

February 27, 2026

SUSTEPS Workshop: Integrated Modelling & LCA

From 9–11 February 2026, the SUSTEPS project successfully held a three-day strategic technical workshop hosted by TÜBİTAK at its premises. The workshop focused on tackling the modelling challenges for the next generation of microalgae-based biofuels and brought together experts to align on the complex modelling, environmental, and techno-economic assessments required to transform microalgae coupled with industrial CO₂ from flue gas and wastewater into sustainable advanced fuels, including biojet, biogasoline, and biodiesel.

Work Package 3 (WP3) is progressing steadily, focusing on developing an integrated simulation model of the entire microalgae biorefinery process. During this workshop, leaders from TÜBİTAK and UNIFEI, in collaboration with ARDITEC, are continuously contributing to the harmonization of the full process and the advancement of integrated modelling efforts. Meanwhile, other partners continue to progress in experimental design.



Within WP3, led by TÜBİTAK in collaboration with UNIFEI and ARDITEC, the team is working on modelling, Life Cycle Assessment (LCA), and Life Cycle Costing (LCC) simulations to support a fully coordinated and scalable microalgae biorefinery design. This effort integrates the Aspen model with LCA and LCC methodologies and relies on hydrogen integration, hydrothermal liquefaction (HTL) of algae, CO₂ balances within the biorefinery, energy and mass integration, profitability of each strategy, and algae growth modelling.

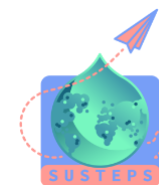
Aligning on key technical aspects and common settings

As part of the SUSTEPS initiative, this collaborative workshop focused on aligning modelling approaches, life cycle assessment (LCA) methodologies, and integration strategies to ensure optimal performance and environmental outcomes. During three intensive sessions, consortium members reached a consensus on key aspects, mainly around the harmonization of assumptions, kinetics models, inventories and boundaries used in LCA and process modelling. Some examples include the development of a model predicting algae biochemical composition via biomass characterization, the selection of



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the best-representative algae growth model, the tuning of recycle streams and heat integration to enhance process sustainability and distinguishing between biogenic and non-biogenic carbon in industrial emissions and the resulting fuels. The workshop went beyond data sharing; it was about building a unified vision for the next steps of the project and aligning efforts across the consortium.



Main discussions were focused on:

- **Algae growth and model challenges:** Cultivation approaches and the method best suited to local conditions and project goals. Algae growth kinetics, ultimate analysis and proximate composition.
- **Harvesting configuration:** Discussions are ongoing regarding the setup for harvesting, aiming to balance efficiency, biomass quality, and operational practicality.
- **Green H₂:** discussing strategies to benchmark green hydrogen integration across Europe, North America, and Latin America, ensuring that the SUSTEPS solution is adaptable to diverse policy and geographical contexts.
- **CO₂ allocation:** Options under consideration include mass-based allocation, economic value allocation, and system expansion or avoided emissions approaches.
- **Plant location concept:** Exploring co-location scenarios near an existing cement plant with access to a nearby wastewater treatment facility, considering how integration could improve resource efficiency.

These discussions mark a key step forward in aligning partners on the development of the SUSTEPS microalgae biorefinery. Next actions were shared internally with partners, and a strategy was outlined to follow up on common activities. The SUSTEPS consortium will continue refining these concepts as the project moves to the second phase, ensuring that the final design is both efficient and sustainable, while advancing innovation and circular economy solutions adaptable across diverse regions and industrial contexts.



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