# Design scenarios for large scale micro-algae production

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The design of large scale systems is not straightforward. Wijffels et al. (2010) show that biomass productivity and economic feasibility are related to the type of reactor, the cultivation location, the production scale, substrates and operating conditions. Estimates of micro-algae productivity used in most life cycle analysis studies are based on experimental work which was not necessarily performed under optimal conditions and the results of algae production differ for plant locations. Furthermore, most experimental studies concern only the effect of a few decision variables at a time. So the outcome of the studies does not reflect the optimal possible performance for a location.

Predictive models on the interaction between light and micro-algae growth allow us to determine robust production estimates for large scale production. These models help to evaluate the effect of reactor design and location on algae growth. We have developed predictive models for algae cultivation in raceway ponds, flat panel and horizontal tubular photobioreactors (Slegers et al. 2011). The differences in algae cultivation systems are taken into account.
The models are flexible and allow to perform scenario studies to compare different algae cultivation systems. Important design variables for production are light path, distance between parallel reactors, algae species, biomass concentration, location and weather conditions. The location's latitude and local weather conditions determine the cultivation season, the lowest and highest productivities. The predicted productivities are in line with values reported in literature. Scenario studies show that several combinations of light path and biomass concentration establish optimal values for biomass production. With these results the algae cultivation system conditions can be adjusted to the requirements for downstream processing.

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**References**
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Wijffels RH, Barbosa MJ, Eppink MHM. 2010. Microalgae for the production of bulk chemicals and biofuels. Biofuels, bioproducts and biorefining 4(3):287-295.