

Circular production of microalgae-based fuels for shipping and aviation

We are pleased to share the first issue of Cocpit newsletter, highlighting the project's progress toward increasing microalgae feedstock for sustainable fuel production.

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1. Introduction to the project

Transportation plays a crucial role for European Union to reach the Green Deal's targets, accounting for the 25% of total EU greenhouse emissions. In particular, maritime and aviation transports rely almost on fossil fuels and constitute about one-third of overall EU transport emissions.

COCPIT is an EU funded project who has the aim to support the sustainable transport fuels uptake through a new end-user' decision tool with a circular and innovative production of microalgae-based fuels for shipping and aviation.

The process originates with microalgae cultivation in photobioreactors (PBRs) covered with semi-transparent photovoltaic (STPV) shell and develops along two possible pathways:

- HEFA - hydrotreated esters and fatty acids
- HTL - hydro-thermal liquefaction

Based on economic, social and environmental indicators, COCPIT decision tool will analyse different scenarios and it will be available to end-users on a comprehensive marketplace, together with a full range of algae fuel technological solutions.

2. COCPIT concept

The COCPIT project aims to deliver an innovative circular complete production chain of microalgae-based SAF through both pathways, HTL and HEFA. The main stages of the complete value chain are algae cultivation, lipid extraction and HEFA, HTL and biocrude upgrading, dark fermentation and fractionation of the final products.

COCPIT utilizes the capabilities of the microalgae strain *Parachlorella kessleri*, which can store significant amounts of lipids (40%) and carbohydrates (30%) when nutrients are the limiting factor.

The strain is cultivated in a thin film reactor to enhance photosynthesis. This reactor is covered with a semi-transparent photovoltaic (STPV) shell, generating electrical energy from the infrared portion of solar radiation.

This innovation allows the regulation of the temperature for the cultivation medium and the maximum solar energy absorption, leading to a dual benefit of generating biomass and electricity.

COCPIIT use the ionic liquids to extract lipids for the HEFA pathway and an associated lipids extraction unit with a better ecologic profile than organic solvents (OS) used actually.

It also covers the extraction of proteins from algae before its use in HTL. This method avoids many nitrogen-related problems in the fuel production chain and makes better use of them in the process by efficiently recirculating nitrogen, producing hydrogen to feed HEFA and upgrading HTL biocrude and producing aromatics as HEFA SAF boosters.

