The Power of Algae

By Chad Wocken


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The world of biomass is bursting with hope for algae, however, we must avoid the course of irrational exuberance that plagued past technologies. Many look to algae as the renewable resource to win the battle over global warming, and provide the U.S. with energy security. In reality, algae hold great promise as a resource that, if developed correctly, could become a sustainable biomass source for energy and fuels. We are still years away from developing meaningful quantities, and prudence must govern the safe development of natural algae strains that will have no adverse impacts on ecosystems.

No one can deny the potential of algae. Unlike traditional oilseed crops, which produce 10 to 100 gallons of oil per acre, algae are mega oil producers capable of producing 1,000 to 5,000 gallons of oil per acre. Oil collected from algae looks very similar, chemically, to crop oils and can be converted to renewable fuel using existing technology. Algae also do not compete with food sources, can grow in nonpotable and saline water on otherwise nonproductive land, treat polluted waters and recycle carbon dioxide (CO2). So if algae are so phenomenal, why aren't we using them to produce biofuels on a large-scale today?

Many challenges to large-scale algae-derived renewable fuel exist and span the entire process from algae strain selection, through harvesting, to fuel conversion.

Although great strides have been made, algae production remains a challenge. Algae grow in shallow ponds or bioreactors where they use photosynthesis (sunlight, CO2 and other nutrients) to grow, reproduce and generate oil. Advancements are needed to optimize the supply of light, CO2, and nutrients to the algae.

Because of algae's small size, and tendency to plug/foul filters, harvesting it from water is challenging. Once harvested, the algae undergo energy-intensive drying and oil extraction processes. Research is ongoing to find ways to more efficiently collect oil and algae solids from their waterborne state.

Economics are also a major challenge facing algae's future in the renewable fuels industry. Currently, the price of feedstock makes up the largest cost of production and can contribute 80 percent to 90 percent of the final fuel price. The hope is that algae will have the ability to produce oil at a price competitive with petroleum oil at $1 to $2 per gallon. To achieve this, technology advancements need to be demonstrated, but additional characteristics of algae will also need to be fully utilized. Treating impaired water and capturing CO2 will improve the economic viability of algal-based systems. Additionally, the identification and extraction of other valuable products within algae, such as nutrients or pharmaceuticals, will aid in the economic viability of algae.

Working to overcome these challenges and unleash the potential of algae, the Energy & Environmental Research Center continues to develop pathways to convert algae to renewable fuels. The EERC is currently teamed with Science Applications International Corp., and others to further demonstrate the EERC process to convert any oil, including algae oil, to "drop-in" compatible fuels.

The EERC has maintained its focus on producing drop-in compatible renewable fuels, meaning that they are virtually indistinguishable from traditional petroleum-based fuels. The EERC and others are engaged in developing an economical process for the production and subsequent conversion of algal biomass to liquid fuels that are identical to gasoline, jet fuel and diesel. These algae-derived renewable fuels have the potential to rival petroleum fuels and truly be the new super fuel.

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