

ITS-Davis e-news is the electronic newsletter of the UC Davis Institute of Transportation Studies. Written for alumni and friends, *ITS-Davis e-news* reports information from ITS-Davis and affiliated campus departments that host transportation-related programs. For previous issues, see the [e-news archives](#).

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► Research Results

CLIMATE CHALLENGE: UC Davis Researchers Inform Policy on Multiple Fronts

It is human nature to seek a single, simple solution to a problem. But when that problem is climate change, researchers across the academic and scientific community recognize that a multi-faceted strategy is needed. In ongoing research efforts and collaborations ITS-Davis researchers are tackling the climate change challenge from many fronts. What they share in common is the understanding that it will take a portfolio approach that combines robust policies with technology development to reduce greenhouse gas emissions to levels needed to sustain the planet.

Low-Carbon Fuel Standard

Two years ago in January, Governor Arnold Schwarzenegger ordered the California Air Resources Board to develop a performance-based strategy for reducing by at least 10% the carbon content in our state's transportation fuels by 2020. The governor first asked UC Davis and UC Berkeley researchers to study the feasibility of California's Low Carbon Fuel Standard to help guide the state air board in its regulatory process. ITS-Davis Director Dan Sperling with the late Alex Farrell of UC Berkeley led a UC research team that produced two comprehensive reports outlining how the state could meet its low-carbon fuels goal.



Since that initial research effort, state regulators have launched an exhaustive regulatory process that culminates in a final proposal due out in March in advance of an anticipated Air Resources Board vote in April. Meanwhile, the combined UC Davis-UC Berkeley team now led by ITS-Davis Research Engineer Sonia Yeh and UC Berkeley's Mike O'Hare has dedicated much of the past two years to a series of studies that lend technical and scientific support to state regulators as they build the standard.

The team is interacting with academics across the globe, including the University of Calgary; industry and environmental stakeholders; state and federal government researchers at agencies as diverse as the California Energy Commission, California Dept. of Forestry and Fire Protection, and California Dept. of Food and Agriculture, as well as the U.S. Forest Service and U.S. EPA; and international standards groups such as the Roundtable on Sustainable Biofuels. On the UC Davis campus, participating researchers represent the California Biomass Collaborative, Agricultural Issues Center, and the UC Davis Energy Institute. In addition to Yeh, the UC Davis team includes Mark Delucchi, Jonathan Hughes, Bryan Jenkins, Stephen Kaffka, Alissa Kendall, Christopher Knittel, Hyunok Lee, Joan Ogden, Nathan Parker, Daniel Sumner, Peter Tittmann, and Christopher Yang.

With at least 15 concurrent research projects underway, the team is examining thorny issues such as the effects of indirect land use on greenhouse gas emissions, water impacts of California biofuel production, sustainability, economic aspects of the Low Carbon Fuel Standard, and much more. Their work is providing a critically important scientific foundation for the state, complementing the work of dedicated state and federal government researchers, and contributing to the broader body of knowledge that guides policymakers around the world working to adopt strategies for reducing greenhouse gas emissions.

Sperling and Yeh have recently published an article in the winter 2009 edition of *Issues in Science and Technology* describing California's proposed approach. The article, aimed at a broader non-academic audience, touches on the country's (and indeed, the world's) tendency to run hot and cold on different transportation fuels and technologies. This "fuel du jour" approach, they contend, is doomed to failure. Instead, Sperling and Yeh state: "The path to reducing oil dependence and decarbonizing transportation involves three related initiatives: improving vehicle efficiency, reducing vehicle use, and decarbonizing fuels." The article goes on to focus on the latter, which they note has the additional benefit of reducing oil use.

Source: Sperling, Daniel and Sonia Yeh (2009) "[Low carbon fuel standards](#)," *Issues in Science and Technology*, 2009 (2), 57 – 66

80in50

What exactly will it take to meet California's ambitious goal of reducing its greenhouse gas emissions 80% below 1990 levels by the year 2050? In a currently online and forthcoming issue of *Transportation Research Part D*, ITS-Davis STEPS researcher Christopher Yang, Ph.D. and Ph.D. students David McCollum, Ryan McCarthy, and Wayne Leighty explore a variety of options for meeting the 80in50 goal (80% below 1990 levels by 2050) in the transportation sector.

