

SMALL VERSUS LARGE SCALE MICROALGAE PRODUCTION

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Microalgae are an attractive source for fuel production. Commercial algae cultivation for biofuel production, however, does not yet occur but is expected for the near future. One of the current challenges is how to design and organise algae biofuel facilities which include a series of successive processing steps. Biomass cultivation, which may occur in various reactor designs, is the first step and depends strongly on the local weather conditions. The construction of algae cultivation plants in sunny regions seems from this point of view to be preferred.

Planning a region for algae biofuel plants, however, does not solely depend on the local weather conditions for cultivation; the availability of water, nutrients and land can also be limiting. The size of a cultivation plant depends therefore on a combination of regional characteristics like climate, land & resource availability and infrastructure. Large plants require large quantities of resources that can only be supplied if the infrastructure satisfies, while small plants are preferred in area with a limiting water and nutrient supply. It is therefore essential to integrate algae cultivation and supply chain logistics to determine limiting factors, to find appropriate production plant sizes and to quantify the effect of regional characteristics and design on process feasibility.

In this work, models on algae cultivation using various reactor designs were integrated with logistic models for transport towards and from the algae cultivation plants. The objective of the integrated approach is to produce algae with the lowest energy requirement for cultivation and transport of resources.

The approach allows studying the suitability of regions for algae biofuel production, based on the climate conditions, the availability of resources and the existing infrastructure. The focus in this work is on salt water and CO₂ supply for algae cultivation and the local use of biodiesel. In the presentation we will show the effect of regional characteristics on the size of algae plants, the logistic supply of resources and infrastructure, and on the energy requirements using various scenario studies.

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