Newsletter
Issue 3 / October 2025

COCPIT Insights: Research Highlights and Milestones Achieved

We are pleased to share the third COCPIT newsletter, highlighting the project's progress toward increasing microalgae feedstock for sustainable fuel production.

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1. Introduction

COCPIT is a four-year research and innovation project that started in October 2023 and has a duration of 4 years and its goal is to improve the entire sustainable fuel production chain by introducing innovations at every stage of it.
The research begins with the cultivation of microalgae in special photobioreactors, enclosed in a photovoltaic shell that produces both biomass and solar energy.
The transformation of algal biomass into SAF is studied using two alternative pathways: the most mature (certified) one, HEFA (hydrotreated esters and fatty acids) and one of the most promising ones (to be certified) HTL (hydrothermal liquefaction) pathways, both leading to the production of biofuels for aviation and maritime use.
Another key outcome of the project is a decision-support tool designed to bring together environmental, economic, and social indicators to help assess which technological pathways are most viable. It's a 'test-before-invest' solution meant to guide investors and stakeholders in choosing the best options for SAF and marine fuel production — especially under uncertain, long-term conditions like climate change.

The project focuses on the circularity, productivity, sustainability and economic viability of the chain.

2. Commissioning of a Small Hydrotreater

During the first 18 months of the project, the partner Aalborg University has built a laboratory-scale continuous hydrotreater at the Department of Energy at Aalborg University (AAU Energy). Developed under the guidance of Dr. Daniele Castello, the unit was specifically designed to support early-stage catalytic testing using small quantities of both feedstock and catalyst, making it ideal for rapid screening and process optimization during fundamental research.
This "mini" unit complements the AAU's existing pilot infrastructure and fills a critical gap in enabling rapid and flexible testing prior to scaling up to larger systems.

The system is used to perform catalytic hydrotreating, a key upgrading process for converting bio-oils, particularly bio-crude oil obtained via hydrothermal liquefaction (HTL) derived from microalgae, into ready-to-use fuels suitable for the aviation and marine sectors. The process involves passing the bio-oil through a fixed-bed catalyst in the presence of hydrogen at elevated temperatures and pressures.

Ahmed Al-Dubai (Aalborg University)
Source: Aalborg University

Colleagues from Aalborg had the opportunity to participate in the Advanced Biofuels event organized by IDA Energi, as part of the LowCarbFuel IFD project. The event focused on direct thermochemical liquefaction (DTL), with contributions from technology developers, refiners, oil suppliers, researchers, policymakers, and investors.
The Advanced Biofuels event highlighted the power of biofuels as essential for the decarbonization of maritime and aviation transport.

Source: Aalborg University

3. Cultivating microalgae under semi-transparent solar panels

Another important milestone achieved in the COCPIT research project was the presentation of the first results on the coupling of semi-transparent photovoltaic panels with photobioreactors for microalgae growth in Anglet.

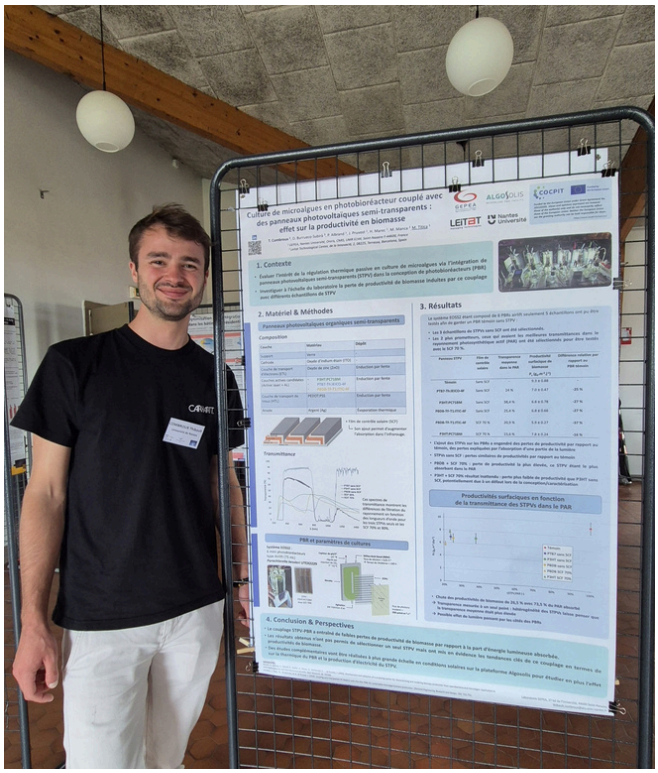
From July 2 to 4, 2025, the COCPIT project participated in the National Solar Energy Congress "JNES 2025," organized by the Federation for Solar Energy Research.
The University of Nantes, a project partner, presented the progress of its cutting-edge research: the cultivation of microalgae under semi-transparent solar panels.
Thibault Combroux, a researcher at the University of Nantes, presented one of the key ideas of the COCPIT project in a poster presentation. The objective is the coupling of semi-transparent photovoltaic panels (STPV) with intensified photobioreactors (PBR), systems designed for microalgae cultivation.

