



ADDING AN ELECTRIC FUEL TANK TO A HYBRID

by Felix Kramer

This year, batteries and electric motors are back in the news, spurred by the popularity of gas-electric hybrids and the recognition that fuel cell cars are electric vehicles. The plug-in hybrid (PHEV), long consigned to a footnote as an interesting but unrealistic idea, may soon enter the mainstream as an automotive option.

Our organization, CalCars, took years to come up with a metaphor that drove home the PHEV concept to drivers: "It's like having a second small fuel tank that you always use first. You fill it at home with electricity, at an equivalent cost of under \$1 per gallon. Your energy is cleaner, cheaper, and not imported."

Now, support for PHEVs is coming from unexpected places: Neo-conservatives seeking rapid reductions in oil dependency. Engineers immersed in online communities. Futurists concerned about a vulnerable, centralized power grid. Ethanol advocates discovering feedstock alternatives to corn. They've joined forces with long-time supporters like renewable energy advocates, utilities with cheap off-peak power, fleet owners eager for green cars, and component suppliers seeking new markets.

One by one, objections have fallen away. One points to the complexity of using two systems, but today's hybrids use advanced technology to remove components and engineer some of our highest quality and customer-value cars. Another is that the national power grid is too dirty. But Argonne National Laboratory studies show that electric vehicles beat out gasoline vehicles on well-to-wheel greenhouse gases. It's argued that nobody is interested. Yet, journalists have jumped on CalCars' and EDrive's high-mpg conversion stories. They understand how flexible-fuel PHEVs would use almost no gasoline, although admittedly, some reporters have not factored in electricity and biofuel costs. But when the bipartisan National Commission on Energy Policy dug into the emissions numbers and looked for achievable strategies, they gave PHEVs the highest grades. Then Orrin Hatch, Barack Obama, and other Senators, along with George Schultz, James Woolsey, and other former Cabinet members, hailed the 2 to 4 cents-per-mile cost for local travel as a breakthrough this country needs.

It's been said that car companies won't build plug-in hybrids. However, DaimlerChrysler is now completing the first original equipment manufacturer PHEVs. Recent statements from Toyota and Ford indicate they are weighing the concept as well. Battery costs are claimed to be too high with their useful life too short. This remains a subject of debate. Even discounting promising materials science advances, batteries are competitive through incremental but substantial technology, production, and cost improvements, and rising gasoline prices. Plus, a new Electric Power Research Institute (EPRI) study finds no technology impediments and sees affordable batteries when produced in volume.

An overly long payback has been claimed, but this topic is fading as many auto buyers demonstrate their willingness to pay more up front for green cars. They recognize that energy security and global warming are not simply issues of "dollars and cents at the pump." Meanwhile, EPRI studies project lower lifetime costs for PHEVs than for any other type of car. PHEVs are an extendable platform that welcomes other solutions like engine efficiencies. They can be designed for any fuel type, starting with gasoline and evolving to biodiesel, cellulosic ethanol, and even hydrogen. This way, PHEVs solve both the "chicken and the egg" infrastructure dilemma and the uncertainty of predicting future technologies.

CalCars.org and our allies plan to partner with OEMs on demonstration programs. We know the auto industry can deliver. After Pearl Harbor, Detroit switched from cars and trucks to planes and tanks in a year. With PHEVs, we have the opportunity to find out how clean and efficient cars can be right now.

— Felix Kramer is founder of the California Cars Initiative (calcars.org), a non-profit group of engineers, environmentalists, and entrepreneurs that combines technology development and advocacy for plug-in hybrid vehicles.

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