

Trying to Turn San Diego into the Green Houston



A bag of algae is hung between a row of lights at General Atomics facilities. Photo: Sam Hodgson

By [DAVID WASHBURN](#)

Thursday, Jan. 1, 2009 | In the early 1990s, San Diego's moribund economy was revived by a bunch of scientists who figured out how to do things like turn a mobile phone into a multi-media entertainment center and develop a diabetes therapy out of lizard spit.

Now, with the economy tanking again, another bunch of scientists is telling anyone who will listen that the region's next economic boom might be borne out of pond scum.

Algae that is — green gold, San Diego soda.

San Diego, already home to dozens of companies involved in solar or wind energy, would be a major player in the nation's multi-trillion-dollar energy economy if a group of local researchers succeed in turning algae into a commercially viable transportation fuel, something they think they can do within a decade.

"[It] is the scientific challenge of our generation," said Stephen Mayfield, a cell biologist and associate dean at the Scripps Research Institute, referring to the need to cure America of its 200-billion-gallon-a-year oil addiction. "And algae is the answer."

And a top-notch research infrastructure, a thriving biotech sector and proximity to cheap land in Imperial County, where the plant could be grown on a large scale with plenty of sun, combine to give San Diego a strong foundation for building on algae's future.

Mayfield is one of several scientists at both Scripps institutions and the University of California, San Diego who are considered among the world's foremost algae researchers. Other prominent names are Steve Kay, dean of the division of Biological Sciences at UCSD, and B. Gregory Mitchell, a biologist at the Scripps Institution of Oceanography.

The consensus is that the technology exists to make algae-based fuels commercially viable within five to 10 years. Others say it could be less than four years. But there are daunting economic and political obstacles, including the stubbornly high cost of extracting oil from algae, and a strong lobby that wants corn to be the primary source of biofuel production in this country.

A growing number of venture capitalists are acknowledging these obstacles, yet banking on them being overcome. San Diego is home to several algae start-ups, the largest being Sapphire Energy, which was founded with Mayfield's help and has 80 employees and more than \$100 million in venture capital funding. Kay is a founder of Biolight, which has received funding from Bay Area-based CMEA Ventures.

"Long term, I see great potential," said Michael Melnick, a partner in CMEA Ventures. "(But) it will take longer than people think, and take a lot of government support."

In recent years some of the area's biggest players have decided they want a piece of the green spongy stuff. And, after abandoning algae as a viable biofuel in the 1990s, the federal government is again funding research.

General Atomics and SAIC, two of the region's largest defense contractors, have algae programs, and last month each received a multi-million dollar [grant](#) from the U.S. Defense Department to develop jet fuel from the plant. General Atomics has about 40 people dedicated to its algae program, and expects to receive \$40 million from the Pentagon over the next three years.

"If we are successful at this it will not only solve the fuel problem, it will solve the economy problem," said David Hazlebeck, the biofuels program manager for General Atomics. "It could translate into several trillion (dollars) in economic activity."

Kay estimates that research and development activities in San Diego County and large-scale growing operations in Imperial County could combine to create jobs in the tens of thousands. "Our vision is that San Diego will become the green Houston of the world," he said, referring to the tens of billions of dollars annually that oil and gas exploration contributes to Houston's economy.

However, a lot has to happen before these visions can become real. Algae companies are a long way from having the same local impact as Qualcomm, the wireless communications giant, or even that of San Diego-based Amylin, the biotech that developed a diabetes drug based on the saliva of a Gila monster.

"It is important not to overhype algae," said Lisa Bicker, president of CleanTECH San Diego, a green industry association. "We are excited about it, but it is early."

Biofuels in general have yet to live up to the hype. There is a broad consensus that the industrialized world's addiction to petroleum is leading us down a path toward both environmental and economic destruction. But finding a cheap and efficient way to produce mass quantities of fuel out something other than oil has proven difficult.

Corn-based ethanol, the oil alternative that has garnered the most attention — not to mention billions of dollars in government subsidies — is now considered by many to be a bad idea. For one thing, every acre of corn used for ethanol is an acre that can't be used for food. The result has been years of steep inflation in the price of corn-based staples, which has disproportionately hurt the poorest on the planet.

Corn ethanol has been a bust environmentally as well. Though the final product burns cleaner than petroleum, its carbon footprint isn't greatly different from oil when all of the greenhouse gases emitted while it is being fertilized and harvested are taken into account. "When it is all said and done you only get a 10 percent reduction in greenhouse gases with corn," Kay said.

Cellulosic ethanol, which is produced from wood, grasses and the non-edible parts of plants, is better environmentally than corn ethanol, but it requires lots of fertile land and lots of irrigation. And ethanol, no matter where it comes from, is far more corrosive than petroleum and would require a significant investment to either retrofit or replace pipelines, experts say.

Algae, on the other hand, can be grown almost anywhere there is water, sunlight and carbon dioxide, including stagnant ponds, wastewater treatment plants or any number of other godforsaken places. "The Salton Sea is 378-square miles of crap, that is a good place for algae," Mayfield said.

It also wins on several other levels. It is a carbon-neutral energy source because the carbon dioxide it consumes while growing counterbalances the emissions from the burning of algae-based fuel. And the process by which the oil is extracted from algae (similar to the process of separating the liquid from a grape) is also carbon-neutral, unlike the harvesting of corn. Finally, the oil produced by algae can be shipped via the existing pipeline structure.

The rub with algae is the cost. Right now, extracting the oil from algae is an expensive process — producing a gallon of algae-based gasoline, diesel or jet fuel can cost \$30. It has to get down to under \$2 per gallon before it will be a viable alternative to petroleum.

More than a decade ago, the U.S. government concluded that it couldn't be done. The Department of Energy had an algae program from 1978 to 1996, and in the end found that "even with aggressive assumptions about biological productivity, we project costs for biodiesel which are two times higher than current petroleum diesel fuel costs."

The academics and the folks at General Atomics think they can prove the government wrong within a few years. Hazlebeck, the General Atomics biofuels chief, said the company has developed a plan to build a 40-acre demonstration plant that would produce algae fuel for \$1 per gallon within three years. That does not, however, mean that motorists will be pumping algae into their tanks by 2011.

That will take government help. And the most difficult obstacle may be political — specifically the nine corn-growing states, whose 18 U.S. Senators (including President-elect Obama) have consistently voted as a block in favor of subsidies for corn ethanol. The algae industry lacks such a coalition, and will not be able to move from the prototype to mass production phases without subsidies, said Kay and others.

"Algae should have the same subsidies as corn," Kay said. "The good news is momentum is building for us, but it is still David v. Goliath."

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