This coupling provides a passive solution for regulating the temperature of the microalgae culture environment. It also expands the range of solar energy harvesting options by enabling the simultaneous production of electricity and biomass on the same surface. Indeed, photovoltaic panels allow the passage of the photosynthetic active ray (PAR), primarily converting infrared photons into electricity. The evolution of this algal culture system was studied as part of the COCPIT project for the production of biofuels (SAF).

The preliminary study tested several samples of STPV panels, produced by technology partner LEITAT, coupled with a mini-photobioreactor system specifically designed at the GEPEA laboratory to rapidly analyze conditions that faithfully reproduce the environment of a representative photobioreactor (EOSS2). This study observed a reduction in biomass productivity ranging from 16% to 37% compared to the control culture without the panel.

However, this loss was significantly lower than expected, considering the transmittance of the panels studied.

These results suggest that the co-production of electricity and biomass is not only feasible, but also more efficient than expected, paving the way for new applications in agrivoltaics.



Thibault Combroux (Nantes University) at JNES 2025
Source: Nantes University

4. Progress on the 1 m² STPV–PBR Coupling at Algosolis

Following an initial laboratory study, work on pilot-scale production, collection, and separation/extraction is progressing with investigations into the STOPV-PBR coupling, including the design and implementation of a 1 m²-scale demonstrator (figure below).

Source: AlgoSolis R&D Facility

This collaborative effort with LEITAT and Nantes University (NU) team at Algosolis has brought together expertise in panel design, construction, and instrumentation.
The STPV panel was built and instrumented by LEITAT, and successfully implemented on site at Algosolis in Saint-Nazaire, thanks to the joint efforts of LEITAT's engineer, who travelled to oversee the integration and set up the monitoring system, and the Algosolis instrumentation engineer, who supported the installation and operational readiness.

David Burrueco Subirà (LEITAT) and Emmanuel Dechandol (NU)
Source: AlgoSolis R&D Facility

NU team and LEITAT are engaged in research activities on the demonstrator, aiming to evaluate the impact of real operating conditions through systematic data acquisition and analysis. The demonstrator consists of two inclined photobioreactors:

- One with the STPV panel
- One without (reference system)

The system has been fully characterised and is currently under operation to collect thermal, electrical, and biological data. These results will enable the validation of the coupling approach and pave the way for for modelling and scale-up to 10 m².

What's next?

The results will be consolidated in the upcoming project deliverable and shared with the consortium in the coming weeks, on the occasion of the 5th consortium meeting, which will take place in Saint-Nazaire at Nantes University.

5. SUSTAFUELS Cluster Expansion and Strategic Synergies

One of the most important aspects of achieving the objectives of the EU Missions and sustainable development is the ability to to build strong collaborations with similar initiatives and projects, facilitating the exchange of knowledge and thus accelerating scientific progress and innovation.

In this regard, we are pleased to announce the expansion of the **SUSTAFUELS Cluster**, which also includes **COCPIT**, **ALFAFUELS**, **FUELGAE** and **SusAlgaeFuel** to include additional European projects: **ALGAESOL**, **CAPTUS**, **ICARUS**, **NIAGARA**, **SUNFUSION**, and **SUSTEPS**.

This expansion represents a step forward in strengthening synergies between research initiatives working towards the shared goal of developing sustainable, renewable, and circular fuel technologies. By fostering collaboration among participating projects, the cluster aims to improve their impact, visibility, and reach, bringing their innovative results to an ever-wider audience: from scientific communities to policymakers, from industry stakeholders to citizens.

More specifically, the SUSTAFUELS Cluster aims to maximize collaboration and facilitate the exchange of technical knowledge by sharing best practices in life cycle assessments (LCAs) and techno-economic analyses (TEAs). The Cluster will coordinate efforts to develop integrated and circular value chains, promoting a systemic approach to innovation that strengthens the sustainability and scalability of biofuel technologies.

