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UC Davis's Energy Efficiency Center Makes Conservation Sexy



By Anya Kamenetz

Professor Andrew Hargadon believes energy efficiency can be sexy -- and he's winning fans at Chevron, Samsung, and Wal-Mart, and in Silicon Valley.

The United States generates more energy than any other country in the world -- and wastes more than half of it. Efficiency, it turns out, can be a rich resource. In an unassuming strip mall off I-80 in California's Central Valley, those riches are being exploited by a kind of alchemy that combines science with business. Efficient technologies, from sensor-equipped LED lighting to smart electric meters, are flowing at a brisk pace out of labs, attracting capital from [Goldman Sachs](#) [0] and Silicon Valley VCs, and support from the likes of [Wal-Mart](#) [0], [Chevron](#) [0], [Samsung](#) [0], and California's major utilities. "In the course of an afternoon, quite literally in this room," says Andrew Hargadon, a business professor at the University of California at Davis, "we've been able to introduce entrepreneurs and their VCs to three different utilities and immediately begin talking about pilot programs." This is UC Davis's Energy Efficiency Center, or EEC, a new nexus for innovation.



"Efficiency," says Ralph Cavanagh, energy director for the Natural Resources Defense Council and a board member of the EEC, "is the unsexy resource." When the EEC was established in 2006, with Hargadon as founding director and a \$1 million challenge

grant funded from the bankruptcy of Pacific Gas and Electric, it was the only such university center in the world, compared to the more than 30 for nuclear power.

But Hargadon, a handsome 45-year-old, is determined to make efficiency if not exactly sexy, then at least marketable. Technology-transfer offices at most universities seem to assume that the institution's role ends when the ink on a new patent is dry. The center works differently, as an ongoing, multidirectional exchange of ideas. "A lot of the original mission and values were based on the notion that what was missing in the puzzle was actually the networks that connected researchers with investors, big companies, utilities, and the public sector," says Hargadon. "So what we could do to have the biggest impact was to foster these network relationships."

Here, Hargadon is speaking from experience. After interning at Ideo [0], he went to Apple [0], where he was an early product designer. A nationally recognized expert on innovation, he wrote *How Breakthroughs Happen: The Surprising Truth About How Companies Innovate* for the Harvard Business School Press, and his consultancy, Hargadon Group, has advised companies including Mattel and Mars on developing new business models. His academic research is on the turn-of-the-century development of the electric industry, and with that, too, he focuses on the relationships forged by early innovators. "You can look back from James Watt, Thomas Edison, all the way up to today -- the reason we remember those inventors is because they built better networks," Hargadon says.

The Davis network includes such students as Siva Gunda, an EEC fellow and a PhD candidate in mechanical engineering. While writing his dissertation on fuel cells and interning at PG&E, he has worked with business students at Davis's Center for Entrepreneurship on two different startups: CEDR is a low-cost demand-response system for electric grids; WicKool is a retrofit device that improves the performance of rooftop air conditioners up to 5% by recycling condensation. Wic-Kool is considered one of the standout ideas developed at Davis so far; within five months of the first napkin sketch, Wal-Mart was trying it out atop a Sacramento store. "As a PhD, the focus is in the lab. You don't really think about where your research is going as long as you can publish something," says Gunda. "But I think the beauty of the center is that it gives the engineers an opportunity to think, Are you working on something that's useful?"

Venture capitalists investing in green tech are essential links in the network. "The most vulnerable element in this kind of academic research is the team that gets built around it as it gets moved out of the lab, and the first early-stage investors that put their time into it," says Hargadon. Raju Pandey, a computer-science professor at Davis, developed wireless monitoring technology that can save tech companies 20% in energy costs by better targeting air conditioning and fans at server racks rather than just blast-chilling an entire data center. Hargadon introduced Pandey to Barbara Grant, managing director of American River Ventures, a Sacramento VC firm focused on efficiency, which agreed to invest; Pandey founded SynapSense in just a few weeks and has attracted \$20 million in venture capital to date from Grant and others. "Andy [Hargadon] is absolutely the linchpin of why this works," Grant says. "It's not only vital and vibrant, it's almost viral."

Chevron -- California's biggest company -- is a major sponsor of the EEC, giving money and time in exchange for first-look access to new products and applications. On the desk of Chevron

CTO James McDonald is a UC Davis -- designed prototype LED lamp that burns just 5 watts. Some new EEC technologies, like the lamp, will be used inside the company; others will go to Chevron Energy Solutions, a subsidiary that does efficiency retrofits, mostly for public clients. "I think what Davis is doing is unique in a couple of areas," McDonald says. "Its strong focus on commercialization resonates with us from a business perspective."

Bringing companies such as Chevron closer to the classroom helps Davis students and professors design better products from the outset -- and efficiency itself isn't always the best selling point. "Compact fluorescents are a global good, but at the individual level, the savings are like one latte -- just not that compelling," Hargadon says. "And so, one of the challenges with energy efficiency is not technological but entrepreneurial." Michael Siminovitch, a design professor and director of Davis's California Lighting Technology Center, a close partner of the EEC, agrees. "At the end of the day," he says, "what you need to do is show there are other values: lighting quality, vision enhancement, safety, less maintenance, actually enhancing the quality of life."

Sometimes this is about aesthetics, like a class, sponsored last year by Samsung and this year by OSRAM Opto Semiconductors, where student create beautiful atmospheric lighting using LEDs. Other times, it's about utility. One of the Lighting Technology Center's most successful designs, which has been installed on the UC Davis campus, is an LED light that's available in two forms: as bollards, the R2D2-like objects that line public pathways, and as overhead fixtures for parking garages. Cheap sensors make the LEDs "boink" up from 50% to 100% when something comes close to it. This saves energy while improving visibility -- a light turning on is more noticeable than one that has been on all along -- and security, alerting you if someone else is moving near the path or around the garage.

But the majority of parking garages -- the majority of buildings -- all over the country leave their lights on all night as a matter of course. Getting people to flick the switch, or install the sensor that will do it for them, isn't just a design or marketing problem, it's a policy problem. That's why Hargadon hopes the EEC will become a lab for national policies as well as better lightbulbs.

The EEC works closely with the California Public Utilities Commission. Most utilities make more money the more power they sell. The CPUC was the first state utilities commission to break that perverse link, so that saving energy is in a utility's business interest. Electricity bills in the state are set at a flat rate regardless of the amount of power used; plus, the utilities must invest \$1 billion annually in efficiency, making them good customers for the technologies coming out of places like the EEC. These pioneering measures are behind the "California miracle": Since they were enacted during the 1970s energy crisis, per capita electricity use in California has remained flat, now standing at 60% of the national figure. Art Rosenfeld, the architect of that policy, called "decoupling," now sits on the EEC's board.

Can these successes be repeated on a national level? President Obama [0] has hit a lot of the right ideas, including smart meters and energy retrofits for 1 million homes a year. Some \$20 billion in the stimulus bill will go to programs, such as improving the efficiency of government buildings and the homes of poor people, and to research.

But Hargadon says the feds need a more nuanced understanding of what exactly to fund, and how: "A lot of companies are pushing technologies that are already part of their repertoire, and labs are pushing for more dollars to continue to advance research. But a lot of stuff on the shelf hasn't been picked up or designed into a business effectively. So we'll either be going with 30-year-old technology or funding technology that won't have an impact for 20 years. My hope is that we can move research out of labs in the next three to five years." Hargadon, and Davis, are providing a model of how to do just that.