Emissions from Electric Vehicles

All-electric vehicles, plug-in hybrid electric vehicles (PHEVs), and hybrid electric vehicles (HEVs) typically produce lower tailpipe emissions than conventional vehicles do, and zero tailpipe emissions when running only on electricity. Tailpipe emissions are only one factor in considering a vehicle's life cycle emissions; gasoline and electricity fuel pathways (/glossary.html#FuelPathway) also have upstream emissions to consider, which include extracting, refining, producing, and transporting the fuel. Estimating cradle-to-grave emissions must account for both fuel-cycle emissions (also known as "well to wheels") and vehicle-cycle emissions (material and vehicle production as well as end of life). The combined emissions from vehicle and fuel production through vehicle decommissioning (i.e., recycling or scrapping) are referred to as life cycle or cradle-to-grave emissions.

Electricity Sources and Fuel-Cycle Emissions

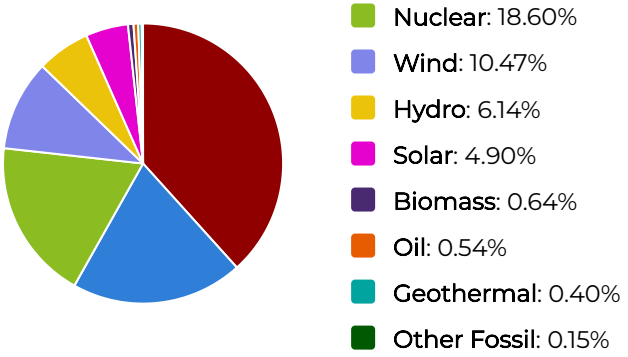
All-electric vehicles and PHEVs running only on electricity have zero tailpipe emissions, but electricity production, such as power plants, may generate emissions. In geographic areas that use relatively low-polluting energy sources for electricity generation, all-electric vehicles and PHEVs typically have an especially large life cycle emissions advantage over similar conventional vehicles running on gasoline or diesel. In areas with higher-emissions electricity, all-electric vehicles and PHEVs may not demonstrate as strong a life cycle emissions benefit.

The source of your electricity has an effect on the emissions of your electric vehicle.

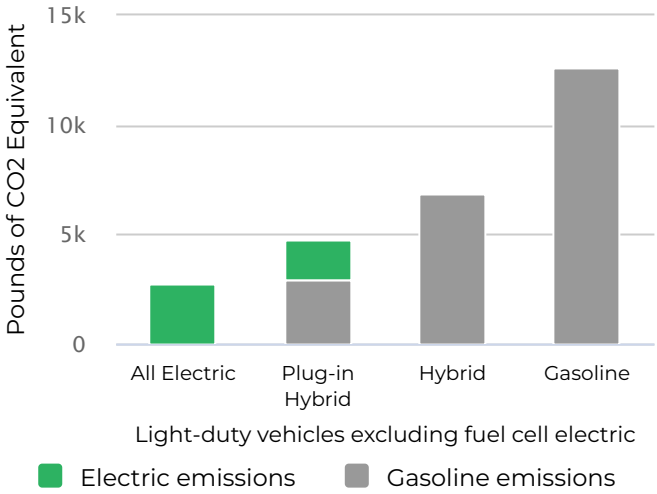
Choose a State

National Averages

Electricity Sources



Annual Emissions per Vehicle



Based on assumptions with 2022 data from EIA

Assumptions Get Widget

Direct, Well-to-Wheel, and Cradle-to-Grave Emissions

Vehicle emissions can be divided into two general categories: air pollutants, which contribute to smog, haze, and health problems; and greenhouse gases (GHGs), such as carbon dioxide and methane. Both categories of emissions can be evaluated on a tailpipe basis, a well-to-wheel basis, and a cradle-to-grave basis.

Conventional vehicles with an internal combustion engine (ICE) produce direct emissions through the tailpipe, as well as through evaporation from the vehicle's fuel system and during the fueling process. Conversely, all-electric vehicles produce zero direct emissions. PHEVs produce zero direct emissions when they are in all-electric mode, but they can produce evaporative emissions. When using the ICE, PHEVs produce tailpipe emissions. However, their direct emissions are typically lower than those of comparable conventional vehicles.

Well-to-wheel emissions include all emissions related to fuel production, processing, distribution, and use. In the case of gasoline, emissions are produced while extracting petroleum from the earth, refining it, distributing the fuel to stations, and burning it in vehicles. In the case of electricity, most electric power plants produce emissions, and there are additional emissions associated with the extraction, processing, and distribution of the primary energy sources they use for electricity production.

Cradle-to-grave emissions include all emissions considered on a well-to-wheel basis as well as vehicle-cycle emissions associated with vehicle and battery manufacturing, recycling (/vehicles/electric_batteries.html#recyclability), and disposal.

Related Reports

Learn more about electric-drive vehicle emissions in two reports:

- Cradle-to-Grave Lifecycle Analysis of U.S. Light-Duty Vehicle-Fuel Pathways: A Greenhouse Gas Emissions and Economic Assessment of Current (2020) and Future (2030-2035) Technologies (https://greet.anl.gov/publication-c2g_lca_us_ldv)
- Emissions Associated with Electric Vehicle Charging: Impact of Electricity Generation Mix, Charging Infrastructure Availability, and Vehicle Type (https://afdc.energy.gov/files/u/publication/ev_emissions_impact.pdf)