainable scaling of advanced biofuels value chains.
- **Pyrolysis & gasification technologies** will form the core value chains for this approach application.



BioTheRoS Expected Impacts

How will BioTheRoS contribute to biofuels promotion

1

Biomass-to-Biofuel Optimization Process

Mapping of biomass potential promotes the optimization of biomass-to-biofuel value chain

2

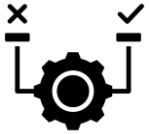
Building knowledge for upscaling

Experimental validation of BioTheRoS thermochemical technologies promotes identification of key bottlenecks and risks for building global knowledge for upscaling.

3

Biofuels efficiency enhancement

Overcoming of technical bottlenecks & integration of CCU and renewable hydrogen enhance the efficiency of advanced biofuel production.



4

Best available alternative identification

Multi-criteria analysis promotes the definition of the best available scenario and enables coordinated actions between stakeholders & end-users.

5

Economic Viability

Techno-economic analysis evaluates the economic performance of the biofuel production and promotes the creation of new market opportunities.

6

Building knowledge for upscaling

Knowledge exchange between BioTheRoS and international networks promotes collaboration opportunities and identification of innovation needs.

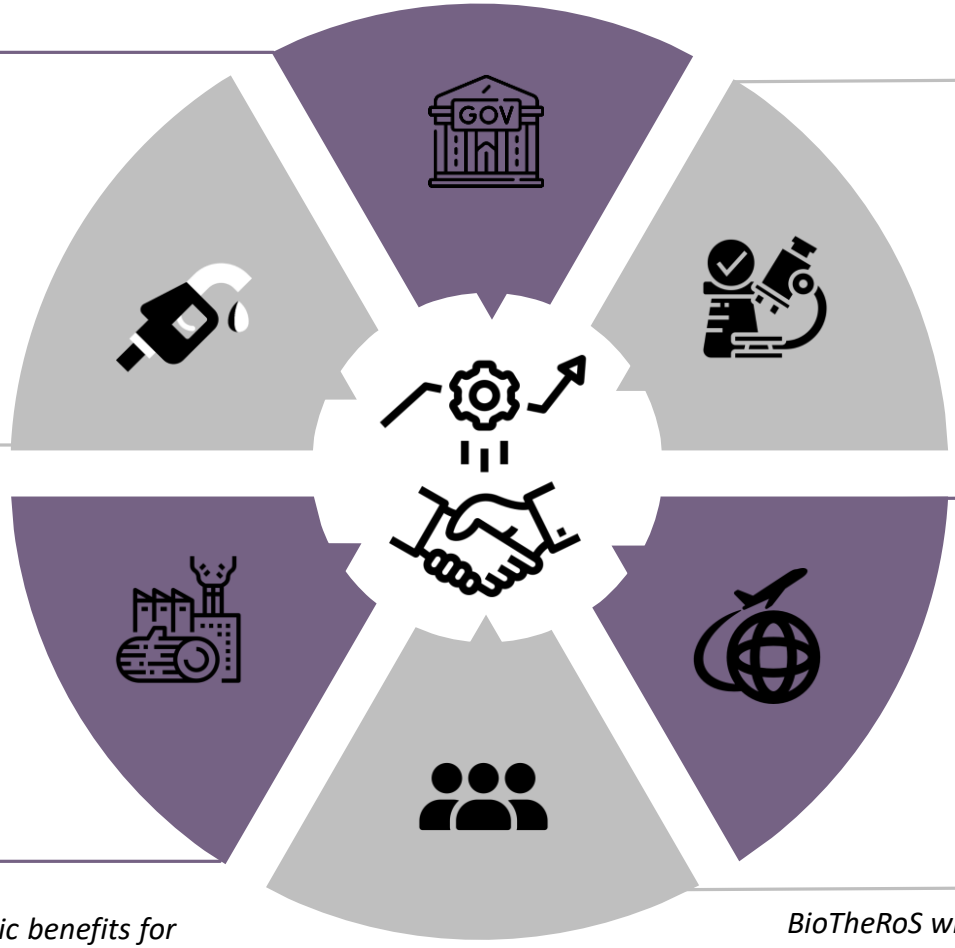
Potential Synergies

Government & Regulatory Bodies

BioTheRoS will disseminate lessons learnt & regulatory aspects at EU/regional levels

Research Stakeholders

BioTheRoS will communicate technical results, innovation and progress & challenges emerged during the project



Fuel Producers and Suppliers

BioTheRoS will provide valuable information on environmental and economic benefits to be incurred from biofuels production & use

Airlines & Shipping Companies

BioTheRoS will enhance awareness on the real possibility of utilizing biofuels

Biomass Providers

BioTheRoS will provide economic benefits for engaging in the biofuel supply chain

General Public / Citizens

BioTheRoS will disseminate European competitiveness & external dependency, environmental impacts & benefits for the environment and society

BioTheRoS

Take-Home Messages

- The **sustainable supply of quality, cost-effective feedstocks** to future biorefineries is fundamental to growing the bioenergy industry.
- The promotion of biomass utilization requires means of offsetting the price handicap of biomass relative to cheaper fossil fuels via **investment incentives**.
- **Managing biomass supply chain risk** is a critical part to favor long term sustainability of advanced biofuels in terms of adequate fuel supply.
- The deployment of a **holistic circular economy-driven guidelines** for the full supply chain of advanced biofuels is needed to stimulate the growth of aviation and maritime biofuel markets. The **constraints & opportunities** for scale up of pyrolysis & gasification pathways should be also highlighted.
- The increasing focus on the GHG impact of maritime & aviation biofuels requires the utilization of **Life Cycle Analysis (LCA) Models.** In the context of **Circular Economy,** economic, environmental and social aspects should be considered in an integrated manner.

Thank you!

Dr. Dimitrios Kourkoumpas

Senior Research Engineer (CERTH)

kourkoumpas@certh.gr

The BioTheRoS Project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101122212.

BioTheRoS