They examine scenarios involving all transportation subsectors, including light- and heavy-duty vehicles, rail, aviation, marine, agriculture, and off-road vehicles, and consider strategies for reducing travel demand, improving efficiency, and using advanced vehicle technologies with alternative fuels.

Their paper uses a spreadsheet model to analyze California's transportation GHG emissions. First they compare so-called silver bullet scenarios against a reference scenario. The reference scenario, based on historical trends, projects a 61% increase in in-state emissions from 1990 to 2050. Silver bullet scenarios include: moderate- and high-efficiency cases where vehicle efficiency is doubled and tripled relative to 1990; a hydrogen-intensive case where fuel cell vehicles and low-carbon hydrogen fuels are spread widely across most sectors; an electricity case that assumes significant penetration of battery-electric and plug-in hybrid vehicles across many sectors; a scenario in which biofuels are widely used; and a scenario in which smart growth and improved land use patterns result in reduced passenger and vehicle travel.

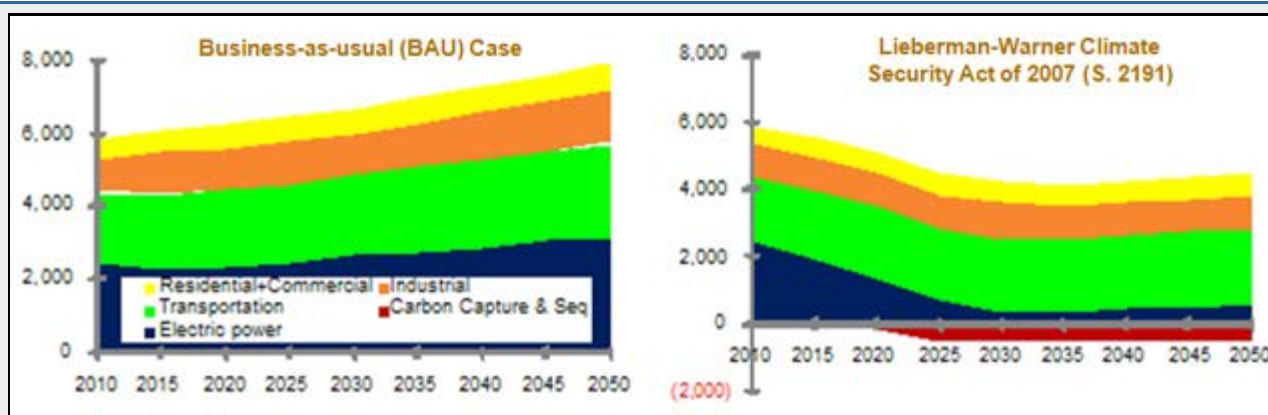
None of the silver bullet scenarios alone meets the 80in50 goal. Many of the individual options are complementary, however, and when these options are combined in new scenarios, they present potential pathways to meeting the 80in50 goal. These scenarios include strategies such as low-carbon cellulosic biofuels with negligible land use change impacts coupled with increased vehicle efficiency; advanced plug-in hybrids, battery electrics and fuel cells where the electricity and hydrogen are generated from low-carbon sources; and an "actor-based" scenario where high energy prices motivate a total transformation in travel behavior and energy use.

In the real world, the authors note, these 80in50 scenarios face challenges. Will there be sufficient low-carbon cellulosic biofuels to meet demand? Can hydrogen or electricity-based vehicle technologies be applied to all transport subsectors, and at what cost? They conclude that the 80in50 goal, while quite challenging, can be met in multiple ways if significant changes in vehicle technologies are achieved and abundant low-carbon energy resources are available.