Finally, the initiative represents a shared commitment to promoting the green transition, with the aim of demonstrating how collaboration can transform research excellence into concrete impact.

Source: Canva

6. EUBCE 2025

COCPIT recently participated in the European Biomass Conference and Exhibition (EUBCE 2025), held from June 9 to 12 in Valencia, Spain. Thanks to the coordination of Sary Awad (IMT Atlantique) and the active involvement of partners HELLENIQ Energy, Universitat Rovira i Virgili, and ETA Florence, the project was well represented at this important international event.
COCPIT contributed to several key activities during the conference:

In the Exhibition Forum, Sary Awad (**IMT Atlantique**) presented an overview of the project, highlighting COCPIT's research objectives and recent progress in its work packages.

Eva Nanaki (**HELLENIQ Energy**) participated in a roundtable discussion organized by the M2ARE project, along with representatives of other Horizon Europe initiatives: SEAFAIRER, Fuel-Up, and POSEIDON. The panel addressed critical topics such as adapting biofuels to existing marine engines; sustainable and scalable feedstock options for marine use; testing and certification requirements; harmonization of industry standards; market uptake and policy needs to accelerate deployment

Eva Nanaki (HELLENIQ Energy) at EUBCE 2025
Source: ETA Florence

Simona Alpi (**ETA Florence**) organized a parallel session entitled "**Biofuels for Aviation: Market Perspectives and Challenges**," with insights from experts such as Dusita De Hoop (SKYNRG), Marco Buffi (Joint Research Centre), Stephen Dooley (Trinity College Dublin), and Matteo Prussi (Politecnico di Torino).

Marco Buffi (JRC), Matteo Prussi (POLITO), Dusita De Hoop (SkyNRG), Sary Awad (IMT), Stephen Dooley (Trinity College Dublin), Simona Alpi (ETA) at EUBCE 2025
Source: ETA Florence

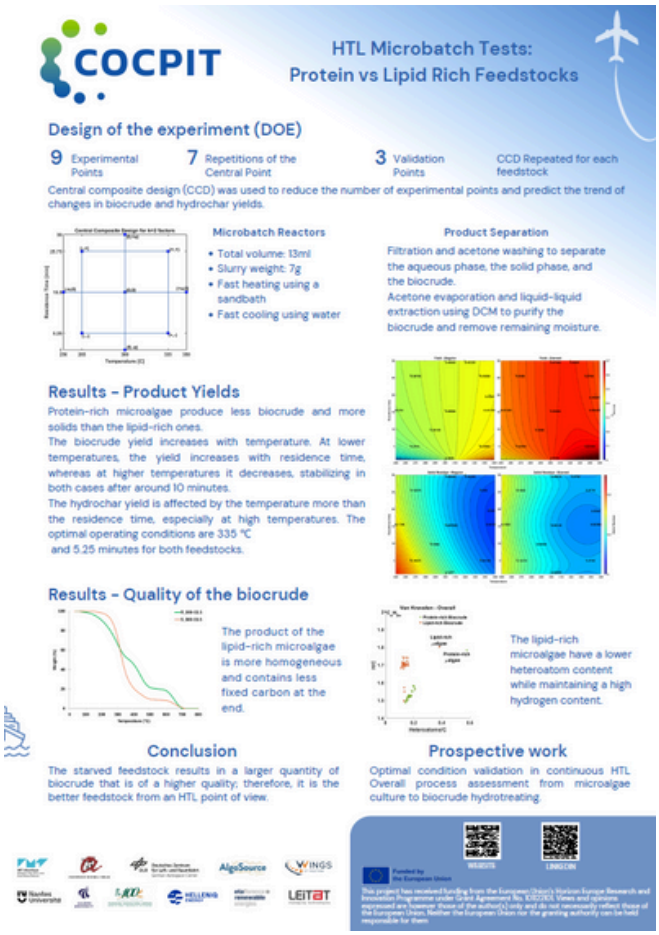
Sary Awad (IMT Atlantique) at EUBCE 2025
Source: ETA Florence

Finally, colleagues Jacky Wafa, Denisse Rivas and Alza Zurita (URV), along with Rami Makarem (IMT Atlantique) contributed to the conference with four posters.

