

PLUG-IN HYBRID TECHNOLOGY

In the wake of rising gas prices and growing concern over combating climate change, the market for more fuel-efficient and environmentally friendly vehicles has grown exponentially in recent years. In the past nine years, hybrid car sales in the U.S. have ballooned from 9,500 in 2000 to more than 270,000 new hybrid cars registered in 2008. Despite a worldwide economic downturn, hybrid car sales remained strong in 2009, with roughly 200,000 new hybrids registered in the U.S. as of October.

The robust market for traditional hybrid vehicles has prompted renewed interest in alternative fuel and more advanced hybrid technologies that will further combat greenhouse gas emissions. Much of the attention is focused on the introduction of plug-in hybrid vehicles. The current leader in hybrid car sales, Toyota, has promised a plug-in version of its Prius will hit the market by 2012. And much of GM's efforts at rebirth are focused on the introduction of the plug-in hybrid Chevy Volt as early as 2010.

Vowing to have 1 million plug-in hybrids on U.S. roads by 2015, President Obama has made the introduction of additional hybrid technology a key component of his highly touted desire to significantly reduce America's greenhouse gas emissions over the coming decades. Given the increased federal attention on alternative energy sources, combating climate change and improving America's energy security, state stakeholders will likely find themselves at the forefront of expanded hybrid promotion. In addition, state policymakers can play a key role in equipping their states to take advantage of this growing market.

The Difference Between Traditional and Plug-in Hybrid Technology

Traditional hybrid vehicles like the popular Toyota Prius average between 40 to 50 miles per gallon and are powered by an internal combustion engine and a rechargeable battery. Most traditional hybrid cars use some combination of engine power and regenerative braking power to continually recharge the battery. According to the Environmental Protection Agency, this combined power source provides traditional hybrid vehicles with a fuel economy that is 30 to 60 percent better than conventional gasoline-only cars. But these traditional hybrids always use some fossil fuel while in operation.¹

Plug-in hybrid vehicles come with a plug that allows the vehicle's battery to recharge from a typical household electric outlet. As a result of the additional charging capacity and the inclusion of larger battery packs than traditional hybrids, plug-in hybrid models can be driven for 40 to 50 miles without using gasoline, according to *hybridCARS.com*.² Because of that, the ideal consumer for



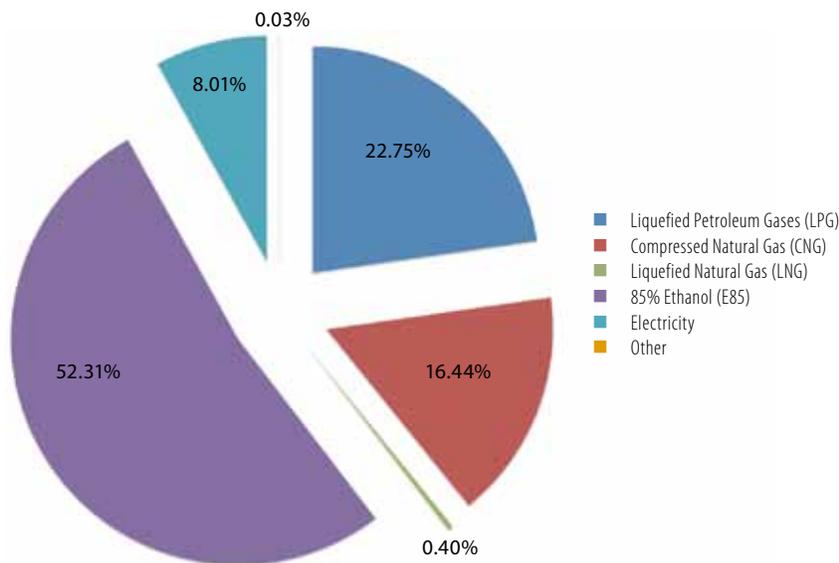
a plug-in hybrid is someone whose driving needs are contained within a small, local area. The battery range of plug-in hybrids would allow most local driving to occur in all-electric mode. When driving at higher speeds, such as on highways, or for longer distances, the car's electric motor assists the gasoline engine and can achieve up to 100 mpg, according to manufacturer estimates.³

Are Plug-in Hybrids the Wave of the Future?

