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FACT SHEET

# Plug-In Electric Vehicles

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**Did you know?**

- Using electricity to power an automotive vehicle would cost the **equivalent of paying less than $2.00 per gallon of gasoline** at current electric prices. In some states, the cost would be **under $1.00 per gallon**.*
- A typical mid-size sedan, when running on electricity from the current U.S. grid, would have the **same carbon footprint as a car that gets 50 miles per gallon** (mpg) of gasoline. As more electricity comes from renewable sources, net carbon emissions would be reduced further.*
- Plug-in electric vehicles could be **on the market very soon**.

## What is a plug-in electric vehicle?

"Plug-in" electric vehicles are cars or trucks that use electricity to move the vehicle's wheels. Some or all of that electricity comes from the power grid -- from "plugging in."

There are several types of plug-in electric vehicles. *Battery electric vehicles* do not use any gasoline or other liquid fuel; *all* electric power is supplied from the grid. Hybrid vehicles with plug-in capability (so-called *plug-in hybrids*) use a combination of grid electricity, regenerative energy from braking, and another onboard power source (an internal combustion engine is currently most typical, but a fuel cell or other power unit could also be used).

Plug-in hybrids can be engineered to use electric power in different ways. Some vehicles run on electricity alone at certain times, such as starting and maintaining a constant speed, and engage the engine when additional power is needed, such as accelerating or climbing.

Other plug-in hybrids use a blended system where the battery and the conventional engine operate together. An extended-range plug-in electric vehicle uses an internal combustion engine or fuel cell only to recharge the battery, but not to drive the vehicle's wheels.

Plug-in electric vehicles are being developed and used in diverse applications – including commuter buses and utility trucks, passenger cars, and high-performance vehicles.

** Based on an electric drive efficiency rating of 0.30 kilowatt-hour (kWh) per mile, estimated for a mid-size sedan, average $CO_2$ emissions for the U.S. electric grid of 1.3 pounds per kWh, $CO_2$ emissions for gasoline fuel of 19.5 lbs per gallon, and current U.S. residential electric rates ranging from under 10 cents to more than 18 cents per kWh.*

## What are the advantages of plug-in electric vehicles?

Plug-in electric vehicles all share the ability to use electricity from the power grid to displace the petroleum used for transportation. Currently, 96 percent of the energy used for transportation in the United States comes from oil. Close to 70 percent of that oil is imported from foreign sources. This overdependence on oil poses a threat to U.S. energy security and economic competitiveness. The transportation sector also contributes nearly one third of U.S. greenhouse gas emissions.

Expansion of plug-in vehicles into the consumer market would significantly reduce oil imports and substitute electric energy produced from domestic sources. At present, the U.S. electric grid is powered predominantly by coal, nuclear, natural gas, hydroelectric sources; renewable energy sources, however, are increasing rapidly as a share of the U.S. electricity sector. But even with the current energy mix of the U.S. grid, electrification of the transportation sector would reduce overall greenhouse gas emissions as well as energy costs.

Electric motors are considerably more efficient than internal combustion engines, which lose much of the energy in gasoline through waste heat. Because of this superior mechanical efficiency, a typical mid-size electric vehicle would have the same carbon footprint of a car that gets 50 miles per gallon and would cost the equivalent of paying less than two dollars per gallon, less than one dollar per gallon in states with low electricity prices.*

## What are the challenges in bringing plug-in electric vehicles to market?

The primary challenge to expanding the market for electric drive vehicles centers on battery technology to store the vehicle's electric "fuel". A viable battery needs to be able to deliver sufficient power, hold a charge large enough to provide a useful travel range, and be durable enough to perform over years of recharging. Battery companies and vehicle manufacturers such as General Motors, Nissan, Toyota and Volkswagen are steadily making advances in battery performance and have announced plans to have a production vehicle in showrooms by 2010. Several companies are also converting existing hybrid vehicles into plug-in hybrids.

The federal government currently supports research, development, and incentives to produce plug-in vehicles. Many states and local governments also have created programs and incentives. Continued support from government and industry will be important to seizing the opportunity and benefits that plug-in electric vehicles and electrification of the transportation sector will bring to our economy, national security, and global environment.

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