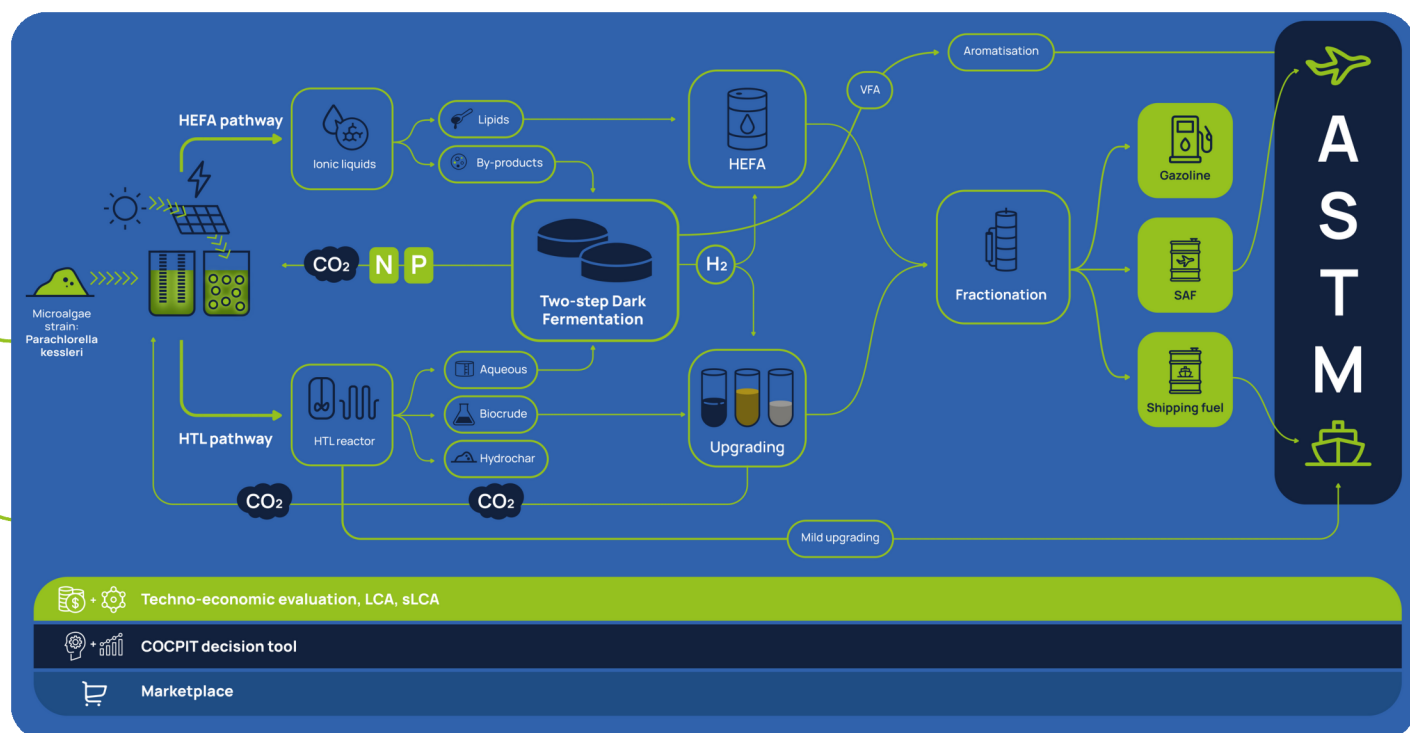


Figure 1. COCPIT concept at a glance.

3. Project tool

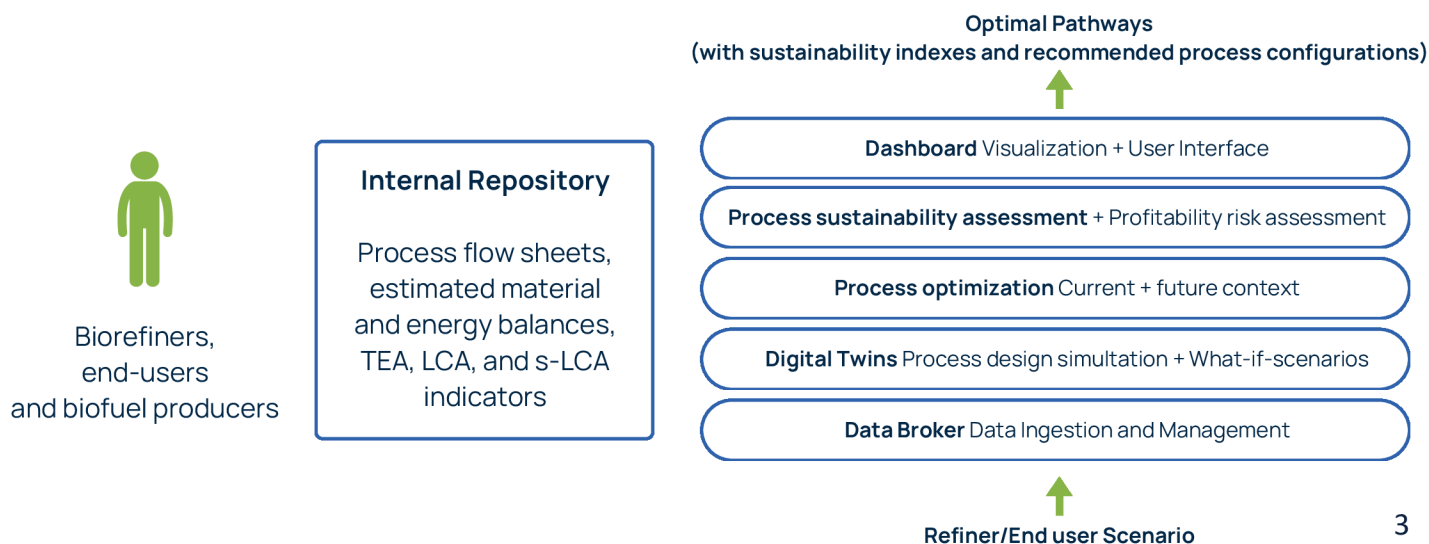
COCBIT aims to create a tool that supports decision making in designing a production chain of microalgae-based biofuels. The main goal of the COCBIT tool is to assist investors, end-users and biofuel producers in selecting, forecasting, and efficiently operating within various conversion pathways based on different scenarios, considering current or future uncertain parameters. There are two categories of users: investors and operational users. Investors, who can look for new opportunities or upgrades to existing investments, analyse the state of underlying processes, assess suitable conversion pathways in defined scenarios, and predict optimal pathways. Operational users, who can focus on optimizing routes for efficient process operation, considering current and future parameters. In this way they can improve operational and resource efficiency and reduce operational expenses (OPEX), maximizing by-product recovery, minimizing energy consumption, environmental impact and raw material loss. Both user groups are important for assessing the sustainability and profitability of different SAF production routes.

