Many leaders in algae production technologies, including Solazyme, Solix, Seambiotic, LiveFuels and Sapphire believe algae will be commercialized in the next few years.

Algae biofuels: commercialisation outlook

The pathway to algae commercialisation is witnessing several breakthroughs and technological advances in synthetic biology, genomics, metabolic engineering, closed-loop photobioreactor systems, raceway pond developments, harvesting, lighting and extraction systems.

Each of these innovations is helping to reduce costs, increase productivity in pilot and demonstration projects, and accelerate the commercialisation of algae biofuels.

Feedstock advantages

Many biofuels and petroleum refinery companies desire a steady supply of feedstocks year-round, and are now diversifying into non-food feedstocks and sustainable feedstocks as a risk-management strategy.

One challenge with traditional feedstocks rapeseed, soya, and corn is these seasonal crops may only achieve one or two harvests a year. In contrast, algae can be harvested daily, and can meets several sustainability criteria as a high-yield, non-arable land use, non-food, non-rainforest based feedstock.

Compared to first generation feedstocks such as soya, which only produces 50 gallons of oil per acre for biodiesel; or corn which can produce up to 400 gallons of ethanol per acre, algae can produce 5,000 gallons of biodiesel or ethanol per acre.

First generation

Traditionally, algae have been developed to produce vegetable oils similar to rapeseed, soyabeans and other oilseeds for biodiesel transesterefication. Since 2002, several companies in the US, Europe, and Israel have been refining methods to produce and extract vegetable oils from algae for use in biodiesel markets.

As the markets expand for algae-based biofuels, producers are now using different strains of algae to produce specific types of fuels. Starch and carbohydrate rich strains of algae are being employed in several pilot projects for ethanol. The US represents the largest market in the world for ethanol fuels, and has established mandates to produce 36 billion gallons of ethanol and renewable fuels by 2022.

Algae ethanol is a good fit for US markets, where approximately 97% of passenger cars run on petrol. Most of these cars can run on up to 10% ethanol or E10 blends. To meet these enormous demands by 2022, several companies are now developing ethanol fuels from algae, including Algenol, PetroAlgae, Inventure, and Virent.

Second generation

Around the world, the petroleum, trucking, aviation and defense industries are intent on making biomass and algae work within their existing automotive fleets, ships, aircraft and petroleum infrastructure. For these reasons, an increasing amount of investment is going into the production of algae oil (also called bio-crude, or syncrude). For example, the US has already invested $7 trillion (€5.5 trillion) in its existing petroleum refinery, storage, pipeline and distribution infrastructure. Petrol refining engineers argue first generation biodiesel and ethanol fuels are not compatible with their existing midstream and downstream infrastructure.

Alternatively, algae bio-crude can be delivered to petroleum refineries and be processed into ‘drop in’ fuels that are compatible with existing infrastructure and automobiles, including: renewable diesel, renewable petrol, and aviation fuel.

For renewable diesel, some strains of algae have been identified and enhanced to produce short hydrocarbon chains that closely resemble the molecular properties of diesel fuel for use in most temperatures and conditions. For aviation fuels, strains of blue-green algae have been identified to produce longer hydrocarbon chains that more closely resemble kerosene or jet fuel for commercial and defense aviation. These are of particular interest to the aviation industry, facing imminent carbon penalties. In the algae to bio-crude space, several companies are now focused specifically on producing bio-crude with hydrocarbon properties similar to light petroleum crude that can be shipped directly to petroleum refineries.

By-products

Algal biomass can generate several valuable products and revenue streams from one feedstock. Most algae producers use a similar process by extracting the oil from the algae for biofuels production, and then utilizing the remaining biomass (or cake/meal) for livestock feed, or for power generation at an integrated algae/power plant. In addition, many forms of algae biomass contain high-value nutritional and pharmaceutical grade products such as DHA (fish oil), heart-healthy omega 3

fatty acids, carotinoids, bio-plastics, and several other products that range anywhere from $500 per tonne up to $15,000 per metric ton.

Commercialization outlook

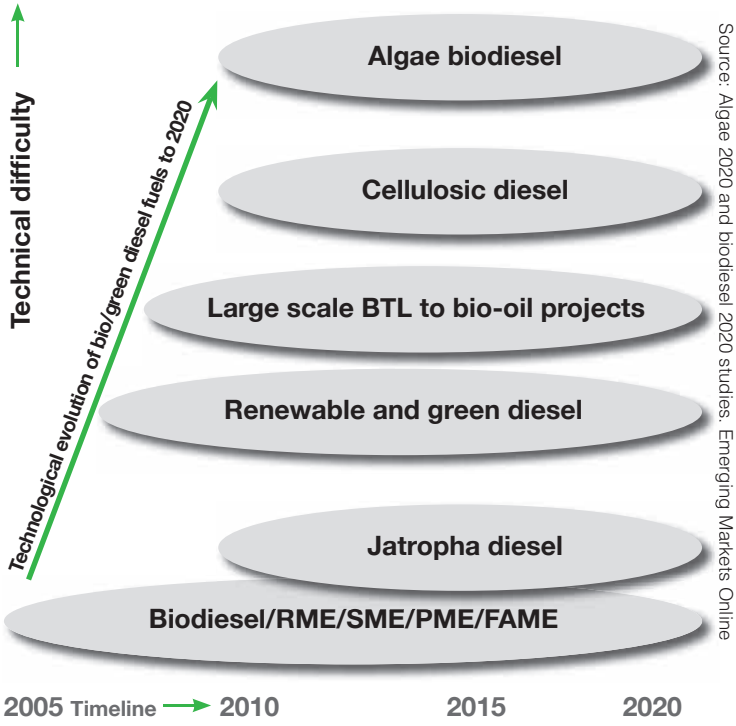
A closer look at the potential for multiple product streams from algal biomass provides some initial clues in the pathway to commercialisation. A dozen or so established and early-stage producers view the pathway to algae commercialisation as a stairway, starting with high-value biomass products as the first steps and revenue streams, in concert with additional steps to use algae for carbon dioxide capture/remediation, and further steps for algae oil biofuels production as it become cost-competitive.

A new study Algae 2020 notes that when the commercialisation of algae biofuels arrives in the next three to four years, it will be a major game-changer in the first and second generation biofuels markets.

As production demands for biofuels worldwide continue to be limited by current feedstock options, algal biofuels will provide much-needed competition, innovation and supply-side support for national renewable energy targets. ●

For more information:
This article was written by Will Thurmond, president of biofuels consulting firm Emerging Markets Online, author of Biodiesel 2020 & the forthcoming study Algae 2020, and chairman of R&D for the National Algae Association

Timeline for commercialisation of biodiesel fuels



Source: Algae 2020 and biodiesel 2020 studies. Emerging Markets Online