



Maryland Department of the  
Environment

## FACTS ABOUT: ELECTRIC VEHICLES

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### What are Electric Vehicles?

An Electric Vehicle (EV) is a vehicle powered solely by an electric motor. Unlike hybrids and plug-in hybrids, an EV does not have a conventional internal combustion engine onboard for additional power or as a backup. This reduces the weight of the vehicle allowing it to have more/larger batteries compared to hybrid vehicles. This equates to increased power and electric only range. Whereas a plug-in hybrid's all-electric range is around 40 miles or less, an electric vehicle's range can be up to 100 miles or more. This range is adequate for most daily commuters. Electric vehicles are classified as zero emission vehicles because they emit no direct emissions, in fact they have no tailpipe. Depending on what source the electricity used to charge the vehicle is derived from an EV can be completely emission free.

### How do Electric Vehicles Work?

An EV uses an energy storage device, most commonly a battery pack made up of many small batteries, (i.e. the Nissan Leaf uses 48 Li Ion battery modules) to supply electricity to an electric motor(s). The battery pack can be re-charged through plugging into a 120 V home outlet or a charging station. Most often these vehicles will be charged at home overnight and fully charged the next morning. Since there is no backup engine, care must be taken to not exceed the range of the battery before being able to recharge. There are a few different stations available for recharging an EV. Level one stations use a typical 120V system and can take from 12-18 hours to fully charge a vehicle. Level two stations use a 220V system and can reduce the charging time to 4-8 hours. Level three charging stations use a 480V direct current system and can charge an EV to 80% capacity in 15-30 minutes depending on the vehicle. Electric vehicles also use regenerative brakes, much like hybrids, to supply additional charge to the batteries, and extend the range. Regenerative brakes use generators to convert the vehicles kinetic energy to electrical energy while slowing the vehicle down. This allows some of the kinetic energy to be recovered rather than just dissipated as heat.



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## Benefits

- Zero direct emissions.
- Since power plants are a more efficient means of producing energy than internal combustion engines, the environmental impact of driving an EV is reduced compared to driving conventional vehicles.
- The use of renewable resources to recharge batteries could eliminate harmful pollutants.
- Most of the electricity produced in America is derived from domestic resources, such as coal and natural gas. Electric vehicles can therefore help reduce America's dependence on foreign oil.
- Electric vehicles can be charged through home outlets.
- Low maintenance compared to combustion engines. No oil changes or other fluids like transmission and antifreeze to change.
- Quieter and smoother operation, electric motors produce little noise pollution.
- On electric grids with a time-of-use option available, EVs that are charged overnight will accrue less cost than those charged during the day or evening when demand is higher, providing even better savings over gasoline.
- Electric motors are much more efficient than internal combustion engines resulting in a tank-to-wheel efficiency (the efficiency of energy stored on-board a vehicle, in the battery or fuel tank, being converted to motion) about 3 times higher for EVs versus conventional vehicles.

## Disadvantages

- EVs have a shorter range compared to conventional or hybrid vehicles. Currently, EVs can only travel about 100 miles before needing to be recharged.
- The recharge time is quite long especially compared to refueling a conventional vehicle. This can be problematic for long trips and reduces an EVs overall appeal.
- In cold climates vehicles require considerable energy to heat the interior and defrost windows. Internal combustion engines provide the heat as a byproduct, where as electrical motors run relatively cooler and would need to use energy from the battery to produce the necessary heating ability.
- Safety is a concern for EVs as well. High voltage cables could become exposed in the event of an accident posing a danger.
- The batteries used in electric vehicles are very expensive, typically over \$10,000. This adds to the initial cost of the vehicle as well as possible maintenance cost if the batteries need to be replaced after years of use.
- An increase in electric bill is inevitable; however this will be more than offset by the elimination of buying fuel.



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- An estimated six million EVs can be added to the electric grid at night without the need for increased capacity. Above this amount power plants will need to generate more electricity, to recharge the increasing number of EVs, which will increase pollution from fossil fuel power plants. Renewable resources can help offset this increased capacity and reduce this pollution.



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