



Treasure hunt. If there's anything reusable in this dumpster, Allen Doyle will find it.

SUSTAINABILITY

This Man Wants to Green Your Lab

Allen Doyle and his team spread the gospel of sustainability from lab to lab, but it's no easy task in the competitive world of research

SANTA BARBARA, CALIFORNIA—For the price of a few pizzas, Allen Doyle saved his science building \$16,000 in electricity costs this year—and kept more than 6 metric tons of carbon from entering the atmosphere. The six-story structure where Doyle manages a soil ecology lab at the University of California, Santa Barbara (UCSB), houses 55 fume hoods, each of which burns through as much energy as three averaged-sized U.S. homes. “I offered pizza to anyone who would let us shut off their [unused] hoods for 6 months or more,” he says. “I was hoping for three hoods; we got nine.”

Doyle hates to see anything wasted. The typical lab consumes four to five times as much energy as an equivalent-sized office or classroom, to say nothing of the huge amount of plastic, paper, and hazardous chemicals researchers go through. Yet in Doyle's experience, scientists are blasé about reducing their environmental footprint while at work. “There's a bit of a ‘Don't ask, don't tell’ culture out there,” he says. Many researchers chastise the government for not doing more for sustainability, says Doyle, “but we're ignoring the same issues in our own labs.”

In the spring of 2006, Doyle co-founded a program called Laboratory Assessments for Research Sustainability (LARS)* with campus sustainability coordinator Katie Maynard. Assisted by a team of interns, Doyle goes from lab to lab on campus, identifying trouble spots, offering advice, and throwing in cookies and coffee when necessary. “We're just

looking for simple answers that may have a significant impact on campus,” he says.

What makes Doyle's program stand out from other sustainability efforts around the country is its student-driven approach, says Dale Sartor of the U.S. government-sponsored Labs21 Program, which aims to improve the sustainability of research laboratories (see p. 40). Already, LARS has helped shut down unused vacuum systems and other utilities, saving departments thousands of dollars in electricity. And by helping researchers trade surplus materials, Doyle has cut down on industrial waste.

Still, the grassroots effort has its limits. Doyle says his team has been stymied by scientists more concerned with cost and competition than conservation. But he remains optimistic that his program is a model for what scientists with a green streak across the country can do to help their labs go easier on the environment.

Campus crusader

Tag along with Doyle for a day, and you can't help but catch a bit of his sustainability fever. The lanky 49-year-old credits his environmental passion to “Jacques Cousteau, Marlin Perkins, and the brook across the street.” After earning a master's degree in chemical oceanography from the University of Alaska, Fairbanks, Doyle came to UCSB almost a decade ago. Since then, he has somewhat obsessively turned the lab he manages into a shrine to conservation. Old wooden shelves

LAB TIPS

1. Close hood sashes and disable unused hoods.
2. Defrost freezers regularly.
3. Turn off equipment at night.
4. Borrow and lend used equipment.
5. Share surplus chemicals and use environmentally friendly reagents.
6. Request removal of unused light bulbs from ceiling fixtures.
7. Print double-sided.



* <http://www.sustainability.ucsb.edu/LARS/>

overflow with opaque plastic tubes, each sporting numerous black marks indicating the number of times they have been reused. And almost every scrap of paper in the room has been printed on at least twice: readouts from a spectrophotometer bleed through to a lab inventory list.

In June, Doyle is spreading the gospel to a neuroscience lab run by Kenneth Kosik. Doyle sees opportunities for conservation around every corner; sometimes he gets so fired up, he can't get his suggestions out fast enough. As third-year graduate student Fernando Santiago shows the team around Kosik's lab, two of Doyle's undergraduate volunteers pepper Santiago with questions. *Is there a labwide policy for shutting the lights off? Do you recycle unused chemicals? How does everyone commute?*

Inside the tissue-culture room, two large hoods glow aquamarine with UV light. Doyle immediately zooms in on a glass vacuum trap that isn't working efficiently. By simply repositioning it, he tells Santiago, the lab could avoid clogging the building's vacuum system and cut down on wasted energy. "It made a lot of sense and hadn't occurred to me," Santiago says later.

