



As they travel from house to house, meter readers for public utility company Virginia Power are enjoying quiet, clean rides in their EVs. The company's 17 EV pickup trucks can travel 50 miles on a single battery charge.

The utility began purchasing EVs in 1993 to test and promote their use. As an electricity provider, EVs make good business sense to Virginia Power. But the company also is interested in cutting U.S. dependence on foreign oil and promoting a cleaner, more energy-efficient technology.

For more information on Virginia Power's fleet of EVs, contact Arlie Hahn at (804) 257-4008.

# Clean Alternative Fuels: Electric Vehicles

One in a series of fact sheets

**M**ore than 4,000 electric vehicles (EVs) are traveling U.S. roads and highways. Although some EVs are found nationwide, California has the greatest concentration of the alternative fuel vehicles. EVs do not produce tailpipe emissions, but generators producing the electricity used to charge EV batteries do emit pollutants.

Electricity for EVs is produced by power plants, which send it to substations through transmission lines and then to homes and businesses through distribution systems. An EV's electric motor converts electricity—usually from a battery pack—into mechanical power that runs the vehicle. After a certain vehicle driving range, however, EV batteries must be recharged.

## AVAILABILITY

Several major auto manufacturers are producing high-performance EVs, including passenger cars, minivans, sport utility vehicles, pickup trucks, and buses.

Homes, government facilities, and businesses must have adequate capacity for vehicle recharging, however, and special outlet hookups or upgrades may be required. In California and Arizona, some shopping malls, grocery stores, hotels, and banks have chargers in place to fuel electric vehicles.

Auto manufacturers also are beginning to sell "hybrid" vehicles that combine an electric motor with a separate gasoline or diesel engine. Hybrid vehicles can more than double the gas mileage of conventional gasoline- or diesel-powered cars and can cut emissions significantly. Hybrid vehicles do not require the use of recharging stations.



## EV BATTERY TYPES



The following types of batteries have the potential to power electric vehicles:

- **Lead-Acid**—Provides a low-cost, low-range (less than 100 miles) option with a 3-year life cycle.
- **Nickel-Metal Hydride**—Offers a greater driving range and life cycle, but is currently more expensive than lead-acid batteries.
- **Nickel-Cadmium**—Offers a range of 100 miles, a long life, and faster recharges than lead-acid batteries, but is more expensive and has lower peak power and recharging efficiency.
- **Lithium-Ion**—Offers the potential for a long driving range and life cycle, but is currently very costly.
- **Zinc-Air**—Currently under development. Provides superior performance compared to current battery technology.
- **Flywheels**—Currently under development. Could be capable of storing a larger amount of energy in smaller, lighter weight systems than chemical batteries.

## AFFORDABILITY

At \$15,000 to \$40,000, EVs cost more than comparable, mass-produced gasoline- or diesel-powered vehicles. Some manufacturers lease EVs to minimize maintenance costs and potential risks such as lower resale values associated with the new technology. To encourage EV purchases, some government agencies offer incentives to offset the higher initial costs. For example, the federal government provides a tax credit equal to 10 percent (up to \$4,000) of the purchase cost of an EV. Some states offer partial sales tax exemptions, one-time income tax credits, or reduced license and registration fees.

EV purchase prices can potentially be offset by lower “fuel” and maintenance costs. The average monthly electricity cost for a typical EV driver is less than \$15, compared to \$50 for gasoline. If EVs are recharged overnight, off-peak rates can decrease the cost of powering the vehicles. EVs can also have lower maintenance costs because they have fewer moving parts than internal combustion engines and do not require tune-ups or oil changes. One obstacle to affordability, however, is that EVs’ lead-acid batteries must be replaced every 3 years at a cost of approximately \$8,000.

## PERFORMANCE

Testing has demonstrated that EV acceleration, speed, and handling can equal or exceed that of conventional vehicles. EVs are also more energy efficient and produce less noise than gasoline- or diesel-powered vehicles, particularly in stop-and-go traffic, because the engine does not run if the car is not moving.

Currently, a large drawback is that the driving range of EVs is much less than that for gasoline- or diesel-powered vehicles. Depending on battery type, climate, and terrain, an EV can travel from 40 to 120 miles on a single battery charge. There are also space considerations with EVs because their batteries can be large and heavy, resulting in less room for cargo or passengers.

## SAFETY

EVs must meet the same safety standards as conventional vehicles. In some instances, research shows that EVs can be safer than gasoline-powered vehicles. EVs usually have lower centers of gravity, making them less likely to roll over in an accident. The danger of fire in a collision is also substantially reduced because EVs do not have a gas tank or reservoir of engine lubricating oil. As with conventional vehicles, however, EV batteries contain toxic elements that raise battery production, transport, use, and disposal safety issues.

## MAINTENANCE

EVs do not require tune-ups or oil changes associated with conventional vehicles. In addition, EVs do not have timing belts, water pumps, radiators, fuel injectors, or tailpipes to replace. Battery recharging can be a frequent and lengthy process, however, taking 4 to 14 hours depending on the battery type and the voltage level used in recharging. High-voltage, fast-charging units (which take approximately 10 to 20 minutes to charge) are under development. Currently, they are being designed for limited use by some fleet operators and public charging locations.

### For More Information

**EPA Alternative Fuels Web Site**  
[www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm](http://www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm)

**Electric Vehicle Association of the Americas**  
701 Pennsylvania Avenue, NW.  
Fourth Floor  
Washington, DC 20004  
Phone: 202 508-5995  
Fax: 202 508-5924  
Web site: [www.evaa.org](http://www.evaa.org)

**Alternative Fuel Refueling Station Locator**  
Web site: [afdcmap.nrel.gov/nrel](http://afdcmap.nrel.gov/nrel)

**Alternative Fuels Data Center**  
Web site: [www.afdc.nrel.gov](http://www.afdc.nrel.gov)

**National Alternative Fuels Hotline**  
Phone: 800 423-1DOE