NexantECA

Technology and Costs

Biorenewable Insights: Algae Technology

Algae Technolgy is one in a series of reports published as part of NexantECA's 2016 Biorenewable Insights program.

Overview

Over 200 companies and many government agencies worldwide have made significant investments in algal biofuels developments. The motivation for this interest has been energy independence and sustainability, carbon capture, and conservation of arable land, water, and other resources. Several major multinational oil and chemical companies have announced partnerships with algae technology developers, including ***Exxon-Mobil*** with ***Synthetic Genomics***, ***Shell*** with ***HR Biopetroleum***, ***Dow*** with ***Algenol***, and ***Solazyme*** with ***Dow***, though many of these partnerships have since dissolved. ***UOP*** has also been instrumental in working with emerging algae companies in order to produce a biofuels from algae products. Major investors in algae development also include the U.S. military as well as aviation stakeholders. Much of the hype over algal biofuels and other commodity products has now dissipated, and what remains for many is a focus on food, animal feed, nutraceuticals, vitamins, and cosmetics. Few still remain committed to algal fuels and industrial chemicals—but there are still a few developers engaged in fuel-related activities.

Algae is touted as a panacea for global warming, in that it is a potential source of fuel that actively fixes carbon. This has the potential to produce carbon-neutral or carbon-negative fuels.

Despite broad interest and financial support by many sponsors and investors, the challenges to economic viability of algal biofuels remain great. No reasonable model exists today of algal oil production at industrial scale for less than $10 per gallon, even with the simplest of production systems, and net of all co-product credits. Versions of algal technology that produce ethanol may have better economic viability in the near term, as may algal sugar fermentation (non-photosynthetic) routes to lipids, but these remain to be demonstrated at commercial scale for industrial products (though they have been commercialized for food and cosmetic use). This challenging perspective stems largely from very high capital costs and high separation costs for the algal oil and co-products.

Technologies

Microalgae are microscopic, fast-growing photosynthetic organisms with significant potential for the production of biofuels and renewable chemicals. Microalgae primarily live in aquatic environments, but can grow in a wide range of salinities, pH, and water purity, which allows them to grow in brackish water and wastewater streams. In addition, some algae are halophiles, which thrive in high salinity environments such as inland salt lakes.

At this time, over 200 companies are focusing on algae for various products, and a significant number of these are targeting biofuels. The simplest way to categorize these and the most significant differences among most of these companies is in their approach to growing and harvesting the algae. Additionally, a subset of the algae industry has emerged to serve the algae producers (e.g., ***Algae Venture Systems'*** AVS Dewatering Technology).

At the present, NexantECA has investigated 3 primary growing systems:

- Open Pond
- Photobioreactor (PBR)
- Heterotrophic

Process Economics

Cost of production models for USGC, Brazil, Western Europe and China are shown for:

- Open Pond Algae Biomass / Algae Oil
- PBR Algae Biomass / Algae Oil
- Heterotrophic Algae Biomass / Algae Oil

Capacity

NexantECA catalogues existing and planned algae capacity and provides profiles of projects.

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Technology and Costs comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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