This isn't the first time eco-friendly researchers and government leaders have touted the beauty of electric vehicles. Electric cars first hit the scene in California more than a decade ago and proved to be a bust for a variety of reasons. This latest clean car trend may be different.

According to the EPA, plug-in hybrid technology will help advance battery and related technologies while reducing U.S. petroleum consumption and greenhouse gas emissions.⁴ The greatest buzz surrounding plug-ins stems from the perceived ability to reduce greenhouse gas emissions and therefore stem global warming. A recent EPA study found that if plug-ins can acquire a 30

Alternative Fueled Vehicles 2007



percent market share by 2025, the U.S. can anticipate a reduction of up to 11,000 million metric tons in CO₂ emissions between now and 2050.⁵ That figure would account for almost one-fourth of the reductions analysts estimate are needed to stabilize emissions for the entire transportation sector.

But reaching that 30 percent market share would be a considerable accomplishment. Despite the rapid growth of traditional hybrid sales over the last decade, the Prius and its counterparts comprised only 2.5 percent of the new car market in 2009, according to *hybridCARS.com*.⁶ In addition, the amount of greenhouse gas reductions depend on the source of the electricity used to charge plug-in hybrids. According to the EPA, in areas where electricity is produced in coal-burning plants, the reductions realized by the use of plug-in hybrids is significantly less than in areas where energy is generated by renewable sources. Despite those caveats, EPA studies said that even given the current electricity generating sources, the expanded use of plug-in hybrid technology will result in significantly fewer greenhouse gas emissions.⁷

Perhaps the most controversial aspect of the plug-in hybrid's potential is the debate over how much impact such

vehicles will have on the nation's energy independence through a reduction in petroleum dependence. While proponents claim plug-in hybrids can get 100 mpg or even higher, the data is not there to support it. The first models of plug-in hybrid cars are not set to hit the market until 2010. As a result, data is limited to that collected from the limited number of traditional hybrids that have been converted to all electric, plug-in hybrids. The mileage results are not the marketing dream many plug-in enthusiasts are seeking.

According to *Wired* magazine, Seattle's fleet of converted Prius hybrids is averaging just 51 mpg. The Idaho National Laboratory is reporting similar figures for the 104 plug-in hybrids it monitors in 22 states. While these estimates are just half the 100 mpg cited as the industry benchmark, Seattle's spokesman Scott Thomsen said that the additional 11 mpg experienced over a traditional Prius' performance has resulted in 25 percent less CO₂ emissions for the city's fleet, according to the May 2009 article in *Wired*.⁸

The disparity between the 100 mpg estimates and the current data averages can be attributed to several factors. According to *Wired*, the biggest culprit is driver behavior: "Aggressive

driving effects the mileage of all cars, but with plug-in hybrids there's more of an impact." The second oft-cited issue is failure to maintain a battery charge. Seattle officials, for example, report to *Wired*, that their drivers were operating on dead batteries at least one-third of the time. Seattle officials also reported that plug-in hybrids with fully charged batteries get 50 percent better fuel economy than those with dead batteries.⁹

The need for optimally charged batteries brings up another criticism or difficulty in realizing the full mileage potential of plug-in hybrid technology. The infrastructure to support an electricity-based automotive industry is not currently available. For example, a commuter may charge the car battery overnight, but if there is no means to recharge the battery during the work day the commuter will drive home on a depleted or dead battery.

The final benefit the EPA credits to increased plug-in hybrid application—the improvement of battery technology—is much harder to argue. Hybrid battery technology has already improved dramatically with the increased use of traditional hybrids and the early stage production of plug-in hybrid cars. The current gold standard—lithium-ion batteries—far outpace the lead-acid batteries used in initial hybrid car models.

