

Charging



Photo by Neil Michel/Axiom.



BY CAROL CRUZAN MORTON

Are we ready yet for electric cars? The state and industry are looking to the UC Davis Institute of Transportation Studies for answers to this and other politically charged questions.

Last year, a newspaper reporter from the San Francisco Bay Area called Dan Sperling, head of the UC Davis Institute of Transportation Studies, for a comment about the future of electric cars in California.

To the horror of oil companies and auto-makers, California air pollution officials had launched a plan in 1990 to put 1 million new nonpolluting cars on the road within 20 years. Initially, only electric cars would meet that zero-exhaust tailpipe emission standard.

Now, state officials were nearing the end of a year of public review. Air resources agency staff had drafted alternatives to soften the first-phase electric cars quotas. The reporter knew Sperling as one of the world's leading experts on alternative transportation fuels. He looked to Sperling as a credible academic source to assess oil and auto industry claims that the public was not ready for electric cars and that electric cars were not ready for the market.

Since 1990, Sperling and his UC Davis colleagues and students had shown in study after study that electric cars are a good thing for California--the state with the worst air quality in the country. Even when the belching smokestacks from power plants are included in the calculations, electric cars in California could substantially reduce both unhealthy urban ozone pollution and greenhouse gases in the upper atmosphere. In addition, a series of UC Davis reports showed that the potential market for electric cars appeared to far exceed doomsayer market estimates--many people liked and would use an electric car as a second household vehicle.

But despite the strong case for electric cars built by UC Davis research, Sperling told the reporter that the state should reduce the plan's early requirements. He recommended that the state stick with the 1998 deadline for introducing electric vehicles, so as to "keep the [auto] industry's feet to the fire," but that the state should consider lowering the 1998 requirement from the current 1 in 50 to 1 in 200 cars sold. That would give auto companies more time "so that they would be less likely to dump a bunch of lemons on consumers and poison the market for electric vehicles for years," he said.

To the dismay of environmentalists, the California Air Resources Board this year indeed softened the sales requirements for 1998. But it did stick to the 1998 deadline for requiring the biggest automakers to begin selling electric cars, and it retained the more important sales requirement for 2003 and beyond--10 percent of all cars in the state must have zero emissions.

"I don't think any adopted emission standards for motor vehicles have ever been implemented on schedule," Sperling shrugs. "The ZEV rule did what was intended. It overcame the start-up barriers to electric-vehicle technology. Every major car company in the world and thousands of smaller companies are now investing in alternatives to the internal combustion engine."

Reporters, public officials, environmentalists and corporate managers seek out Sperling for his ability to synthesize many different aspects of a complex problem. "That means taking pure research findings, such as market research, engineering analysis and economic analysis," he says, "and interpreting them in the context of the political process and corporate and regulatory behavior and articulating them in terms of conventional wisdom."

Even as revised, the zero-emission rules are a milestone. The state agency sets global trends with its innovative air-quality regulations. Earlier rules regarding low tailpipe emissions have been incorporated into the federal Clean Air Act. Northeast states have adopted zero-emission vehicle plans. The agency can claim responsibility for car emission improvements ranging from catalytic converters to reformulated gas.

Because of the California rules for non-polluting cars, the 1990s may be remembered as a crossroads in the history of transportation as the world turns toward electric-based car technologies. Sperling is widely credited as one of a handful of individuals most responsible for sustaining the highly contentious "zero-emission vehicle" mandate.

It is also the decade when transportation studies at UC Davis revved up to regional, national and international renown, in part because of the leading role the institute plays in research and education regarding the economic, environmental and technological future of vehicles.

Started in 1987 by Sperling and several of his UC Davis colleagues, the Institute of Transportation Studies became a formal research unit in 1991. Five years later, the institute now administers \$6 million in grants and contracts, employs 100 graduate, undergraduate and faculty researchers, and produces about 80 papers and reports a year, according to the institute's latest annual report.

In the kind of interdisciplinary research often celebrated at UC Davis, the institute fosters collaboration among economists, engineers, psychologists, anthropologists, ecologists and others. Research projects tend to cluster under a number of subcategories: energy and environmental analysis, transportation

economics, travel behavior analysis, hybrid and electric drive vehicles, transit services, and intelligent transportation systems.

