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The algae evangelist

It may be only pond scum, but Ross Youngs believes algae "is critical to the future of civilization." Don't laugh.

BY NANCY
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While the wind turbines turn and the solar panels gather rays, a new contender has floated onto the alternative energy scene: the humble algae plant. And algae's prime advocate in Central Ohio is entrepreneur Ross Youngs.

Tall and affable, dressed in a green sweater and black jeans that fall short of nerdiness, but do not aspire to fashion, the 53-year-old is the CEO and founder of three Marysville companies: Univenture, Algaeventure Systems and AlterE. He could have retired early on the success of Univenture's innovative, soy-based packaging products. Instead, he has become an algae evangelist, winning a \$6 million U.S. Department of Energy Advanced Research Projects Agency (ARPA-E) merit grant to advance the algae technology he invented.

Although algae as an energy source may be a new idea to the average Central Ohioan, it has become a growth industry—and the original concept has been around for a while. From 1978 to 1996, the Department of Energy funded the Aquatic Species Program, charged with discovering whether oil extracted from algae could meet the country's energy needs.

The concluding report found the process too expensive given the cost as-

Algae guru Ross Youngs sits in front of four algae cultures in his companies' Marysville office. The vats contain samples of a high oil producing type of algae native to Ohio.

sumptions as compared to the price of crude oil then (about \$60 a barrel in today's dollars). But the Department of Energy now is funding the algal research of Youngs and others. Youngs's inventions have improved dramatically the benefit-cost prospects for large-scale processing of algae as a viable energy source.

The idea is not such a stretch, according to Youngs, who says scientists theorize that today's petroleum may have been yesterday's algae. "The carbon chains in petroleum and algae can match up very well, and some species of algae produce a fat or lipid that looks very close to petroleum."

Youngs first met algae when he and the Univenture team "challenged themselves"—the word "challenge" holds a special place in his vocabulary—to build a better bio-plastic, and he quickly saw its virtues, which include rapid growth (look at any Ohio pond in the summer) because of its single cell structure.

He speaks about algae with the conviction of a zealot. "I am absolutely convinced that algae is critical to the future of civiliza-

tion," he says. "It will give us clean water by consuming our waste. It can supply food and feed and fertilizer and chemicals and fuel."

But a few minutes after those breath-taking assertions, Youngs talks like the hard-headed businessman he also is. "I'm a very conservative entrepreneur," he says. "My approach is to take small steps, not shoot from the hip."

He explains there already is a viable high-end algae market for "pharmaceuticals and nutraceuticals," which are, in layman's terms, vitamins and food supplements. Fish oil is derived from algae, as well as DHA and ARA, the fats used in baby formulas. Spirulina and chlorella, both algae, are widely available in your neighborhood GNC store. Algae even can be found in sushi.

In 2008, he and his crew decided to invest a year of Univenture profits and focus their research on a big barrier: getting algae out of the water, where it grows in minuscule concentrations.

The traditional technology used a centrifuge to extract water, a "brute force" approach that was prohibitively expensive for most applications because it relies on such high amounts of energy. Youngs turned his attention to a counter-intuitive, low-energy approach.

With a fingertip, Youngs demonstrates how a drop of liquid (in this case, the Arizona tea he has been drinking) clings to his skin until a paper towel touches and rapidly absorbs it. "Wicking," he says of the process. "Very little energy is involved. Nature has the most efficient way to move liquids and solids. We are big believers that nature has a lot of experience—so we pay attention!"

The resulting technology, known as SLS (solid-liquid separation) and its application, the AV Harvester, are, like most good solutions, both simple and elegant. Porous belts and liquid adhesion combine to produce the shiny, dark green flakes that are dewatered algae.

This algae is not only twice as dry as algae dewatered in a centrifuge, but also 94 percent cheaper to dewater, making the Harvester a disruptive technology. Luke Geiver, associate editor of *Biodiesel* magazine and author of the blog "Algal Technology & Business," gives Youngs's technology a thumbs up.

