An hour's drive south of Los Angeles on Interstate 5, Santa Ana (population 400,000) lies 13 miles inland from the Pacific Ocean and 100 miles from the Mexican border. Home of the world's first drag strip, the city is far more famous for its mountain winds that, in Raymond Chandler's words, "...curl your hair and make your nerves jump and your skin itch." I'm here to visit Mayor Miguel Pulido, a member of the board of the Air Quality Management District (AQMD), California's powerful smog-control agency. Although his house is only 200 feet away from the road, the tall trees and expansive yard make his 1.7-acre plot seem distinctly rural.

Major car companies with research and development centers in California, and individual auto tinkerers here, are competing in the quest for the best technology to decrease carbon emissions. Mayor Pulido is "knee-deep in both sides" of the current debate over auto efficiency; at 13 years old, he began helping out in his family's muffler shop, and he still works with a Mexican catalytic-converter manufacturer. But about eighteen months ago, the AQMD converted several Toyota Priuses into plug-in hybrids (PHEVs) to see if they could help solve the town's air pollution problem, and asked the mayor to be a volunteer test driver. Unlike regular hybrids, which can't run on electricity alone, plug-ins, at city speeds, can travel 20 all-electric miles— with zero emissions. Pulido became both a convert and an evangelist.

After a remarkably precocious drum solo by his seven-year-old son, the mayor takes 

Electric Avenue

A new kind of hybrid uses less gas and more electricity. All-electric cars are already here. What will this mean for the road trip of the future? DAVID MORRIS plugs in
me for a drive. The game is to see how far we can go without the gas engine kicking in. At about 35 miles per hour, the Prius engine starts up even if there is charge left in the battery. We watch the speedometer carefully. The mayor is adept. “I’ve driven 600 miles on eight gallons of gas,” he announces. That’s the equivalent of 77 miles per gallon—roughly three times the national average—and that’s why, to Pulido and a growing nationwide constituency, plug-ins are the stepping-stone to a future of electric cars.

“We’re getting closer to the tipping point,” says Pat Gadam of Pat’s Garage in San Francisco. He’s a celebrated mechanic, one of the first to be trained on hybrids, and is rapidly becoming an expert on both plug-in hybrids and electric cars. His staff is giving a checkup to one of the four plug-in Priuses owned by Google. They find no problems. The Internet giant, it turns out, gives $5,000 rebates to employees who buy hybrids—and recently announced a $10 million initiative to promote and develop plug-ins.

One company promises chargers that will fill batteries in 10 minutes

OF COURSE, ELECTRIC cars were the future once before, and recently at that. In 1990, inspired by General Motors’ electric prototype, the Impact, California passed a Zero-Emission Vehicle mandate ordering major car companies selling cars in California to make 2 percent of them all-electric by 1998. Some 5,500 leased electric vehicles plied California’s highways by 2000, refueling at hundreds of special charging stations. Automakers sued California to weaken the mandate; in 2003, despite protests by electric-car drivers, the state dramatically reduced electric-vehicle requirements. When the leases on its EV-1’s expired, GM refused to renew them, recalled the cars, and crushed them. Today, only about 1,000 all-electric vehicles remain on California roads.

A few days after I meet up with Mayor Pulido, I’m driving one of those cars, a Toyota RAV4-EV, across the Golden Gate Bridge toward Point Reyes with photographer Marc Geller, cofounder of the nonprofit Plug In America. Geller’s car batteries allow 130 miles per charge. A digital display on the dash shows the percentage of electricity remaining in them. Whenever we drive up a hill, the number declines; the faster we go, the faster it drops. But when we coast downhill, it rises, thanks to a process called regenerative braking: when the brakes are used or the pedal is released (depending on the make of the car), the engine reverses its spin, converts its kinetic energy into electrical energy, and feeds it into the batteries. At the bottom of a half-mile hill, the RAV4-EV’s battery reserve has increased by 1 percent. This is a familiar dashboard scenario for owners of hybrid cars, with one significant difference—electricity, not gasoline, recharges the RAV4-EV battery.

Hybrids might never have been developed without the drive systems, software, electronics, and batteries created for electric vehicles built after California’s Zero-Emission mandate. In her book Plug-in Hybrids, journalist Sherry Boschert tells the story of how the hybrid grew a socket. Owners of the 2004 Toyota Prius began to wonder about the blank black button on the dashboard, which the operating manual didn’t explain. Online auto aficionados found out that in Japan, pressing the button disabled the gas engine’s automatic cut-in, which allowed the car to travel solely on electricity for one mile as long as its speed was kept under 35 mph.

An anonymous Texas engineer figured out how to activate the Prius button stateside, and that inspired California entrepreneur Felix Kramer to put out an online call for help in converting another Prius—one that could go farther. Electrical engineer Ron Gremban offered both his car and know-how. One-and-a-half years and one nickel-hydride battery later, they had a plug-in vehicle that could travel at least 20 emission-free miles—about the distance the average American drives per day. Its rear windshield reads: WORLD’S FIRST 100+ MPG PLUG-IN PRIUS.

