

Seminar in the winter term 2026/2027:

Sustainability Potential of Algae-Based Biorefinery Value Chains in Europe: Screening Feedstock Availability, Conversion Pathways and Products for BioSMART

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Background and objective

The BioSMART (<https://biosmart-biorefinery.eu/>) project focuses on the development of sustainable biorefinery solutions for the production of aviation and maritime fuels, chemicals and other bio-based products. Algae may represent an additional biomass resource for such multi-product biorefineries. However, their practical potential depends on biomass availability, regional conditions, cultivation and harvesting requirements, conversion technologies, possible products and the overall sustainability of the value chain.

The objective of this seminar project is to investigate the potential role of algae in European biorefinery value chains. The students should identify relevant algae resources, examine selected conversion pathways and assess their suitability for integration into the BioSMART project. The study should be designed as a literature-based screening rather than as a complete European biomass potential assessment, LCA or techno-economic assessment.

Main research question

Which algae resources and conversion pathways have the greatest potential for integration into sustainable multi-product biorefineries in Europe?

The students should:

1. Define the system boundaries and distinguish between microalgae and macroalgae, cultivated biomass and residual algae streams.
2. Identify and describe relevant algae resources and selected European examples. The analysis should focus on approximately three to five countries, regions or representative case studies.
3. Collect available data on algae productivity, biomass composition, cultivation or collection methods, geographic availability and relevant infrastructure.
4. Develop a value-chain model covering biomass production or collection, harvesting, dewatering, transportation, pretreatment, conversion and final products.
5. Select and compare two or three conversion pathways, for example:
 - algae to aviation or maritime fuel;
 - algae to chemicals and materials;
 - cascading use of algae for high-value products, fuels and residual energy recovery.
6. Conduct a sustainability screening covering:
 - energy, water and land requirements;
 - resource and nutrient efficiency;
 - logistics and storage;
 - technological maturity;
 - economic and scalability limitations;
 - potential social and regional value creation;
 - major sustainability hotspots.
7. Assess the relevance of the selected pathways for BioSMART and recommend which options should be investigated further.

The relevant dates (kickoff, midterm and final presentations) will be announced here soon.

Attendance at all dates is mandatory.

Online registration must be completed before 08 Oct 2026, 00:00 via <https://portal.wiwi.kit.edu>.
Confirmation of a seminar place is only valid once final registration has been made in the student portal (<https://campus.studium.kit.edu/exams/registration.php>).

Important: Please check your emails regularly after submitting your application in order to respond promptly to a seminar place offer! If you do not reply within the deadline, the place will be reassigned to other applicants.

Application Documents:

- Current transcript of records (Bachelor and, if applicable, Master)
- Short motivation letter

Contact:

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