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Pond Scum: Fueling our Future?

As higher gas prices, larger utility bills and skyrocketing energy costs plague the nation, Utah State University researchers are looking for solutions to ease consumer heartache while, at the same time, sustaining the world.

The researchers, funded in part by the Utah Science and Technology Research Initiative, are working together to come up with a secure, clean and sustainable energy source.

"This is perhaps the most important scientific challenge facing humanity in the 21st century," said Lance Seefeldt, professor of chemistry and biochemistry.

Seefeldt, along with several fellow USU professors, formed the Biofuels Program to develop new and emerging technologies that will produce methane, biodiesel, hydrogen and alcohols from renewable, carbon-dioxide-neutral energy sources, such as consumer and agricultural waste and sunlight.

The team includes Brett Barney, chemistry and biochemistry; Jeff Broadbent, nutrition and food sciences; Scott Ensign, chemistry and biochemistry; Carl Hansen, nutrition and food sciences; Conly Hansen, nutrition and food sciences and biological and irrigation engineering; Ron Sims, biological and irrigation engineering; Byard Wood, mechanical and aerospace engineering; and Henry Nowak from the USU Technology Commercialization Office.

**Our work makes an impact,
not only here in Utah, but
around the world**



USU researchers (from left) Ron Sims, Conly Hansen, Lance Seefeldt and Byard Wood.

"There are several options for solving the world's energy problem, but at this point, none of them are realistically viable for long-term use," said Seefeldt.

The world today relies on fossil fuels to supply much of its energy, and there are currently 13 terawatts of energy used per year. A terawatt is 1,000 billion watts, and Seefeldt said usage is predicted to double to 26 terawatts by the year 2050. Fossil fuels are expensive, finite and generate greenhouse gasses that many believe are harming the environment, said Seefeldt.

"It is obvious that we need to do more research," he said.

One of the options USU is working on is what Seefeldt describes as a second-generation solution - that is, taking oil from algae and converting it to biodiesel fuel. Algae, plainly referred to as pond scum, can produce up to 10,000 gallons of oil per acre and can be grown virtually anywhere.

Biodiesel is a clean and carbon-dioxide-neutral fuel that is becoming more popular, but most of the current product comes from soybean and corn oil. As supply and demand grows, so does the price of soybeans and corn. People and animals rely on soybean and corn as a food commodity, eventually causing competition between commodities and growing enough product. Meeting this demand would require the world to use virtually all of its arable land, said Seefeldt.

USU is currently conducting research on algae and plans to produce an algae-biodiesel that is cost-competitive by 2009.

The state of Utah sees so much promise in the research that it has given the USU Biofuels Program \$6 million for five years through the USTAR program. USTAR makes highly-selective, strategic investments in research with the potential to benefit Utah's economy.

"This has moved from a purely environmental issue to a global economics issue," said Seefeldt.

Sir Nicholas Stern, chief economist for the World Bank, said that climate change presents a unique challenge for economics and that it has the potential to be the world's greatest and widest ranging market failure ever seen.

"Business as usual will result in a five-to six-degree warming of the Earth by 2100," said Stern. "This will result in a five to 10 percent loss in global gross domestic product, having a direct impact on human health and environment."

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The state of Utah, and especially USU, has positioned itself to be a key player in the future for this type of research thanks to the foresight of the Utah legislature, said Seefeldt.

The research has already set in motion several spin-off and industry relationships, and one patent has already been issued, with four others pending.

One spin-off company is Conly Hansen's company, Andigen. Andigen has created an efficient, affordable system for converting manure into electricity. Hansen's work, funded in part by the state of Utah's Centers of Excellence program as well as USTAR, is marketing its technology to the agricultural industry.

Hansen spent more than 30 years honing his research and, a few years ago, launched the university's Center for Profitable Uses of Agricultural By-Products. Andigen is among the companies spawned by the center.

Andigen creates induced-blanket-reactors, a type of anaerobic bacterial digesters that breaks down organic matter and produces a by-product of methane gas. The methane, in turn, can be used to run a generator that produces electricity or it can be compressed to fuel farm vehicles.

Andigen's systems feature a three-story, 32,000-gallon bioreactor into which manure is stored for up to six days. Such systems can be installed at livestock operations and food processing facilities and carry the added benefit of reducing odor.

A system for a 1,000-cow dairy can generate enough electricity for 100 homes. Hansen estimates that the payback for system installation is about eight to ten years.

"We are looking toward the world's future energy solutions, and USU is part of it," said Seefeldt.

The research takes a tremendous amount of investment and energy, but the payoffs will be worth it, he said.