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Developing Smart Cars, Roads for a Greener Drive

Even without fancy new cars or fuels, technology now motoring off the drawing board will help you take that lead foot off the accelerator and start driving green.

By Melinda Burns



University of California engineers are developing technology to promote "dynamic" eco-driving and deliver real-time feedback about traffic speed and signal changes. Studies show that eco-driving can reduce fuel consumption and carbon emissions by nearly 20 percent. (Thinkstock.com)

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If you're the kind of driver who over-accelerates between traffic signals and jerks to a stop on red, you're a prime candidate to learn eco-driving, the steady-as-you-go technique that can cut down on fuel consumption by more than 10 percent.

Eco-driving means "reading" the traffic flow as far ahead as possible so that you can maintain a consistent speed, anticipate stops and avoid excessive braking and accelerating. It means acting instead of reacting. You shift up as soon as possible. You don't barrel toward the intersection and slam on the brakes. You slowly coast to a stop, saving gas and cutting down on idling time, when a lot of fuel gets wasted.

That's "static" eco-driving. Now, engineers at the University of California, Riverside, are working on "dynamic" eco-driving, in which drivers get real-time feedback and advice on how to improve their fuel efficiency and cut carbon dioxide emissions. Within five years, researchers say, computer screens on the dashboard will likely tell drivers when to slow down to anticipate a red light, what the optimum fuel-efficient speed is for the stretch of freeway they're on and whether to change lanes to maintain a consistent average speed.

The road transportation sector consumes a vast amount of fuel and accounts for about a third of U.S. emissions of carbon dioxide, a greenhouse gas the main culprit in global warming. In the campaign to reduce these emissions, dynamic eco-driving is "low-hanging fruit," engineers say. It's cheap and easy, compared to putting cleaner cars and alternative fuels on the market or building a mass transportation system. According to a real-world study by UC Riverside engineers, the fuel and CO2 savings from dynamic eco-driving ranges from 12 to 14 percent on freeways.

Can it persuade drivers to change the way they drive?

"At \$3 per gallon, maybe not – but if fuel cost is high, they'll pay attention," said Matt Barth, director of the Center for Environmental Research & Technology at the UC Riverside's Bourns School of Engineering. "And having a constant feedback is valuable. Hopefully, that will stick."

Newer car models already provide instantaneous fuel economy readings, allowing drivers to adjust their speed as they judge best. The technology of dynamic eco-driving goes a step further. Gathering data from sensors embedded in roadways and around traffic signals, it can actually advise drivers what to do to save fuel as the traffic speed, flow and density changes around them.

In the not-so-far-off future, engineers predict, small computer screens mounted on the dashboard of any model year from 1996 to the present (cars built with onboard computer units) will display a "current speed" and an "eco speed" and be able to alert drivers as to whether they can make a red light. The technology will not, however, give drivers a countdown to the next light, which might encourage them to stomp on the accelerator.

"We can still guarantee you'll get home in the same amount of time," Barth said. "We're just smoothing out how you actually drive. Based on

the timing of the signals, we're saying, 'Speed up a little here, slow down here.' We're guiding you so that your likelihood of getting through the green phases is increased. These little things together add up to much greater savings."

If even 25 percent of the cars on a freeway were equipped with dynamic eco-driving technology, they would form a block that all traffic would follow, and the savings in fuel and CO2 emissions would be substantial, engineers say. Eco-driving can apply to vanpools, buses and trucks, as well as cars. A recent report by the Commission for Environmental Cooperation, representing the governments of Mexico, Canada and the U.S., recommends a North American eco-driver certification program for freight truck drivers.

Eco-driving works best in light-to-moderate traffic: On congested roads, there is no room to speed up or slow down. For both fuel efficiency and savings in carbon emissions, the "sweet spot" is at 45 to 50 miles per hour, on average, though it varies, depending on the make of the car.

Having looked at freeways, Barth's team is now designing a field experiment on surface roads with traffic lights, to compare the fuel and CO2 savings of drivers with and without eco-driving technology on board.

At the same time, Wenlong Jin, an engineer at UC Irvine, is studying how cars traveling on the same roadway can send information about traffic speed and congestion to each other on smartphones.

"With more cars, the information is more accurate," he said. "One advantage of green driving is that just a few vehicles can set the pace and greatly smooth the overall trajectory."

It's safer, too. In a separate initiative, federal officials with the Intelligent Transportation Systems Joint Program Office are studying the use of dedicated short-range communications, a wireless connection with a 1-mile radius, to improve safety on roads. As Miller-McCune's Emily Badger wrote in January, "The Department of Transportation is largely focused on the technology's safety implications, but officials want to make the anonymous data that's routed through the system available to other researchers in an open-source platform."

Global positioning satellite navigation systems now provide drivers with turn-by-turn directions on the dashboard or by cellphone; and there are apps for getting real-time traffic conditions on iPhones and Blackberries. For traveling "green," the 2011 Ford Edge navigation system has an eco-routing feature that tells drivers the most fuel-efficient route to their destination, in addition to the fastest and the shortest routes. (The eco-route is not always the shortest: If the shortest route is congested, the longer way around may save more fuel and CO2 emissions.)

Finally, UC Riverside engineers have developed, but not marketed, an application for an eco-routing navigation system that could be used on a website, iPhone, iPad or Android phone as well as the dashboard of any car. The UC system provides seven routing options for minimizing distance, time, fuel consumption and the emissions of CO2, carbon monoxide, hydrocarbons and nitrogen oxides.

Eco-driving has been around for more than a decade, most notably, in Europe and Japan. Last year, the European Union launched eComove, a three-year, \$19 million project to support eco-driving with "perfectly eco-managed" road networks, including vehicle-to-vehicle communication.

In a recent study, 5,700 Fiat drivers in England, France, Germany, Italy and Spain were equipped with eco:Drive, a Fiat application designed to improve their driving. In the car, they plugged a UBS connection into the dashboard to record information about their speed, gear changes, acceleration and deceleration. At home, they plugged the USB into a computer to track their fuel and CO2 savings and get tips on how to improve. After 30 days, the Fiat study showed, participants stopped less frequently, slightly reduced their trip times and slightly increased their average speed. In short, they drove more fluidly. (Germany proved easiest to drive in; Spain and Italy were hardest.)

On average, the eco-drivers saved 6 percent on fuel consumption, with the best drivers getting a 16 percent savings, the study found. If all European drivers performed like the best eco-drivers, it said, every year they would save five times as much fuel as is produced yearly on the world's biggest oil platform; an amount worth \$68 billion, or as much as what the European Union spent on renewable energy in 2009. At the same time, they would reduce their CO2 emissions by 90 million tons, equivalent to one year's worth for the entire country of Portugal.

"Of course, this is a utopia, but it provides a flavour of the power of eco-driving if it were to become the ordinary way of driving," the study concluded.

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