Elsewhere in the lab, Doyle's team offers more obvious suggestions. *Turn your computers off at night.* The average computer uses at least 100 watts. If the members of the Kosik lab powered down its four desktop computers when they left for the night, the lab could



Waste stream. Plastic tubes and old electronics can become huge sustainability problems for biomedical labs.

keep a maximum of 700 kilograms of carbon out of the atmosphere each year. *Defrost your freezers regularly.* The frost insulates the coils and makes the compressor work harder to pull heat away. *Make yourself aware of the electricians on campus.* Sometimes a simple tweak can help a piece of equipment run more efficiently or save a gadget that would otherwise end up as industrial waste.

Other issues don't lend themselves to simple solutions. For example, Santiago guesses his lab goes through somewhere between 20 and 40 kilograms of plastic a month—in the form of pipette tips, polypropylene tubes, and tissue culture plates (not to mention the packaging). "Plastic use is a huge issue in biomedical labs," says Doyle. But when he suggests that the Kosik lab switch to glass, Santiago looks skeptical. Reusing glass opens the lab up to the risk of contamination. "If we lost even a few cell lines because of this, it would be a big punch to the stomach," Santiago says. "Nobody wants to take that kind of blow to their science in the name of sustainability." Plus, hiring a dishwasher would cost \$7 to \$8 an hour.

Doyle admits that the issue is not clear-cut. Washing glass has its own environmental impact in terms of water use—especially in southern California. Still, he doesn't give up easily. "I could reuse your plastic for my work," he says, explaining that because his lab studies dirt, it doesn't have major contamination issues. "I could live downstream of you." Santiago agrees, and a new sustainability relationship is born.

Not easy being green

Even with the best intentions, Doyle's program is struggling to grow beyond its pilot phase. LARS currently operates on about \$40,000 and is largely staffed by interns,

Energy-Efficient Freezers for Everyone

If you live in the United States, it's easy to spot the most energy-efficient appliances at your local home electronics store. Thanks to a joint program of the Environmental Protection Agency (EPA) and the Department of Energy, more than 50 types of products—from computer monitors to air conditioners—sport an "Energy Star"

label if they are among the most energy-efficient items in their line. But leaf through a catalog of lab equipment, and you'll find no such guides.

Paul Mathew hopes to change that. The staff scientist at Lawrence Berkeley National Laboratory has been working with EPA for more than a year to put Energy Star labels on lab appliances. "People are clamoring

for energy-efficient equipment," he says, "and the best way to do this is to have labels." Starting in 2008, researchers should have their wish—at least as far as fridges and freezers are concerned.

That still leaves out a host of other lab gadgets, including ovens and centrifuges. The short-term prospects for getting Energy Star labels on these products are dim, says Mathew, because they represent a niche market. So he and colleagues at Labs21,* a federal green-labs program, have been calling manufacturers and plugging in watt meters to obtain energy-use figures for as much lab equipment as they can. Those data should start appearing on the Labs21 Web site in about a year, meaning scientists will soon be able to tell which water bath is likely to send their energy bills off the deep end.

—D.G.

* www.labs21century.gov



who call themselves the Laboratory Research and Technical Staff (LabRATS). Doyle and his helpers scrounge most of the money from receptive departments and grants from foundations. The university won't commit hard funding until more labs are eager for assessments.

That's been a big challenge. In its first year, Doyle and his crew only visited labs they were friendly with, racking up 11 assessments. But in early January, the program started cold-calling professors, and the reception was far more chilly. Out of 27 invitations, only four labs have said yes.

Why the cold shoulders? "People don't want to take time away from their projects," says LARS co-founder Maynard, even if it's only for a couple of hours. And researchers just don't give conservation a high priority, adds UCSB paleobotanist and campus sustainability crusader Bruce Tiffany: "Scientists think about being green in their personal lives, but when it comes to work, they start thinking about publications and promotions." To that end, they typically don't want to risk using recycled reagents or tweaking delicate equipment just to save a few watts.

