Military backing algae-based fuel research

By Mike Stark - The Associated Press
Posted : Friday Jul 3, 2009 12:49:55 EDT

LOGAN, Utah — Somewhere among the beakers and the bubbling green-tinged tanks in this Utah State University lab, Jeff Muhs is searching for champion pond scum for the U.S. government.

If he and others like him around the country are successful, algae-based biofuel could one day power one of the world's biggest gas guzzlers: the U.S. military.

Heady stuff for a simple sun-sucking organism. But algae's ability to grow fast and churn out fatty oils makes it an alluring prospect for a military looking to lessen its dependence on foreign oil.

"It inherently makes sense to start there," said Muhs, who runs Utah State's energy lab.

Work at the lab is part of a Pentagon project aimed at fast-tracking research to eventually produce algae-based biofuel that costs less than $3 per gallon, can be produced at a rate of 50 million gallons per year and meets strict military standards.

"We believe it's possible. We wouldn't invest in it if we didn't," said Jan Walker, a spokeswoman for the Defense Advance Research Projects Agency, the Defense Department's main research arm.

In December, DARPA awarded a $20 million contract to General Atomics and a $15 million contract to Science Applications International Corporation (SAIC), two San Diego-based research companies. The contracts ask the companies to find a biofuel surrogate for JP-8 — the petroleum-based fuel for military jets, planes and other vehicles.

Lab tests and smaller-scale experiments over several decades have shown that algae oil can be turned into fuel. But the military, which spent more than $12 billion on fuel in 2007, wants something large-scale and cheap.

"We view that as the primary challenge of the job, to get it where it will serve as a source of affordable JP-8," said Bill Davison, vice president for the Advanced Process Systems division at General Atomics.

The workload is being spread among subcontractors from universities and private research firms across the country.

Part of the trick is finding the right algae for the job.

There are about 40,000 species to choose from. Many are efficient at converting nutrients and carbon dioxide into the organic matter that provides oils that can later be refined and used as a base for biofuels.

The problem is certain algae grow fast — some can double their mass several times a day — but produce little oil. Others produce gobs of oil but are slow growers.

"You have to find a happy medium," said Muhs, whose lab is examining about 300 kinds of algae.

His researchers are running experiments on the effects of temperature, sunlight and other factors on productivity. Some like fresh water, others thrive in salt water. Tweak their living conditions — nutrients, carbon dioxide, flow of water — and their ability to produce oil changes along with it.

"There's so many variables to look at," Muhs said. "You can begin to see why there's a need for research. It's a daunting task."

At Arizona State University, scientists are testing about 500 strains, searching for the most robust specimens in flasks and beakers that could make the transition to larger outdoor ponds and growing facilities.

"We call them the athletes. If they perform well in the lab they get to play on the big field outside," said Milton Sommerfeld, a professor and researcher at the university.

He was part of a federally funded project that started in the 1970s to look at the viability of algae-based fuel. It's still too early to say what kind of growing systems will work the best and exactly how laboratory successes will be scaled-up for commercial use, he said.

Intensified interest in recent years, he said, will move the process along more quickly.

"But it's going to require tens of millions of dollars," he said.

Part of what makes algae attractive is that it doesn't compete with food sources in the same way ethanol does and it has the potential to produce far more biofuel per acre than corn or soybeans.

There are still plenty of unknowns, including how much energy it will require to produce fuel from algae at a large scale and whether it's better to grow algae in pools or in enclosed tanks called photobioreactors.

Researchers are also trying to determine the most economical way to extract oils from the algae and put it through the refining process.

The rough cost estimates for producing algae fuel vary right now from $10 a gallon to $40, said Al Darzins, who manages the national bioenergy center at the National Renewable Energy Laboratory in Golden, Colorado.

"Obviously, that's not cost effective," Darzins said. "So we have our work cut out for us."

NREL has ramped up its own research into algae-based biofuels a decade after a similar program was scrapped because the fuels were considered too expensive to compete with petroleum.

Today, he said, there are hundreds of companies studying algae fuels. A few high-profile tests — including commercial jet flights using a blend of algae- and petroleum-based fuels — are intriguing but nowhere close to showing that commercialized algae fuel could replace the 100 million gallons of petroleum diesel and jet fuel burned each year, he said.

But research from this Pentagon-funded project could help spur use of algae-based fuels in the commercial aviation market, according to Paul Bollinger, a vice president with SAIC.

"The military has the potential of serving as a market initiator and the airlines as a market maker," Bollinger said.

Back at the Utah State lab — where algae are shaken, stirred and stressed in the name of science — Muhs tempers his excitement over the potential of the green slime with a dose of reality. Algae fuels could be a transition-type fuel in the coming years but aren't the singular savior to weaning modern society from petroleum.

"It's not a silver bullet," he said.