As a result of the advancement in battery technology, Ann Schlenker with Argonne National Laboratories, one of the nation's leading hybrid and automotive technology research organizations, has no doubt electric cars will one day be a reality.

"Vehicle electrification is coming! I have no doubt that fully electric cars are a key part of our automotive future," said Schlenker.

How Can State Policymakers Plug-in?

Given the popularity of traditional hybrid cars, the national security and environmental implications of reducing petroleum use and the corresponding emissions and the Obama administration's dedication to the cause, it seems likely that the plug-in hybrid movement will continue to gain momentum. Just a few weeks ago, Vice President Joe Biden

announced the opening of a Fisker Automotive plant in his home state of Delaware that will produce a plug-in hybrid similar to the Chevy Volt. Fisker will receive \$528.7 million in federal loans to develop two plug-in vehicles while GM has been granted \$240 million from the federal government for hybrid development.¹⁰ With the federal government doling out cash, what role can state policymakers play in advancing the role of such hybrid technology?

In a recent analysis of plug-in hybrid vehicles, Argonne National Laboratories included several public policy considerations for state and federal government lawmakers. One suggestion, the adoption of plug-in hybrids in public and commercial fleet vehicles, has already been adopted by several state and local governments. Minnesota recently adopted a state law (House File 3718) encouraging the state to buy plug-in hybrids for its public vehicles. New York and California both support feasibility studies to analyze the benefits of introducing plug-in hybrids statewide.

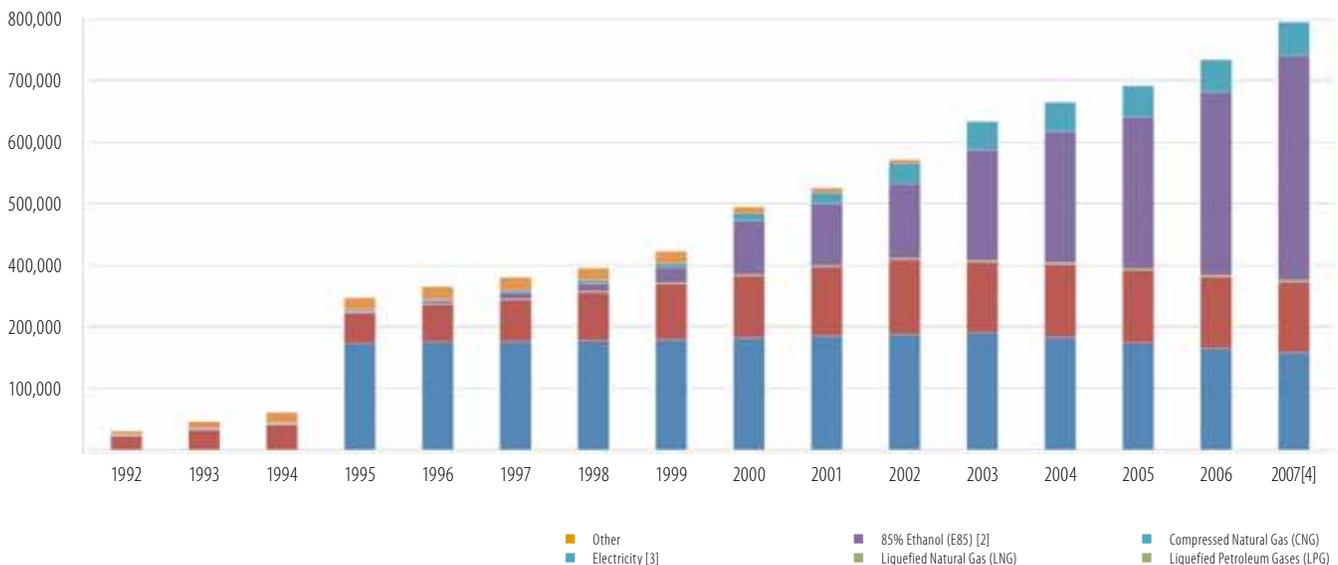
Argonne is also encouraging the adoption of tax credits and state sales tax exemptions as incentives for consumers. As part of its general appropriations bill, South Carolina recently adopted a \$300 sales tax rebate for plug-in hybrid purchases. In the meantime, the state is also offering a \$500 sales tax rebate to those who purchase conversion kits that will turn a traditional hybrid into a more efficient plug-in model. Other financial incentives Argonne cites include subsidies that would lower the initial purchase price of these vehicles. Because early models of new technology are often the most expensive, state governments can help ease the transition with a variety of financial incentives.¹¹