The 1990s has been a difficult decade for an institute to start up and grow. Cuts in state higher education funding combined with reduced federal research and development money have left long-established research groups scrambling for dollars to support graduate students and other researchers.

For the fledgling institute's researchers, defining new areas of study and looking in provocative ways at transportation problems have meant finding diverse and nontraditional sources of funding. This year, the institute hired development officer Joseph Krovoza to help raise more funds. Increasingly, research groups on campus and across the country are finding themselves similarly looking for private funding to replace reduced public research dollars.

In the case of Sperling, the institute's high-profile director, the funding issue is further complicated by that fact that he studies and publicly discusses contentious issues.

"It's important for academics to participate in the policy process in a public way because academics are among the few people in society who are independent, credible and knowledgeable," he says. "We have a real responsibility, because most of the policy debates have become so adversarial and polarized that the scientific underpinnings are often ignored or lost."

Early in his career, Sperling learned the cost of speaking out. He was one of the few respected independent analysts of transportation energy issues to refute the exaggerated claims of methanol's advantage as an alternative to gasoline. His words, he soon found out, erased any hope of funding from several key government agencies that advocated methanol.

But Sperling has learned there will always be someone in a company or government agency willing to fund credible, well-reputed research. The secret, Sperling says, is to speak from a strong research base.

"In most cases, there are two well-funded sides to every issue," he says. In the case of methanol, another source was willing to fund the research road Sperling wanted to travel.

Recently, Sperling testified before the U.S. Congress, criticizing the management of a major advanced technology research partnership between the government and the "big three" automakers (General Motors, Ford and Chrysler). A representative from Toyota, a company excluded from the partnership, was impressed that Sperling stood up to such powerful transportation forces and expressed interest in supporting the institute.

Sperling seems particularly adept at maintaining his and the institute's reputation, research integrity and academic credibility with funding from unusual bedfellows.

For example, despite the institute's strong research findings favoring electric cars and Sperling's support of continued state zero-emission mandates, the institute counts Atlantic Richfield Co., Chevron Research and Technology Co., Exxon USA, Daimler-Benz, Honda and Nissan among its corporate sponsors.

Although electric cars are a major threat to the future of the internal combustion engine, Daimler-Benz and Nissan are involved with the institute's projects. And despite accepting money from the oil companies and auto-makers, the institute hosts extended sabbatical visits of prominent environmental activists from such groups as the Environmental Defense Fund, the Sierra Club and the Natural Resources Defense Council.

Especially in the electric car debate, the UC Davis institute plays a major role, and even people who might not believe in an electric car future want to have as much insight and some influence in such an important discussion.

"UC Davis has filled a certain niche: People look to it for balanced thought," says Terry Day, who assesses short- and long-term U.S. energy and oil supply and demand for Exxon. "Sperling is willing to incorporate other opinions, and he's not afraid to take a stand on issues he believes in."

There are other drawbacks to such a public role. Sperling's been booed at conferences for oil economists and environmental advocates. He's been heckled at public hearings. He has received angry handwritten letters from people who read his widely distributed editorial in their small town newspaper. Two prominent people--an irate oil company executive and an entrepreneur selling a water-alcohol fuel--called the chancellor to ask for Sperling's resignation.

But there are benefits, as well. He can see his research making a difference. His book, *Future Drive*, a discussion of future car technologies, has been cited frequently in public meetings and media coverage of the public policy debate. This spring, he received a Distinguished Public Service Award from his UC Davis colleagues. And once in a while, he'll receive a heartwarming letter of support like this one from a musician with a 13-year-old son:

"[Young people] can be totally wild, crazy, even out-of-control, petty thugs, gang members, substance abusers, you name it, but boy, don't use Styrofoam around them once they learn about how it's killing sea life or affecting the ozone layer! This generation will embrace electric cars with a decisiveness that will be unimaginable to those stuck-in-their-thinking-Big-3-automaker types, and they are going to be left in the dust when it happens."

