
- Facilities Designs
- Equipment
- Wastewater Reclamation
- Scientific Consulting
- R&D
- Life Cycle Assessments
- Techno-Economic Analyses

MicroBio Engineering
US DOE funded algae biofuels and wastewater treatment projects

First use of paddle-wheels for mixing large raceway ponds,
Demonstrated settling algae for harvesting and CO2 fertilization (Benemann et al, 1980)
A Look Back at the U.S. Department of Energy’s Aquatic Species Program: Biodiesel from Algae

Aquatic Species Program
U.S. DOE 1980 - 1996

J. Sheehan, P. Roessler, T. Dunahay, J. Weissman, J. Benemann (Principal Investigator)

Close-Out Report

Joe Weissman

Paul Roessler now at Algenol (before that at Synthetic Genomics)

Algae-powered cars: Science fiction or science?

Say again, and most people think of those unpleasant green organisms found in swimming pools and fish tanks. But to the scientists and engineers of ExxonMobil, algae seem like something more appealing. Opportunity? Why? Because algae can create renewable energy while absorbing CO2.

The energy from algae might someday produce biofuels that are compatible with those made from conventional crude oil. That’s why ExxonMobil is committed to a major long-term research and development program aimed at developing algae as a viable fuel source. Unlike other biofuels sources such as corn and sugar cane, algae do not compete with our food supply. And because they consume CO2, algae could help reduce greenhouse gases.

ExxonMobil is partnering with Synthetic Genomics Inc., pioneers in bioengineering, on this groundbreaking research effort. Our goal is to produce biofuels from algae in the future to supplement the fuels we use in our vehicles today, while reducing greenhouse gas emissions. Algae have never tasted so inviting.
GreenFuel Technologies & Arizona Public Services (APS)

Claimed 85% NOx, 50% CO2 removal, ~30,000 gal oil/ac-y

Founded 2005, MIT
Raised >$70 million, in 2007 move to APS
bankrupt in 2009
Major algae-based CO₂ capture/utilization projects in 2010
Reality Check: None still active in this field

Some more recent examples of algae CO2 Utilization Projects:

Reality Check: CO2 flue gas utilization not yet commercial
~20 billion gal\textsubscript{eq}/year of algae biofuels could be produced in the US, needs ~ 200 million tons CO\textsubscript{2} (US consumption ~300 billion gallons/year)

Venteris ER, et al., A national-scale comparison of resource and nutrient demands for algae based biofuel..., Biomass Bioenergy (2014) (PNNL-DOE http://dx.doi.org/10.1016/j.biombioe.2014.02.001
MicroBio Engineering Inc. RNEW® Process for wastewater treatment, biofuels and CO₂ utilization

Recycle
Nutrients
Energy
Water

- CO₂ addition for complete nutrient removal
- Algae harvesting by bioflocculation (settling)
- Biofuels co-products (anaerobic digestion, HTL, etc.)
- Low cost and low energy vs. conventional treatment

THANK YOU!