The Argonne report also cites the need for new infrastructure that will promote plug-in hybrid use. While most models for energy consumption and fossil fuel conservation allow for most plug-in hybrid charging to occur at night during off-peak hours, the battery needs to be charged as frequently as possible in order to maximize the benefits of an electrically

powered car. The U.S. currently is not equipped with the public access to electrical outlets necessary to fully embrace a plug-in hybrid revolution, according to several sources. As such, large municipalities and states with large commuter populations might consider the installation of curbside plug-in stations and other similar infrastructure investments.

Finally, states can always revisit the traditional means of enforcing reduced emissions and fuel use with introduction of higher CAFÉ standards for fuel efficiency and CO₂ regulations. States are already acting individually and collectively along these lines. The Regional Greenhouse Gas Initiative in the northeastern and mid-Atlantic region is one highly publicized example of states working together to reduce greenhouse gas emissions. Such state efforts at tougher regulations have met with support from the Obama administration. When California's efforts to set independent CAFÉ standards higher than the federally mandated levels met with resistance from various sources including automakers, President Obama instructed

Alternative Fueled Vehicles in Use (1)

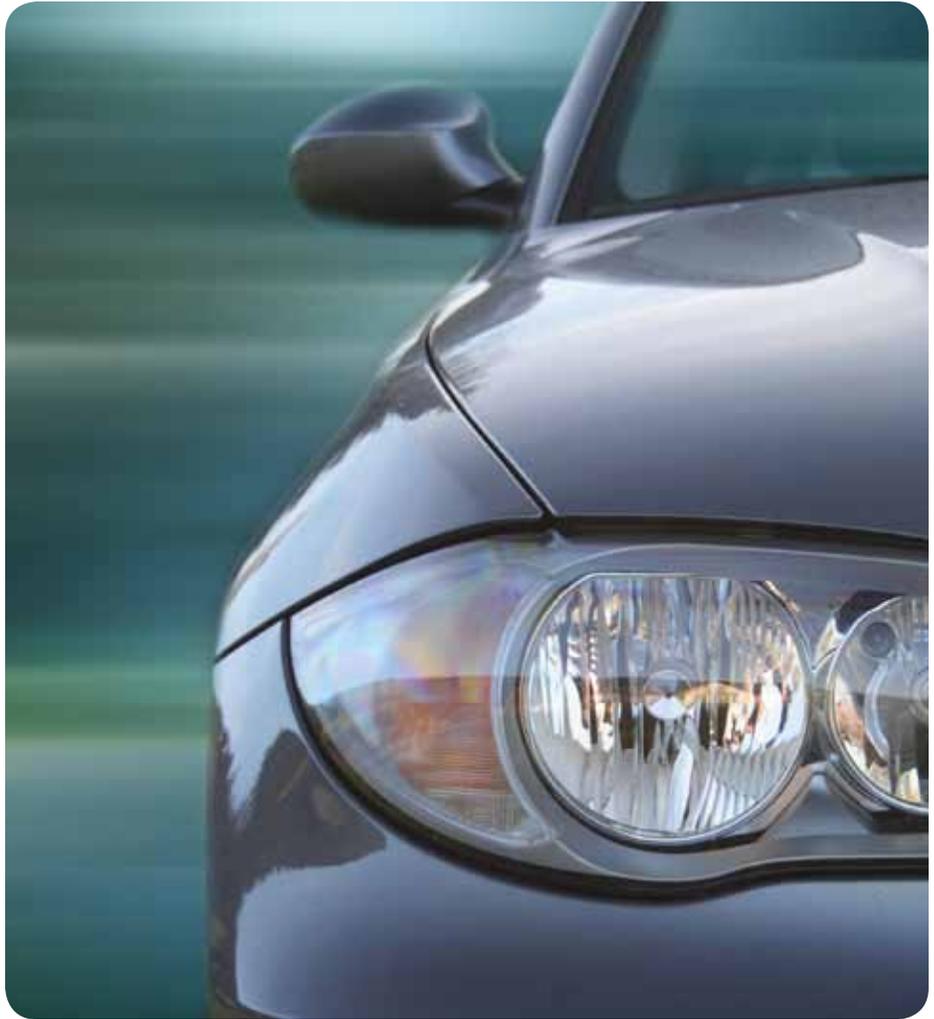


Source: EIA's Annual Energy Review, Table 10.5. Available at www.eia.doe.gov/emeu/aer/renew.html.

Notes: [1] Vehicles in Use represent accumulated acquisitions, less retirements, as of the end of each calendar year. They do not include concept and demonstration vehicles. [2] Includes only those E85 vehicles believed to be using E85. Primarily fleet-operated vehicles; excludes other vehicles with E85-fueling capability. In 1997, some vehicle manufacturers began including E85-fueling capability in certain model lines of vehicles. For total number of E85 vehicles on the road, see "E85 FFVs in Use." [3] Excludes HEVs. [4] 2007 numbers are preliminary.

