A MEAN, GREEN ENERGY MACHINE

BY MARY MCNALLY

POND SCUM MAY FUEL A REVOLUTION thanks to Professor Ilhami Yildiz and his students.

Since joining the BioResource and Agricultural Engineering Department two years ago, he has already helped propel Cal Poly to the forefront of the national race to develop alternative fuels. Through Yildiz's research, Cal Poly has become the first in the country to establish a rigid-tube, closed-system photobioreactor for growing algae, one of the most promising forms of renewable biofuel.

Algae has many attributes, the first being high oil content. Compared to other crops, such as corn or soy, algae has the potential to generate more than 100 times the oil output – and that's before genetic engineering or researching different strains of the green goo.

At the same time, it can be cultivated anywhere, as Yildiz points out, "on mountaintops, on rooftops, in the desert, anywhere." So it doesn't compete with food production for the use of agricultural land, helping to stabilize food prices.

That's where the photobioreactors come in, a system of enclosed solar tubes designed to mass-produce algae. Until the advent of controlled-environment systems, algae had been cultivated on ponds. However, only the top two or three centimeters of pond water got enough sun to foster growth.

The photobioreactors maximize algae production by increasing the volume of surface area exposed to light, and the closed-system model allows them to closely monitor and calibrate various conditions to determine the most efficient way to mass-produce what Yildiz calls his "little green friend."

Ultimately, the ancillary benefits may be as beneficial to the environment as the development of a renewable energy source. The four elements necessary to grow algae are water, air, sunlight and, ironically, carbon dioxide, a major culprit in global warming. With the development of closed-end-systems, carbon dioxide can be captured from other sources, such as industrial venting, and channeled into the production of algae – effectively transmuting these harmful emissions into a harmless and renewable source of energy. "It's a completely sustainable and enriching cycle," said Yildiz.

Even the byproducts of the production cycle are useful, including Omega-3 and algae-cake (a euphemism, to be sure), a protein-rich source of animal feed. Even waste-water is repurposed as fertilizer for the algae. Nothing is wasted.

To say that Yildiz is enthusiastic is something of an understatement. "You have to describe him with a metaphor that involves energy," commented Mark Shelton, associate dean of the College of Agriculture, Food and Environmental Science. "He's not only working on energy, he's generating energy. His attitude is infectious, and the students get that."

"I am honored to work with such students," Yildiz says of the cross-section of students his work attracts from majors across the campus. "They help each other. Some are strongest in math, some in biology or engineering. As an interdisciplinary group, it works so well."

The team meets weekly for updates, private tutoring, technical presentations, faculty visits, mentoring and bonding. "No matter how long it takes each week, we stay here," said Yildiz.

So far, they designed, built and operated a lab-scale model in the loft next to Yildiz's office overlooking the BioResource and Agricultural Engineering workshop.

Students also helped technicians install the full-scale photobioreactor project, working throughout Dead Week to get it done. One student has already authored three peer-reviewed papers. Several were offered jobs after attending a conference with Yildiz. Others have been admitted to grad school.

In addition to winning a grant from the U.S. Department of Agriculture, the program is attracting budding interest from public and private partners. "When he came here, we didn't have anything except some greenhouse space to support what he wanted to do," Shelton offered. "He is building the infrastructure, and there is a tremendous potential to grow in bio-process engineering." □

For more information, go to *www.brae.calpoly.edu*

(R) Ilhami Yildiz examines the photobioreactor that will turn algae into fuel