"It's a pretty innovative approach, and an important step for dewatering algae, because it's not a technique that requires a lot of energy like the centrifuge," Geiver says. "It can potentially be coupled with other systems that will then use the dry biomass for livestock feed, pharmaceuticals, lipid oil extraction for biofuels and so on."

This giant leap forward is what won Algaeventure Systems the ARPA-E grant. In

fact, Youngs, who, it should be noted, holds 56 U.S. and international patents, went beyond the scope of the original grant to develop a lab-sized commercial model.

Not bad for a guy from Indiana with a self-described normal childhood. He spent hours doing "mechanical and electrical stuff" and, from the age of 6, accompanying his father on jobs repairing X-ray machines.

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"I also loved going on hikes with my dad. I was in a naturalist club in high school where we hiked and went on bird-watching expeditions in the surrounding areas and states."

Youngs earned an associate's degree in environmental engineering from the Florida Institute of Technology and then studied industrial engineering at IUPUI (Indiana University-Purdue University Indianapolis). He moved to Ohio to follow a job in the CD production and packaging industry.

Youngs's dislike of the standard CD jewel case led him to design an alternative that used 90 percent fewer materials, and on the strength of this design he founded Univenture in 1988. "I always look for things that are better, faster, cheaper," he says. "If I can meet those opportunities, I will find customers."

Today, Univenture shares its big, blue building with Algaeventure and Youngs's third company, AlterE, which together employ about 130 people.

While Youngs's algae dewatering rig is being scaled up for future commercial harvest, the smaller lab models already are being sold to other algae researchers. The Algaeventure website features the logos of nearly 40 collaborators in algae technology, including Marathon, NASA, Wright-Patterson Air Force Base, the Ohio State University Extension Office, the Columbus Zoo and Aquarium and a number of universities and engineering firms.

Youngs's third company, AlterE, exists specifically for sales to non-algal industries, since many other solutions can be dewatered with Youngs's technology. Customers in the U.S., Asia and Europe successfully have used the process to separate and dewater poultry fats, wastewater slurry, food waste streams and hog manure, among others.

Commenting on Youngs's technology, David Brune, professor of bioprocess and bioenergy engineering at the University of Missouri and a worldwide expert in aquacultural engineering and wastewater treatment, says that although he has not seen hard data to support the company's claim, "I like the idea and believe it is worthy of funding and investigation."

When testing has proven that Youngs's Harvester can dewater algae on a commercial scale, he would like to see algae farms in Ohio. He disagrees with those in algae tech who think algae farms belong in the Southwest. "It's not a realistic idea—it's like growing corn in the desert," he says.

Research supports his view. A Department of Energy study published in April in *Water Resources Research* points to the Great Lakes region as one of the optimal areas for growing algae. Anyone who has seen an Ohio lake in the summer can testify to algae's growth potential, but, as Grand Lake St. Marys residents can testify, not in a good way. However, Youngs's company is working experimentally on 40 acres of the lake to develop a method that uses silica to encourage beneficial algae while limiting the toxic kind. "Ohio has an incredible agricultural heritage," Youngs says. "Great scientists and farmers and researchers who understand plants and the environment." Ohio also boasts a central location and lots of waste for algae to eat.

Youngs, who is fond of analogies, sees algae tech accelerating in the next few decades in the same speedy and unpredictable manner as mobile technology. "Who could have predicted the iPhone," he says, "based on the design of the first cellphones?"

At a whiteboard in the company conference room, Youngs produces a slew of figures that eventually demonstrate that Grand Lake St. Marys, as one example, could produce 109,000 tons of algae on a single summer's day. "Ohio was an energy exporter once—of coal and wood. In the future, an area of less than two Ohio counties could grow the algae to supply the liquid petroleum needs of the whole state."

In a world hungry for energy and growing short of resources, oil extraction from algae is the holy grail of the industry, but Youngs sees algae meeting many other needs, especially in cleaning water and providing food and feeds.

"I'm still incredibly excited about algae and algal technology," he says. "Nothing is more important." ■

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