Piecing together the policy puzzle to meet the 80in50 goals will challenge the brightest minds for the foreseeable future. As this paper describes, meeting the goals will require a durable and robust policy framework that simultaneously leads to improved vehicle efficiency, reduced fuel carbon intensity, and reduced travel demand.

Source: Yang, Christopher, et al., "[Meeting an 80% reduction in greenhouse gas emissions from transportation by 2050: A case study in California.](#)" *Transport. Res. Part D* (2009), doi:10.1016/j.trd.2008.11.010.

Carbon Wedges



Cap and Trade policies such as the Climate Security Act of 2007, and carbon taxes, aren't enough for the transport sector. More direct policy is needed to ensure long term GHG reductions.

STEPS researcher Sonia Yeh has recently published a paper that contributes to the growing body of work on "carbon wedges," the wedge-shaped space on a line graph that shows growing emissions over time.

Yeh, with the late Alex Farrell and Richard Plevin of UC

Berkeley, Alan H. Sanstad of Lawrence Berkeley National Laboratory, and John Weyant of Stanford, used a bottom-up market allocation model (MARKAL) to show how different policy mechanisms would affect transportation sector greenhouse gas emissions. Their paper finds that stringent system-wide CO₂ reduction targets will be necessary to achieve significant greenhouse gas reductions over time.

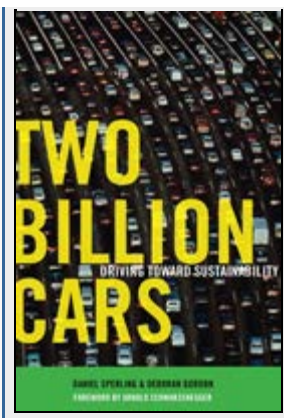
This wedges paper follows groundbreaking work by Princeton professors Rob Socolow and Stephen Pacala, who in 2004 identified seven wedges or sectors of the energy economy that would contribute to the so called "stabilization triangle," the space between the upward "business as usual" trajectory and a lower emission, climate stabilizing emissions scenario as depicted on a line graph. In follow-on research, the U.S. EPA applied the wedge concept to the transportation sector, identifying nine potential sector wedges while noting the size of the wedges could vary dramatically depending on scenarios and assumptions chosen.

Yeh et. al. sought to examine how different policy strategies coupled with a range of uncertainties such as fuel prices could affect climate wedges, especially those in the transportation sector. The researchers examined different light-duty passenger vehicle and fuel policy scenarios, including an economy-wide cap on greenhouse gas emissions (varying from 10% to 50%) and an economy-wide cap coupled with a separate cap on transportation emissions. They found that a moderate economy-wide cap, such as that proposed at the federal level, will do little to reduce transportation GHG emissions. A more stringent economy-wide cap or a transportation-specific cap will be needed to achieve significant transportation GHG emission reductions. The study also found some wedges are sensitive to policy uncertainties (such as biofuels), while others are robust to a broad range of policy objectives (such as improvement in efficiency, plug-in hybrid vehicles). The researchers note that though the results are illustrative, they provide useful lessons that policy makers can use to tackle the climate challenges for the transport sector. The paper suggests that mitigation policies should be informed by the transitional nature of technology adoptions and the interactions between the mitigation strategies, and the robustness of mitigation strategies to long-term reduction goals.

Source: Yeh, Sonia, Alex Farrell, Richard Plevin, Alan Sanstad, and John Weyant, "[Optimizing U.S. mitigation strategies for the light-duty transportation sector: What we learn from a bottom-up model.](#)" *Environmental Science and Technology*, Vol. 42, No. 22, 2008.

TWO BILLION CARS: Sperling's New Book Now Available

Worldwide, we're at a billion cars and counting...within 20 years, there will be 2 billion cars on roads around the globe, says ITS-Davis Director Dan Sperling with co-author Deborah Gordon in their just-published book, *Two Billion Cars: Driving Toward Sustainability*, published by Oxford University Press.