Our colleagues from **URV** presented findings from complementary investigations on enhancing lipid recovery from nitrogen-starved Parachlorella kessleri in three scientific posters. Nitrogen deprivation was shown to influence the composition, morphology, and nanomechanical properties of the microalgae, providing insights for optimizing cell disruption. Various techniques—including ultrasound, microwave, bead milling, and ionic liquids—were assessed for their effectiveness in disrupting the cell membrane and facilitating lipid extraction. In addition, the design and application of ε-caprolactam-based ionic liquids were explored as sustainable and efficient solvents, demonstrating significant potential for microalgal lipid recovery in the production of sustainable aviation fuels (SAF). Collectively, these findings advance strategies for efficient lipid extraction and contribute to the development of renewable biofuel technologies.

Denisse Rivas, Esther Torrens, Jacky Wafa (URV) and Sary Awad (IMT) at EUBCE 2025
Source: ETA Florence

Our colleague Rami Makarem from IMT Atlantique prepared the poster below, which presents the effects of lipid enrichment in P. kessleri on its hydrothermal liquefaction, with a focus on yield and quality assessment.



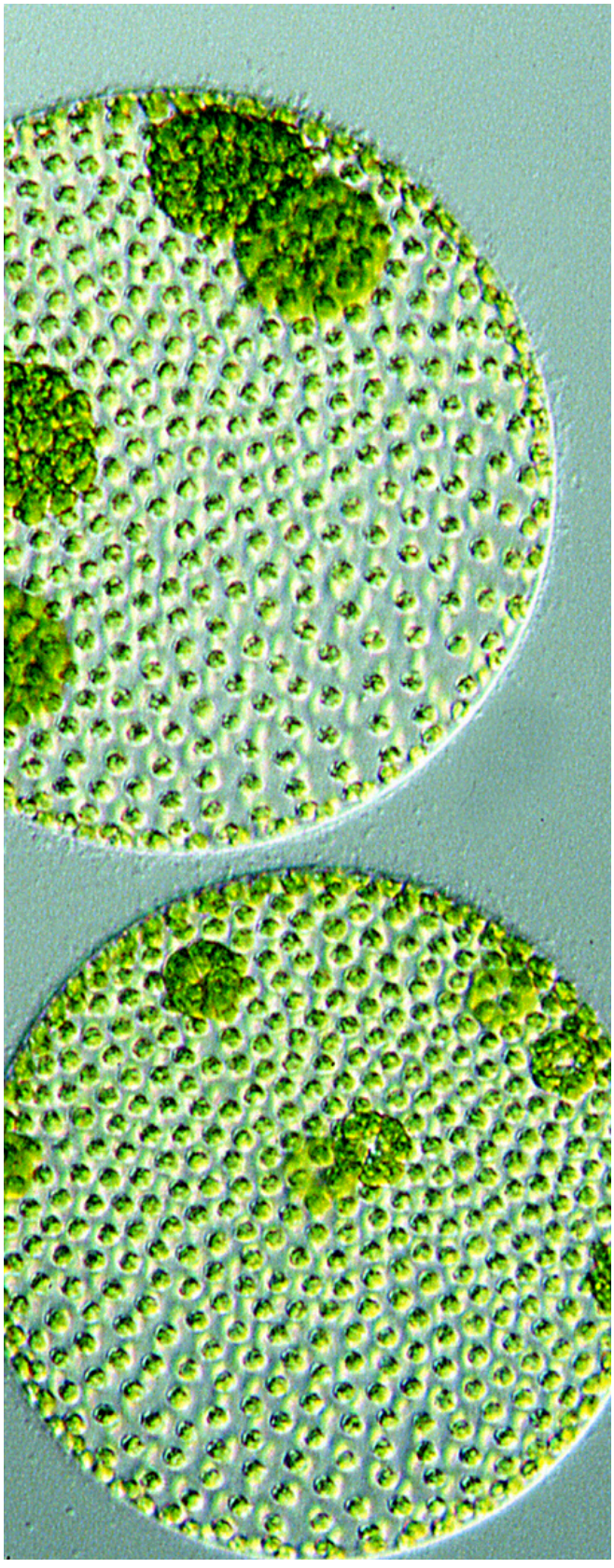
Rami Makarem (IMT) Poster at EUBCE 2025
Source: IMT Atlantique

The composition of the HTL feedstock, as well as the operating temperature and residence time, largely affect the quantity and quality of the resulting biocrude.
To study these effects, a set of experiments was designed using the central composite design (CCD).
This consisted of 9 sets of different operating conditions in the range of subcritical HTL, 7 repetitions of the central point, and 3 additional validation experiments.

