

The REFOLUTION project: Unlocking the potential of biofuels production in Europe

The Horizon Europe REFOLUTION project will deliver a cost-effective production of advanced biofuels in aviation and marine sector via a process that can be implemented in existing European refineries.

The European project REFOLUTION is making significant progress in the development of advanced biofuels, both in terms of technical advances in integrating pyrolysis bio-oil into refineries and in-depth societal analysis to examine public perceptions of biofuels and related technologies. While technological innovations promise to make biofuels more stable and traceable, dialogue with civil society is proving crucial to addressing concerns about sustainability, costs, and transparency, key elements for the effective decarbonization of transport.

In these first 30 months the project has achieved several scientific and technological milestones:

- **Pilot Plant Upgrade:** At the VTT research center, the fluid catalytic cracking (FCC) pilot plant has been successfully modified for the co-processing of bio-oil and fossil fractions, with a capacity of up to 20 kg/h. This modification allows for the simulation of real refinery conditions, testing the integration of renewable feedstocks into existing infrastructure to accelerate large-scale adoption.
- **Stabilization of Bio-oil:** Intense research into the stabilization of bio-oil through low-temperature hydrogenation has led to a surprising discovery: commonly suspected compounds such as acetic acid, furfural, and methyl-thiophene are not the main culprits for catalyst deactivation. This result, while presenting a new challenge, allows researchers to focus on other compounds, optimizing the purification process.
- **Traceability with Digital Carbon:** An innovative digital carbon tracking model has been developed. This tool, which integrates experimental data, allows for the precise monitoring and prediction of the amount of renewable-origin carbon in the final products. It represents a cost-effective and reliable alternative to complex laboratory analyses, ensuring transparency and sustainability throughout the entire production chain¹.

¹ All detailed findings are available on the project [website](#), including the related [factsheets](#).

A Guide for Research

Alongside technical progress, REFOLUTION has placed a strong emphasis on public engagement. The webinar organized as part of the project, “Fueling change: the importance of citizen involvement in the discussion on biofuels” held on November 8, 2024, was organized by ETA Florence in collaboration with ETIP Bioenergy and the Bio4Fuels Centre². The event highlighted the results of citizen panels conducted in Bulgaria, Italy, Sweden, and Austria by the Center for the Study of Democracy, presented by Remina Aleksieva (analyst at CDS), and the results of a dedicated workshop conducted by VTT as part of the REFOLUTION project, focusing on the principles of Responsible Research and Innovation (RRI), presented by Nina Wessberg (Principal Scientist at VTT).

Remina Aleksieva’s (CSD) analysis revealed a significant increase in participants’ awareness of bioenergy, underscoring the importance of direct communication and active citizen involvement in shaping the public debate. Building on this initiative, VTT organized a second workshop in Tampere, Finland, which offered local residents the opportunity to delve deeper into the future of biofuels. Although the general attitude is positive, clear and shared concerns have emerged, which the project is using to guide its next phases:

- **Feedstock Sustainability:** The main concern is the origin of the raw materials. Citizens are demanding guarantees that biofuel production will not lead to deforestation or conflict with food production.
- **Transparency against Greenwashing:** There is strong skepticism towards corporate sustainability claims. Consumers are calling for full traceability to prevent biofuels from becoming a marketing tool (“greenwashing”).
- **Cost and Accessibility:** The workshop participants were clear: biofuels should cost the same as or less than fossil fuels. Sustainability must not become a luxury for the few.
- **Shared Responsibility:** Citizens believe that the responsibility for the energy transition in transport should fall primarily on politicians and companies, who should make sustainable options the norm, not the exception.

What emerged from these workshops is that citizens want sustainable, but also accessible and transparent solutions, and this feedback from engagement activities is valuable as it will guide both communication and research priorities, ensuring that the solutions developed by REFOLUTION meet the real needs of society.

² All detailed findings are available here: [Workshop](#).

Next Steps

The REFOLUTION project will continue its experimental campaigns in the pilot plant to test the technology under prolonged operational conditions. The data collected, combined with insights from the dialogue with citizens, will be integrated into a comprehensive technical-economic and sustainability analysis, which is crucial for the future industrial implementation of the developed processes.



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