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The Automobile Shifts Gears

Mark. P. Mills 09.16.08, 5:00 PM ET

The future of the automobile is being fought on the two stages of politics and raw capitalism. No surprise, given that cars are at the epicenter of not only oil demand and manufacturing might but also technology deployment.

Both presidential aspirants (cars seem to bring out the inner dweeb in the candidates) have tech-centric future-car plans. Not coincidentally, the world's two largest automakers have started a Kabuki dance over who will lead the next secular shift in automotive technology from whence 21st century market dominance will emerge. Regardless of who wins either battle, the transformation of the car, over time, alters energy markets in far-reaching ways.

Obama and McCain are pushing for the development of new, plug-in hybrid cars. The idea: charge your car by plugging it into the wall. It'll take your electric bills up but your gas payments down. What do you think? Leave your comments below.

Both Obama and McCain propose to accelerate the idea of a "plug-in hybrid," a vehicle directly derived from the digital silicon economy. So do automakers. In mid-August, General Motors announced it had "essentially finished" the design of its Volt, a radical new hybrid car first unveiled just a year ago in January, with planned production in 2010.

Not to be outdone, Toyota quickly announced, contemporaneous with the Democratic Convention, an acceleration of its own similar plan and release schedule. Nissan, Ford, Mitsubishi, Chrysler and Mercedes all have plans too.

What's the big deal? Don't we already have hybrids? Yes, but these new hybrids will have a plug that connects to a wall socket, giving consumers a choice of using (mostly domestic) electricity to replace all (mostly foreign) gasoline on most trips.

This simple feature has immense consequences.

The plug is the physical and economic link that makes it possible, for the first time, to connect two nearly independent parts of our energy economy--the oil

and the non-oil domains. By doing that, the plug-in hybrid has the potential to radically alter the energy equation that currently favors gasoline.

Consider: 95% of all American transportation energy is supplied by oil. Meanwhile, the energy for everything else--offices, factories, homes and data centers—is 85% supplied without oil, and most of it is delivered as kilowatt-hours. (Only a vanishingly 2% of electricity is generated by oil.) Once you connect automobiles to the electric grid, you access a trillion-barrel-of-oil-equivalent energy infrastructure almost entirely fueled by domestic sources: coal, uranium, natural gas and hydro dams.

Look at this another way. Today, most alternative energy technologies that are discussed--wind, solar, tides, waves, clean coal, nuclear fission and, perhaps one day, fusion--are useful only for making electricity. Yet today, wind does no more for commuters than gasoline does for computers.

Conventional hybrids such as Toyota's Prius have moved from a cult niche to a mainstream product, with a cumulative million units sold--the demand for this car has closely tracked oil prices. Nevertheless, conventional hybrids are still locked into the oil economy, with a drive shaft directly connected to a gasoline engine.

Plug-in hybrids turn this upside down--reversing the roles of gasoline and electricity. Conventional hybrids use mainly the gasoline engine for propulsion, drawing on the electric drive and batteries only occasionally to (impressively) improve gasoline efficiency. Plug-in hybrids use mainly electric motors and batteries for propulsion, relegating gasoline to occasional use to extend the battery range. The gasoline engine serves as an on-board personal electric utility for when you forget to plug in to the local grid, or for ensuring a total range to match that of any conventional car you'd buy today.

The Volt's gasoline generator is mechanically independent of the wheels--easily swapped in the future for ethanol, biodiesel or fuel cell generators. Think of the plug-in hybrid as the biggest consumer electric appliance ever. Store enough kilowatt-hours for 40 miles in a battery (the Volt's planned range) and you capture daily driving for most people. So the average commuter could stay in kilowatt-only mode every day. A pint of gasoline is displaced by each grid kilowatt-hour--whether produced from one pound of coal, five seconds of a wind turbine's spinning blades or 20 square meters of solar cells.

What does it mean for energy markets? Ultimately, the invisible, under-the-hood electronic architecture of the plug-in hybrid will become as commonplace as automatic transmissions and anti-lock brakes. Once the majority of domestic cars become plug-in hybrids, we could displace most urban gasoline use, or nearly one-half of current U.S. oil imports.

To make this technology practical, automakers had to wait for ultra-powerful but compact electronics and, critically, useful batteries. Storing large quantities of electricity has long been the domain of 150-year-old lead-acid chemistry. Lead, while cheap, is a nonstarter; your small laptop computer battery would wheeze to a stop in 30 minutes using lead, as would your Volt if its 400-pound battery pack were lead. Driving for 30 minutes at commuting speeds yields a useless dozen miles.

Lithium battery chemistry, commercialized in 1991, changes this equation with a four-fold gain in energy stored per pound. Lithium technology was a key market enabler for notebook computers and cell phones. Now automotive-class lithium price, performance and safety is emerging from dozens of venture-funded entrepreneurs and established battery players.

They're going to be busy though. If 10% of the world's automotive production switches to plug-in, we'll need to at least double the world's current lithium battery output. And then we'll need substantially more electricity to charge them up. On average, each Volt will add electric demand equal to a couple of home refrigerators. These challenges, however, are more under our control than what happens in oil markets. GM is already working with several dozen utilities to smooth the transition to smart, electric refueling. Many more utilities and automakers will follow.

History is littered with examples of products created before their time, from Ford's Edsel to the Osborne PC years ahead of Apple, and Apple's own notorious flop with the Newton (the iPhone's ancestor). Add to the dud list GM's 1996 EV1 electric-only car. The timing and technology finally appear right for car unshackled from oil dependence.

Doubtless, the next president will implement policies and take credit for helping this inevitable transformation. But credit will belong to a global constellation of digital entrepreneurs, and engineers at the likes of GM and Toyota, who compete to finally take the auto industry out of its 19th century roots.

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