the EPA to revisit the previous administration's policies on the matter. The current administration has made clear its commitment to advancing hybrid technology repeatedly, so states can likely count on a friendlier federal regulatory culture moving forward.

It remains to be seen whether the current wave of excitement surrounding plug-in hybrid technology will usher in a new, cleaner future for the U.S. automotive industry and market. But one thing is clear: Given the current financial situation—relatively stable gas prices and a slow economic recovery—the introduction of a new automotive lifestyle will likely need assistance from the federal and state governments in the form of various financial incentives, infrastructure investments and general public education campaigns if this round of electric cars is going to make it off the showroom floor.



Resources

The California Cars Initiative

<http://www.calcars.org/vehicles.html>

The Hybrid Center

<http://www.hybridcenter.org/>

HybridCars

<http://www.hybridcars.com/hybrid-technology>

Hybrid Car Technology

<http://www.hybridcartechnology.net/>

US EPA

<http://www.epa.gov/epahome/technology.htm>

Argonne National Laboratory

<http://www.anl.gov/>

References

¹ Environmental Protection Agency (EPA), "Overview: Pollutants and Programs," October 2007, p. 1.

² HybridCars.com "A Comprehensive Guide to Plug-in Hybrids," accessed from www.hybridcars.com/plug-in-hybrid-cars on November 6, 2009.

³ HybridCars.com

⁴ EPA, 1.

⁵ EPA, 1.

⁶ Duffy, Sandra, "Hybrid Car Sales Figures," accessed from www.hybridcar.com/index2.php on December 1, 2009.

⁷ EPA, 1–2.

⁸ McCredie, Scott, "Plug-in Hybrids: More Hype Than Hope?," *Wired*, May 2009. Accessed from www.wired.com/print/cars/coolwheels/news/2009/05/plugins0506 on November 6, 2009. P. 1–3.

⁹ McCredie, 3.

¹⁰ HybridCars.com, "Fisker to build Plug-in Hybrids in Former GM Plant," October 2009. Accessed from www.hybridcars.com/news/fisker-build-plug-hybrids on November 6, 2009.

¹¹ Argonne National Laboratory—Energy Systems Division, "Well-to-Wheels Energy Use and Greenhouse Gas Emissions Analysis of Plug-in Hybrid Electric Vehicles," February 2009, p. 44–46.

Krista Rinehart is the Toll Fellows Program Director and a policy analyst for The Council of State Governments.