The tool integrates process data, operational data from microalgae-based SAF production processes, and domain knowledge, including methodologies, equations, and interpreted data used in assessments.

In particular the tool integrates:

- Process design to develop alternative process flow sheets for SAF production via microalgae conversion
- Estimation of material and energy balances as well as sizing of unit operations at different plant capacities
- Optimization of a specific unit operation
- Estimation of TEA (e.g. MSP, FCI etc.), LCA (e.g. Global Warming Potential) and s-LCA indicators
- Evaluation of process profitability risk assessment via Monte-Carlo simulations.

In the end, the tool will access fixed parameters according to literature and databases such as solar radiance in each region and the ability to determine CO₂ resource parameters based on sustainability indexes, facilitating informed decision-making for sustainable SAF biofuel production.



4. SUSTAFUELS cluster

The aim of the cluster is to promote synergies and share knowledge, driving scientific progress and innovation to address global challenges that require bold solutions. Our COCPIT Project is part of the SUSTAFUELS cluster, focused on developing innovative solutions for cleaner and greener energy working on algal and renewable Fuels.

Algal and renewable fuels can significantly lower carbon emissions, helping to combat climate change and also, by diversifying energy sources, these fuels can reduce dependence on foreign oil.



EU-funded project that aims to support the large-scale production of microalgae-based fuels for hard-to-electrify sectors.

[MORE INFO](#)



EU-funded project which seeks to develop innovative Sustainable Aviation Fuels (SAF) technology to reduce aviation's reliance on fossil fuels.

[MORE INFO](#)



EU-funded project developing ways to use Microalgae to turn CO2 into Biofuels for green transportation.

[MORE INFO](#)

The kick-off webinar of the cluster was organised on May 21st 2024 and was an opportunity to learn about the aims, ambitions, methodologies and impacts of each project, and their work in the context of alternative fuels and green transition.

For next year, there are already many ideas for communication activities, conferences, webinars with which to publicize the work of the projects and the SUSTAFUELS cluster.

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EU-funded project that aims to develop innovative approaches to enable a more sustainable and cost-competitive production of microalgae aviation fuels.

[MORE INFO](#)

5. Communication and dissemination activities

COCBIT started on October 1st 2023 and the first activities carried out were related to the communication and dissemination of the project, its objectives, partners and activities. Among the first activities carried out were those related to the creation of the visual identity of the project and its presentation in events and conferences. Among the presentations in which the project took part, COCBIT was presented and disseminated through the Bio360 Expo in Nantes (France) and the 32nd EUBCE in Marseille (France).