Last year, Kramer took his own plug-in hybrid—the world’s eighth—to Washington, D.C., to show public officials that fuel efficiency could be doubled.  »
right now, without sacrificing safety or comfort. Until then, even most electric vehicle-enthusiasts have scoffed at any car that relied on gas. But Kramer proved, and publicized through his nonprofit campaign, California Cars Initiative (CalCars.org), that a vehicle could run on electricity as its primary power source, with a gasoline backup, instead of the other way around.

The electric cars manufactured in the 90's under California's Zero-Emission mandate had to rely on their own curbside and parking lot charging stations. The new electric vehicles and plug-in hybrids do not. In front of his house in Redwood City, Kramer plucks a yellow three-pronged connector attached to an extension cord into his Prius and puts the other end into an ordinary electric outlet in his garage. “I call it the fueling infrastructure of the future,” he says. And the power plant of the future? He shows me his four-kilowatt rooftop solar system, the flat panels barely visible from his backyard. But solar-powered or not, any ordinary household has the capacity to recharge a plug-in hybrid's battery. The cost, experts say, is a few cents per charge.

How long it takes to refill a car's batteries depends largely on the price of electricity coming out of a designated socket. Most household circuits are 120 volts and take six to eight hours to refill a car's battery. A 220-volt circuit that runs an electric washer and dryer will recharge a battery in half that time. Fast chargers are currently in development. One company, Phoenix Motorcars, in Rancho Cucamonga, California, will offer all-electric pickup trucks and SUV's to business fleets next year, promising rapid chargers that can refill batteries in just 10 minutes.

So far, the only plug-in hybrids available to the public are hybrids that have been converted in very small numbers. Seventy or so custom PHEVs (plug-in hybrid electric vehicles) are now on the road. But before too long, there could be upwards of 800. New York State is converting 600 of the hybrids in its state fleet to plug-ins, and California businesses and local agencies are adding 100 more. That doesn't count the private conversions going on or the plug-ins in development at such companies as Volvo, GM, and Ford. Toyota announced in August that it will be testing 10 newly redesigned plug-in Priuses in Japan.

If plug-in hybrids are the bridge to all-electric cars, then the bridge and the cars may arrive at the same time. Plug-ins will soon be less expensive to acquire and will far exceed the national gas-mileage average. But electric vehicles already out there get an energy equivalent of up to 130 mpg. Tesla Motors, maker of the widely heralded Tesla Roadster, says its car will have a range of more than 200 miles per charge. (A gas car can travel 300 to 400 miles on one tankful.)

D OES ALL THIS MEAN a guilt-free road trip anytime soon? The answer to that question leans toward yes. Even on the highway, running on gas, plug-in hybrids will still have greater fuel efficiency. Flexible-fuel plug-in hybrids can run on gasoline or biofuels (ethanol or biodiesel), the last mitigating our dependence on foreign oil while also lowering emissions.
When and if electric vehicles start to dominate, that will mean more stops for charging, perhaps, but also less money laid out along the way. Bryon Bliss of Phoenix Motorcars, which is now awaiting federal certification of its electric sports utility truck (SUT), predicts that filling stations will start out offering free rapid charges as a lure to get motorists to stop and shop in their stores. As more plug-ins and all-electrics go on the road, quick-charging stations will begin displacing gas pumps. Drivers could conceivably enter an era when, like the ATM’s that have wandered beyond banks, quick-charging stations will also be found at motels and hotels, parking lots, retail stores, you name it. In August, in fact, Tesla and Hyatt Hotels announced a partnership (Tesla investor Nicholas Pritzker, nephew of Hyatt’s founder, bought one of the company’s first cars). Hyatt plans to install chargers in its hotels that will take a car to full charge in 3½ hours or to a half-charge in 1½ hours. The company is basically saying, Come into Hyatt for lunch, plug in, and leave with a refilled “gas tank” that’ll take you another 100 miles. Stay overnight, and you’ll have a completely refilled battery.

One obvious point critics of PHEV’s and electric cars make is that they still contribute emissions by taking energy from power plants. But the United States uses little oil in generating power, and even when electric cars draw energy from existing power plants—half of which are coal-fired—they cause around 35 percent less pollution than gas-powered cars. (Emissions are virtually eliminated if the electricity comes from renewable resources like wind and sunlight.) Where will all this new electricity come from? If cars are charged mainly at night, we already have enough capacity to support millions of PHEV’s and electric cars without building any new power plants.

The most talked-about new electric car, hands down, is the Tesla Roadster, for which many of the roughly 600 buyers have plunked down a $30,000 to $50,000 deposit without ever having kicked the tires or looked inside. I catch up with one of the two Roadster engineering prototypes in Chicago, where public relations director David Vespremi takes me for a spin. He once taught racecar driving, a skill I am grateful for as he darts in and out of blessedly modest traffic in Chicago. It’s a bracing experience to accelerate so quickly—the Roadster is capable of going from 0 to 60 in four seconds, with barely a sound.

The company expects to sell 800 Roadsters this year and up to 2,000 in 2008, and sales may capitalize its next, more ambitious undertaking: a new plant in Albuquerque with the capacity to build 20,000 five-passenger sedans (they’ll cost half the Roadster’s $98,000 price) per year. Phoenix Motorcars wants to set up headquarters at a factory in southern California that can turn out thousands of electric vehicles annually. It looks as if cars themselves may help pave the way to a carbon-free future. ✨

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