Sperling and Gordon provide a concise history of America's love affair with cars and an overview of the global oil and auto industries. While the United States is still the leading emissions culprit, particularly worrying is that developing nations are becoming car-centric cultures as well. The authors expose the roots of the problem—the resistant auto industry, dysfunctional oil markets, short-sighted government policies, and unmotivated consumers. They zero in on reforming our gas-guzzling culture, expanding the search for low-carbon fuels, environment-friendly innovations in transportation planning, and more. Promising advances in both transportation technology and fuel efficiency together with shifts in travel behavior, they suggest, offer us a realistic way out of our predicament.

The book includes a foreword by California Governor Arnold Schwarzenegger.

Sperling is traveling the nation and beyond giving talks and media interviews. Among the highlights is an appearance on [The Daily Show](#). View his recent schedule and short video interviews [here](#). In January he presented to the World Affairs Council in Washington DC, was a featured lecturer at the University of Vermont, and was a guest on NPR's "Fresh Air," among other notable appearances.

Order the book from your local bookseller or [online at Amazon](#).

TRB: UC Davis Makes a Big Impression Once Again

UC Davis was again a commanding presence at the Transportation Research Board's annual meeting in Washington DC in January. The theme of this 88th annual meeting, Transportation, Energy, and Climate Change, offered many opportunities for ITS-Davis researchers to present and participate. [See the list](#) of UC Davis faculty, researchers, and students who gave papers and participated in poster sessions.

The annual ITS-Davis reception was again a big success. Plus, the Institute's presence in DC presented the perfect opportunity for a Congressional briefing. [Read more in the Institute Update](#).

Sustainable Transportation Center Update

The Sustainable Transportation Center's (STC) mission is to conduct research, education, and outreach on sustainable transportation, which we define as an approach to transportation that meets the needs of all segments of society while minimizing environmental, societal, and economic costs. With funding authorization in 2005 from the U.S. Department of Transportation and a matching grant from the California Department of Transportation (Caltrans), the STC officially launched in 2006.

Dissertation Grants Awarded

The Sustainable Transportation Center awards dissertation grants to support the research of Ph.D. students who have advanced to candidacy and are working on their own original research. The following students were awarded dissertation fellowships in fall 2008.

David Vernon, Mechanical and Aeronautical Engineering
Adviser: Paul Erickson
Title: "Hydrogen Enriched Internal Combustion Via Thermochemical Recuperation to Increase Efficiency and Reduce Emissions"

Jason Lee, Economics
Adviser: Alan Olmstead
Title: "An Economic Analysis of the Good Roads Movement"

Zhen Qian, Civil and Environmental Engineering
Adviser: Michael Zhang
Title: "Holistic Dynamic Congestion Pricing (HDCCP) With Heterogeneous Travelers in Corridor Networks"



David Vernon



Zhen Qian

ANNUAL REPORT: STC 2008 Report Available

The Sustainable Transportation Center's 2007–2008 Annual Report can now be downloaded from the STC web site. [Find it here](#).

BICYCLE ROUNDABOUTS: Davis Featured in National Magazine



Bicycle roundabouts are a longstanding feature of the UC Davis campus. Now, bicycle and pedestrian roundabouts are becoming a more prominent feature in urban transportation planning around the country. [A January-February 2009 article](#) in *Public Roads* magazine features bicycle-friendly Davis and the campus's many roundabouts. The article includes a sidebar on UC Davis graduate Ted Buehler's thesis topic, "50 Years of Bicycle Policy in Davis, CA." Buehler's work with Susan Handy was supported in part by the Sustainable Transportation Center.

Education Highlights

NEW ENDOWMENT: Chevron Supports Energy Efficiency Center

Chevron Corporation has created a \$2.5 million endowment for the Energy Efficiency Center (EEC), the world's first university center of excellence in energy efficiency, launched at UC Davis in 2006. The EEC is focused on developing and commercializing advanced technologies to enable energy efficiency in buildings, agriculture, and transportation. ITS-Davis hosts the transportation component, which emphasizes the emerging interdependence of vehicles and the electricity system, and information technologies to encourage more efficient driving.