From the beginning of his academic career, Sperling has focused on technologies, fuels and policies for improving the transportation system, environment and society. His doctoral research at UC Berkeley focused on alternatives to petroleum-based fuels. He studied and discarded options such as ethanol from corn, synthetic fuels and methanol. In the late 1980s, at the instigation of his graduate students, he began looking more closely at electric vehicles. Surprisingly, electric cars proved to have dramatic environmental benefits.

Early in discussions about the environmental impact of electric cars, people worried about the increase in power plant emissions due to increased electricity demand from electric cars. Two of his graduate students, Mark Delucchi, now a staff researcher at the institute, and Michael Q. Wang, now a senior researcher at Argonne National Laboratory, investigated what are called "cradle-to-grave" emissions, a big-picture look beyond the cars to the power plants supplying the electricity.

In terms of air quality, California relies on relatively "clean" power sources--hydroelectric dams and nuclear power plants. Of the power from fossil fuels, virtually all comes from natural gas, and those smokestacks are cleaner in California because of strict emission standards for the power plants themselves. For each gasoline car replaced by an electric car, Delucchi and Wang found about a 99 percent reduction in carbon monoxide and hydro-carbons. They also found a 50 to 90 percent reduction in nitrogen oxides, which are precursors to urban ozone pollution.

In other states, more of the electricity comes from coal-fired power plants. Delucchi and Wang found that the air would still be cleaner with electric cars, but the net benefits would not be as dramatic as they would be in California (or as in some other countries, such as France, where two-thirds of the electricity comes from nuclear power).

For years, automakers insisted no one wanted electric cars, because they did not go as far or as fast as gasoline cars. But Tom Turrentine and Ken Kurani, who joined the institute as graduate students in Sperling's group and have both continued as research staff, reframed the questions, integrated survey

techniques from other fields, such as anthropology. They designed a study that also educated drivers about the different characteristics of electric cars.

The only publicly available study showing a significant market for electric cars, the findings revealed a near-term market as large as 7 to 10 percent (compared to car company estimates of less than 1 percent). Many people surveyed found the shorter driving range to be only a minor disadvantage. People in the study most likely to buy electric cars usually owned two or more cars and could easily swap vehicles on days when the electric-car driver need to take a long trip. In fact, many people expressed a surprisingly strong dislike of gasoline stations. For them, avoiding gas stations altogether more than compensated for the limited driving range.

In the UC Davis electric car market study, Turrentine and Kurani found that an electric car makes a good second or third vehicle for a household. Take a gasoline car to the mountains for the weekend, and use the electric car for commuting, shopping, errands and evenings out around town.

These findings do not surprise students of electric car history. University of Arizona technology anthropologist Michael Schiffer analyzed the early history of cars to find out why gasoline cars came to dominate the market over electric cars at the turn of the century. He found that women, who used cars for short shopping trips around town and to drive out to the country club to play tennis, preferred electric cars. Henry Ford's wife was one such woman.

Men, on the other hand, wanted a machine associated with power and adventure and long drives into the country. Wealthy households that could afford two cars generally had a gasoline and an electric car in the garage. Gasoline cars predominated in middle-class households that could afford only one car and that relied on the men to make most of the income and important family decisions, Schiffer found.

Two years ago, no one acknowledged a significant market for electric cars. Now, car companies are starting to accept the premise that the different attributes might be preferred by some people. As for the power issue, drivers of electric cars like the General Motors EV1 are finding that an electric car has full and smooth acceleration power from a complete stop, unlike gas cars, which are much slower in getting up to speed, points out Tom Cackette, deputy director of the California Air Resources Board.

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Although Sperling and the institute have become associated with electric cars, Sperling tries to avoid an advocacy role for any one transportation option.

"I'm looking at issues and technologies in terms of long-term potential to improve the world," Sperling says. "I didn't think the zero-emission vehicle mandate was a great policy in and of itself. It's too rigid and too focused on air quality. But I think it sets us on a path in the right direction. It will not generate any real air quality benefits in the short term, but for me that's not the point."

Sperling is looking beyond that. Electric cars are a good first step that opens up a world of opportunities. "The transportation system has become homogeneous, like a monoculture," he says. "One of my central beliefs is that we need to pursue policies and strategies that allow us to test different technologies and transportation systems to see what might work better. A more diverse transportation system will allow more benign and efficient technologies to flourish."

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