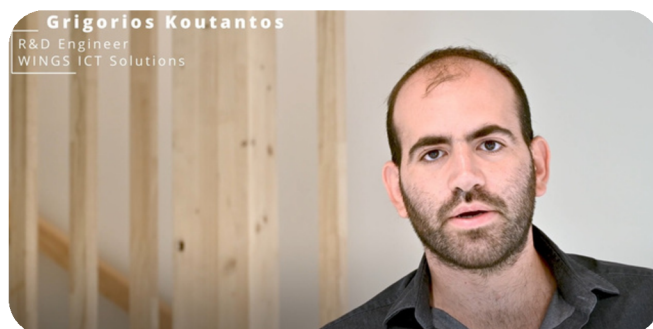


Bio360 Expo, Nantes, France.
Sary Awad - Cocpit Presentation.

Bio360 Expo is an annual meeting whose mission is to support and accelerate the biotransition. The goal is the transition from fossil-based energy and production lines to bioenergy and biobased molecules and building blocks for a sustainable and circular economy. During the Expo Bio360 Sary Awad of IMT Atlantique, project coordinator, presented Cocpit in the context of sustainable transport explaining how COCBIT aims to establish a low-impact maritime and aviation fuels production chain from microalgae.

"As part of the project's communication and dissemination activities, some partners presented their work through informative video presentations.

These videos, available on LinkedIn and Youtube, provide an in-depth overview of the various research activities and objectives to be achieved within the project.



Videos Presentation - Sofia Maria Ioannidou, Grigoris Koutantos, Mariana Titica



[Click here to watch the videos](#)

6. Project presentations - EUBCE 2024

The EUBCE - European Biomass Conferences & Exhibition is a scientific event organized and established by the European Commission in 1980 (Brighton, UK).

In 2024 the conference was held in Marseille, at Chanot Convention Centre, from 24th to 27th June 2024.

The COCPIT project was present at the 32nd EUBCE thanks to two project partners: Moeen El Bast from IMT Atlantique who presented the project through a poster on the "Scalable solutions Optimisation and Decision Tool Creation for Low Impact SAF Production Chain from Lipid-Rich Microalgae Strain and Incorporating Innovation" and Eva Nanaki from HELLENiQ who presented the "New Technologies into the Production of Sustainable Aviation Fuels: The Role of Industry" in the discussion on the Advanced biofuels.

Furthermore, in the exhibition area of the conference there was a visibility point composed by a roll up, a QR Code linked to the website and the threefolds relating to the project.

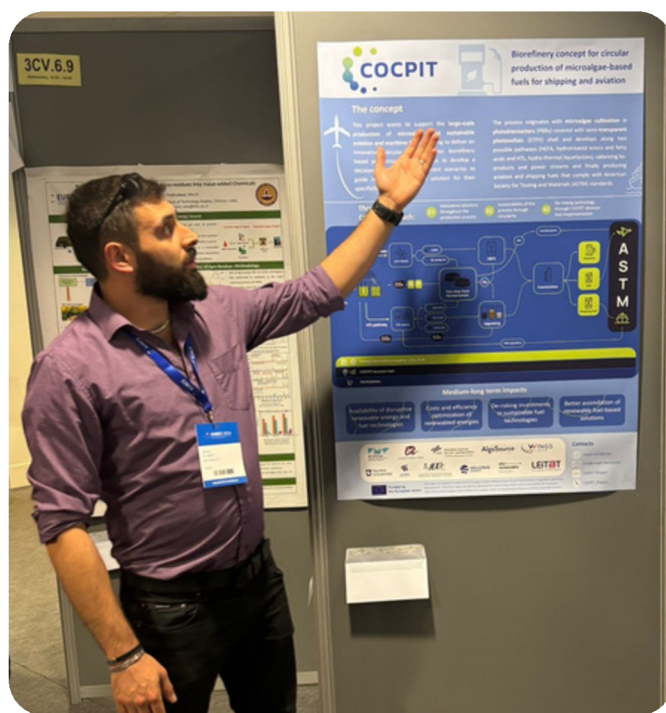


Figure 4. EUBCE 2024 Marseille, France.
Moeen El Bast Poster Presentation. Source: ETA Florence.



Figure 3. EUBCE 2024 Marseille, France.
Eva Nanaki and other presenters on the topic Advanced biofuels - aviation: gearing up for market deployment discussion.
Source: ETA Florence



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