



Maryland Department of the
Environment

FACTS ABOUT: PLUG-IN HYBRIDS

What are Plug-in Hybrids?

Plug-in hybrid electric vehicles (PHEV) are similar to regular hybrid electric vehicles in that they use a conventional internal combustion engine and an electric motor to power the vehicle. The main difference is that plug-in hybrids are designed to travel on only electric power if plugged-in and charged before driving. These vehicles only use the gas engine when the electric power is insufficient. Plug-in hybrids are equipped with larger battery packs than regular hybrids and can therefore store a greater amount of energy and power the vehicle greater distances before needing the gas engine. Plug-in hybrids provide a good middle ground between regular hybrids and electric vehicles. They eliminate the worry associated with all-electric vehicles of driving range. Since the gas engine acts as a backup when the batteries are out of charge, the vehicle won't strand consumers even on long road trips. On short trips PHEVs could burn little to no fuel, greatly increasing the vehicles overall fuel efficiency. Many manufacturers now offer PHEVs or have plans to sell them in the coming years.

How do Plug-in Hybrids Work?

Plug-in hybrids can be charged through conventional 120V outlets or dedicated charging stations, similar to electric vehicles. When fully charged these vehicles can be driven anywhere from a few miles to as much as 40 miles without using any fuel. When the batteries are depleted of charge the gas engine turns on and the vehicle begins to operate as a conventional hybrid would. PHEVs can use regenerative braking, like HEVs, to recharge their batteries and further improve fuel mileage. The battery packs used in plug-in hybrids are similar to the ones used in all-electric vehicles. These battery packs provide greater energy storage capacity compared to conventional hybrid-electric vehicle allowing all electric travel. The added weight of a gas engine reduces their all electric range but eliminates 'range anxiety' associated with electric vehicles. Even if not charged overnight the vehicle will still operate like a regular hybrid. This makes PHEVs more versatile than electric vehicles, which will not operate at all if not re-charged. Since some PHEV configurations use the internal combustion engine like a generator, to charge only the batteries and not power the vehicle, the engine can run at its optimum speed which increases its overall efficiency.

Benefits



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- Zero direct emissions while operating on electric power.
- Increased gas mileage, some vehicles can get up to 100 mpg overall efficiency.
- Decreased dependence on foreign oil due to improved fuel economy.
- Eliminates fear of 'range anxiety'. The gas engine will automatically turn on when electric power is exhausted.
- The use of renewable resources to recharge batteries could eliminate harmful pollutants.
- The equivalent cost of electricity is less than the cost of gas, about 3cents vs. 10cents per mile.
- Still operates even if not charged through plugging-in.

Disadvantages

- Plug-in hybrid batteries are more expensive, meaning the vehicles are \$5000-\$7000 more than standard hybrids, which are already more expensive than conventional gas vehicles.
- Reduced battery life due to multiple cycles of full charge and full depletion.
- Currently used battery packs can cost \$10,000 or more which will add to the operating cost if they needed to be replaced.
- Increased weight of bigger battery packs could reduce fuel efficiency when gas engine is operating.
- Reduced harmful emissions could be offset if electricity is drawn from burning fossil fuel.
- High voltage wires could become exposed in the event of an accident posing additional danger.



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