This new funding will support the search for a permanent director for the EEC, to expand the impact of the center's research programs through interdisciplinary collaboration, education, outreach, and commercialization of technologies, with a focus on developing strong links with state and federal government, as well as with international programs, to advance energy efficiency.

"Chevron's endowment will ensure long-term strategic leadership for the Energy Efficiency Center," said Larry Vanderhoef, UC Davis chancellor. "By bridging long-term research with real-world applications, the director will guide the center in its goal of commercializing groundbreaking technologies, powering economic progress and helping to conserve resources."

TIME IS NOW: Prospective Student Applications Due Soon

Applications for fall 2009 admission are due April 1. If you're thinking about returning to school, now is the time to apply. [Learn more.](#)

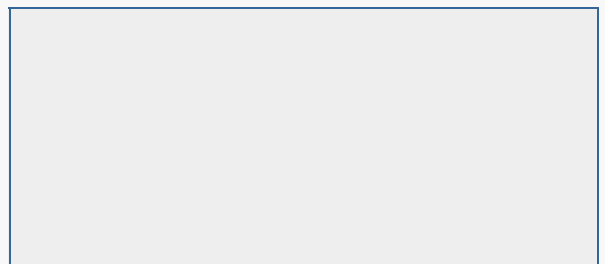
WEEKLY SEMINARS: Free and Open to the Public

Looking to advance your understanding of transportation policy or hear about the latest modeling tool and results? Then the ITS-Davis weekly seminars are for you. Free and open to the public, the seminars are on Fridays from 1:30-3:00. See the [winter series schedule](#) for speaker and location details. You can also watch pre-recorded and live seminars online from the same link.

ITS-Davis and Campus Highlights

CONGRESSIONAL BRIEFING: The Future of Low Carbon Transportation: Policies and Strategies

An ITS-Davis cast of experts laid out the multi-pronged approach necessary to reduce carbon from transportation during a briefing at the new U.S. Capitol Visitors Center in Washington DC in early January. The presentation to over 100 congressional and agency staff and other transportation policy workers on the Hill coincided with the annual Transportation Research Board conference that many ITS-Davis researchers were attending the same week. The Institute thanks Congressman Mike Thompson for sponsoring this event.



Institute Director Dan Sperling moderated the session, which tackled the combined vehicles, fuels, and land use components that he and others say are needed to reduce climate change emissions. ITS-Davis Visiting Scholar David Greene, a corporate fellow at Oak Ridge National Laboratory, presented on “Feebates to Support Improved Vehicle Efficiency.” UC Davis Plug-in Hybrid Electric Vehicle Research Center Director Tom Turrentine discussed the vehicles component in his presentation on bringing PHEVs to market. Research Engineer Sonia Yeh outlined how low carbon fuel standards can complement greenhouse gas cap and trade policy. And Mike McCoy, director of the new Urban Land Use and Transportation Center (ULTRANS), spoke on the third key policy component, smart land use, outlining for the DC audience California’s newest land use and greenhouse gas law, SB 375, which passed last year.



Mike McCoy, Sonia Yeh, Tom Turrentine, David Greene, and Dan Sperling at the briefing

MIXING WORK AND PLAY: ITS-Davis TRB Reception Always a Smash Hit



Pat Mokhtarian (3rd from left) with students and alumni



Continuing the discussion at the reception



ITS-Davis students David McCollum and Jonn Axsen enjoy the reception following their TRB presentations



David Greene, Lewison Lem, and Robert Noland talking transportation

THE FUTURE OF MOBILITY: Sperling Presents the Latest Thinking in Davos

ITS-Davis Director Dan Sperling has just returned from the late-January World Economic Forum annual meeting at Davos, Switzerland, where he and hundreds of other world leaders contributed to the discourse on global issues. Sperling spoke on the future of mobility.

Sperling chairs the Global Agenda Council on the Future of Mobility, one of 68 prestigious panels created to convene “the most innovative and relevant leaders to capture the best knowledge and integrate it into global collaboration and decision-making processes,” according to the World Economic Forum.