The lack of tangible incentives is also a roadblock, says Doyle. Sustainable lab practices often save money, especially when energy is involved, he says, but labs don't see those savings because the university pays the bills. UCSB campus energy manager Jim Dewey agrees. "Researchers aren't going to make compromises just to save the campus money," he says. And if making a change costs the lab itself cash, forget it. "Researchers are not held responsible for meeting carbon goals," Dewey says. "They're held responsible for meeting their budget."

Labs in hot fields—especially those run by young professors—also worry about competition. Doyle recommends that researchers turn off their water baths at night to save energy. But heating those baths back up in the morning can take precious time. "The pressures on productivity are huge," he says. "If you ask a lab to do something that will slow them down, it won't work out."

Spreading the word

Despite faculty resistance, Doyle's program has begun to win converts on campus. After the LabRATS visited a soil science lab in the fall of 2006, the researchers began pestering the recycling office about recycling pipettes, paper, and electronics. "Apparently, we got them thinking, and they started calling every other day," says Maynard. In other instances, lab members have become LabRATS themselves and have helped spread the word to

Do-It-Yourself Recycling

What if your lab went through enough plastic pipette tip boxes a month to fill a small backyard pool, and your university didn't recycle any of it? Such was the case in the Johns Hopkins University laboratory of Bert Vogelstein as it plowed hot and heavy into the cancer genome project in early 2006. "The sheer volume of what we were wasting was annoying to me," says postdoc Devin Dressman.

So Dressman took matters into his own hands. He hauled the plastic boxes to a local recycling pickup site and made reusable cardboard receptacles back in the lab. "Most people were really into it," Dressman says of his labmates.

Eventually, Dressman convinced his building manager that the program made financial sense. Johns Hopkins pays about 66 cents a kilogram to destroy biohazard trash, he notes, so the campus reduces those costs by recycling the harmless pipette boxes. The entire medical campus is now recycling the boxes, and efforts are under way to get the rest of the university involved. "It's a win-win situation for everybody, and it's self-sustaining," says Dressman. Best of all, he no longer has to schlep plastic across town himself. "My goal was to take myself out of the picture," Dressman says. "I'm not here to do recycling, I'm here to do research." —D.G.



Tip top. Devin Dressman sits on a throne of recyclable pipette tip boxes.

other labs. "Once you tune people in, some people get really turned on," says Doyle.

Over the next year, Doyle hopes to reach even more scientists. One goal is to incorporate "eco-training" into the safety course that all faculty members and students must complete before working in a lab. Another project involves creating a Web site for surplus equipment to make it easier for scientists around campus to find and trade used equipment.

Still, Doyle says that to make more than an incremental impact, he'll need to get the university involved. If UCSB were to mandate a similar program in every department—what Doyle describes as going from retail to wholesale—he predicts it could save the campus hundreds of thousands of dollars in utility bills and equipment purchases. So far, university officials have shown no sign of wanting to set any requirements. With enough faculty support, however, they just might. A positive sign is that LARS just got permission from the dean of the Division of Mathematical, Life, and Physical Sciences to assess all eight labs in the department's new marine science building.

Doyle thinks his approach could work at

other institutions, too, at least on a similarly small scale. "The challenge is finding a blend of dedicated staff and students to make the communications happen and to look for the conservation opportunities," says Doyle, "but our experience is that there are strong personalities and dedicated conservationists on most campuses." They just need the right tools, says Doyle, and he is planning on publishing his survey questions and other techniques on the Web.

For now, however, Doyle is focused on the task at hand. A couple of hours after visiting the Kosik lab, the LabRATS finish an assessment of an ecology lab run by Bradley Cardinale. The lab runs out of a World War II Army barracks, and Doyle jokingly refers to it as a recycled building. Cardinale's lab has done a good job optimizing its equipment to save energy, but Doyle suggests decommissioning a few unused overhead lights and unclogging a cold-room compressor. Cardinale seems eager to comply. "I think it's going to be a very successful program, and it makes a lot of sense for academics to get involved," he says. "If we don't take leadership for sustainability, who will?"

—DAVID GRIMM