This CCD was repeated for 2 feedstocks: a regular microalgae strain (P. kessleri), and an autotrophically lipid-enriched culture of this same strain. Due to the large number of experiments, microbatch reactors (12ml) were used. The products were separated using filtration, acetone washing, and DCM liquid-liquid extraction.

The results were fitted into mathematical equations and plotted onto contour plots. The biocrude yield of the lipid-rich feedstock was much higher than the regular one. This yield increased with the residence time at lower temperatures but decreased at higher temperatures. The hydrochar yield was more strongly affected by temperature and was comparable for both feedstocks. These plots indicate that the best operating condition was 335 and 5.25mins.
As for the biocrude quality, the TGA analysis shows that the lipid-rich biocrude has less fixed carbon and is more homogeneous. The Van-Krevelen diagram shows that the biocrude from the lipid-rich feedstock is closer in elemental composition to the ideal hydrocarbon fuel (C_nH_{2n}), theoretically rendering its upgrading easier.
In conclusion, the lipid-rich biocrude is produced in larger quantities and has a higher quality, proving that the lipid-rich feedstock is better suited for HTL.

In the future, the overall process must be studied, starting from the culture of microalgae to reach hydrotreating and SAF production, in order to further validate whether the starved feedstock is superior.



Source: Canva

Discover IMT poster here!

7. Project Meeting

On October 2nd and 3rd, the COCPIT project consortium met in Saint-Nazaire, France, for the fifth project meeting, hosted by partner Nantes University.

Saint Nazaire, France
Source: Canva

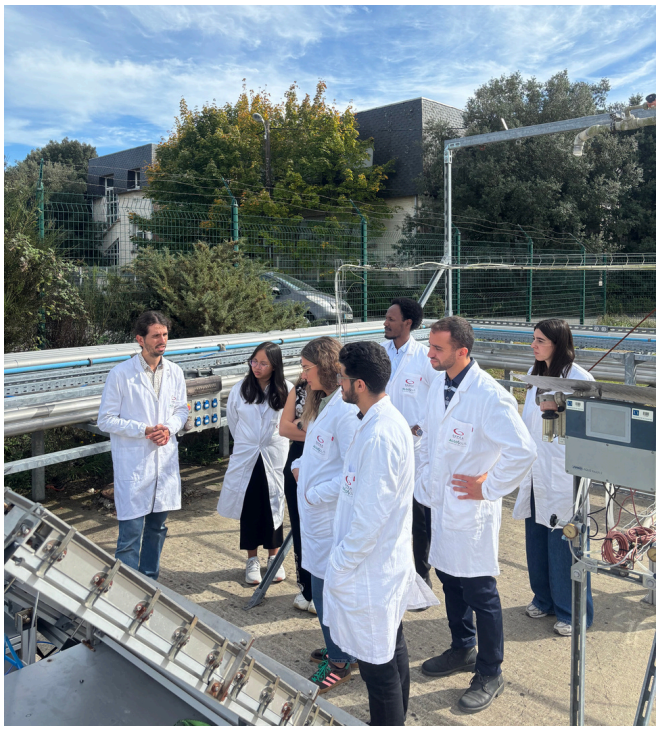
Colleagues Mariana Titica, Thibault Combroux, and Emmanuel Dechandol from the University of Nantes organized the event and a wonderful visit to the Chantiers de l'Atlantique shipyard!
It was a unique opportunity to see firsthand how cruise ships are built, starting from a simple sheet of steel.

COCPIT Partners
Source: ETA Florence

This meeting was crucial for reviewing the progress made so far and planning the next steps to advance the COCPIT project's mission:

- Strengthen the sustainable fuel value chain through cutting-edge innovations at every level;
- Develop a high-confidence decision-making tool in a "test before invest" manner.

Led by our colleague Jordan Prieto (from AlgoSolis), we had the opportunity to visit the AlgoSolis R&D Facility, an academic platform committed to developing a sustainable microalgae industry.



Project Partners at AlgoSolis R&D Facility
Source: ETA Florence

As the COCPIT project moves forward, we invite you to stay connected with our journey — follow us on **LinkedIn** for regular updates and highlights from our work.
Visit our **website** to learn more about the next research developments.

COCPIT

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COCPIT Project

The COCPIT project started in October 2023 and will end in September 2027. Coordinated by IMT ATLANTIQUE, the project consortium is composed of 11 partners from 6 EU countries, selected to meet the technical scope of the project providing complementary and interdisciplinary expertise.

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DLR Deutsches Zentrum für Luft- und Raumfahrt
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managing technologies

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