In preparation for the Davos meeting, Sperling traveled to Dubai last November to chair a session at the Summit on the Global Agenda 2008. There, 700 experts in each of the 68 councils met to explore linkages between their issues and integrate the most current knowledge to facilitate global collaboration at the Davos meeting. Sperling incorporated the most compelling mobility concepts and ideas from his Dubai trip into his Davos presentation.

Sperling also will be involved in follow-up work; the Global Agenda Council will publish a comprehensive report aimed at bringing the ideas presented during these brainstorming meetings to a wider audience.

PEOPLE: UC Davis Faculty and Student Accomplishments

The Institute of Transportation Studies welcomes two new UC Davis faculty. [Jae Wan Park](#) is an assistant professor in Mechanical and Aeronautical Engineering. His current research focuses on the design and optimization of Proton Exchange Membrane fuel cells and hybrid power systems for transportation.

[David Rapson](#), assistant professor, Economics, specializes in industrial organization and energy and environmental economics, investigating the determinants of organization and consumer behavior. His research interests include the effects of gasoline prices and CAFE standards, and the industry dynamics of biofuel production.

[Deborah Salon](#), who received her Ph.D. in Agricultural and Resource Economics from UC Davis in June 2006, has joined ITS-Davis as a researcher. She is involved in projects with the new Urban Land Use and Transportation Center (ULTRANS) and the China Center on Energy and Transportation.

[Xuping Li](#) was recently awarded the 2008 Helene M. Overly Scholarship by the Sacramento Chapter of the Women’s Transportation Seminar (WTS). The scholarship was established to encourage women pursuing career paths in transportation, and is awarded to women pursuing graduate studies in transportation or a related field. Li is a Ph.D. student in Civil and Environmental Engineering, and a graduate student researcher with the STEPS Program.

[Joan Ogden](#) appears in a video that is part of at the current exhibit on “[Climate Change: The Threat to Life and a New Energy Future](#),” now through August 16 at the American Museum of Natural History in New York City. Ogden was interviewed for the video in New York City last summer. She’s featured in the final segment on solutions.



Xuping Li (right) with Caltrans Director Will Kempton

THANK YOU: Institute Board of Advisors a Great Resource



ITS-Davis 2009 Board of Advisors

Nineteen members of the [ITS-Davis Board of Advisors](#) attended the annual meeting in Davis in December. Institute staff and researchers updated advisors on the successes of the preceding year and discussed research plans for 2009. Board members and friends attended a pre-meeting dinner reception in Sacramento featuring short talks by state and federal policy leaders Mary Nichols, chair of the California Air Resources Board, and fellow ITS-Davis board member David Burwell. The Institute is grateful for the guidance and insight offered by each member of the Board.

EXTRA! READ ALL ABOUT IT! ITS-Davis and UC Davis Researchers in the News

Dan Sperling, numerous interviews nationwide on his book [Two Billion Cars](#), co-authored by Deborah Gordon. Among Sperling's appearances are [an op-ed](#) in The New York Times; NPR ["Talk of the Nation"](#) and ["Fresh Air"](#); WHYY-FM Philadelphia ["Radio Times."](#)

Mike McCoy, January 27, in The Modesto Bee, in [an article about San Joaquin Valley residents' acceptance of higher density development patterns](#) as outlined in a blueprint report based on UC Davis researchers' modeling results.

Marshall Miller, Dahlia Garas, and David Greene, January 26, on ABC7 News (KGO-TV San Francisco) in [a story on getting to the cars of the future.](#)

Dan Sperling, January 1 in [San Francisco Chronicle](#) and December 28 in [The Sacramento Bee](#), on the year in review and future prospects in transportation policy; and earlier in December on multiple state and national media outlets on California's new truck emissions rule and its adoption of California's AB 32 Greenhouse Gas Emissions Scoping Plan. Finally, Sperling made a February 11 appearance on [The Daily Show](#)

Ken Kurani and Tom Turrentine, October 2008, in [Forbes](#), on the PHEV Research Center.