Union of Concerned Scientists

FACT SHEET

Electric Vehicles Are Cleaner than Gasoline—and Getting Better

HIGHLIGHTS

Driving an electric vehicle (EV) results in less global warming emissions than the average gasoline-fueled vehicle, and as the US electricity grid gets cleaner (by shifting away from coal and adding solar and wind power), the benefits of EVs compared with gasoline vehicles will continue to grow. UCS analysis over the past nine years demonstrates this trend in action: in 2012, less than half the people in the United States lived in a region where the average EV produced less emissions than a gasoline car with a fuel economy rating of 50 mpg—today nearly everyone does. This reinforces the role that EVs will play as a key solution to reducing the US transportation sector's contribution to climate change.

Electric vehicles (EVs) will be an important part of the American transportation future, given their potential to dramatically cut global warming emissions—especially when charged by a clean electricity grid. Together with other solutions to cut emissions, such as more efficient vehicles and increasing numbers of shared trips and public transit, EVs can help the United States achieve the deep emissions reductions needed by mid-century if we are to avoid the worst impacts of climate change.

While a fully electric vehicle eliminates tailpipe emissions, a more complete picture should also consider the global warming emissions associated with generating the electricity that charges an EV. The latest data affirm previous results: EVs produce significantly less emissions than gasoline, and the gap between electricity and gasoline is growing larger over time (Nealer, Reichmuth, and Anair 2015).

Using the most recent data available, the Union of Concerned Scientists (UCS) calculated the total emissions for refueling and driving gasoline and electric vehicles and found that the average EV produces global warming pollution equal to a gasoline vehicle that gets 88 miles per gallon (mpg)—significantly better than the most efficient gasoline car available in the United States today (58 mpg) and far cleaner than the average new gasoline car (31 mpg) or truck (21 mpg) (EPA 2020a; EPA 2020b).

Our current estimate for EV emissions is almost 10 percent lower than our previous estimate two years ago (Reichmuth 2018). And 94 percent of people in the United States now live where driving an EV produces less emissions than a gasoline car that gets 50 mpg.

David Reichmuth/UCS

The Tesla Model 3 is one of the most efficient (i.e., lowest electricity use per mile) EV models available. Efficient EVs help minimize the global warming emissions from driving.

EV Emissions Are Lower in Every Part of the Country

To calculate total global warming emissions from gasoline-powered cars, we analyzed emissions produced by extracting crude oil from the ground, moving the oil to a refinery, making gasoline and transporting it to filling stations, along with combustion exhaust from the tailpipe.

For electric vehicles, the calculation includes both power plant emissions and emissions from the production of coal, natural gas, and other fuels used by power plants. Our analysis relies on emissions estimates for gasoline and fuels production from Argonne National Laboratory using the GREET 2019 model (ANL 2019) and power plant emissions in 2018, based on data released by the Environmental Protection Agency in January 2020 (EPA 2020b).

When looking at all these factors, driving an average EV is responsible for less global warming emissions than the average new gasoline car everywhere in the United States. In some parts of the country, driving the average new gasoline car will produce four to seven times more emissions than the average EV. For example, the average EV driven in upstate New York has emissions equal to a (hypothetical) 231 mpg gasoline car. And in California, a gasoline car would need to get 122 mpg to have emissions as low as the average EV. (See Figure 1.)

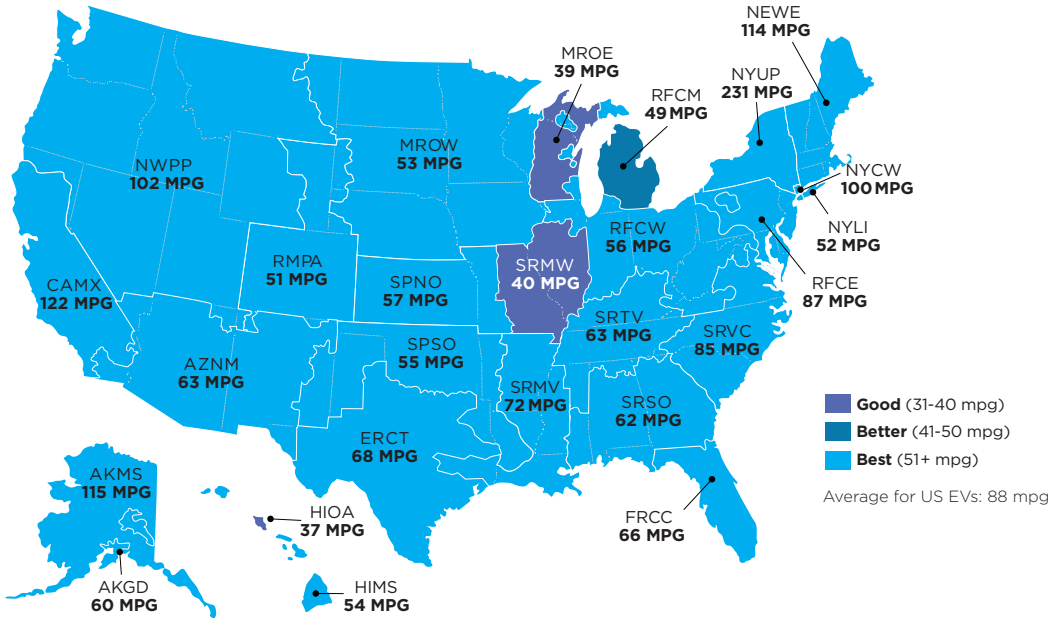
Compared with our previous analysis that used 2016 power plant data, emissions from EVs are now 10 percent lower on average. This reduction comes from two primary sources:

- The emissions rate from US power plants fell more than 5 percent between 2016 and 2018 due to lower generation from coal and increases in natural gas, wind, and solar.
- The average efficiency of EVs sold to date in the United States improved over the same period by about 6 percent, primarily due to sales of Tesla's Model 3. One of the most efficient vehicles on the market, the Model 3 now makes up more than 20 percent of all US EVs (and more than one-third of battery-electric cars).

A Decade of Improvement

The change from our first analysis of electric and gasoline vehicle emissions in 2012 (using 2009 power plant data) is even more impressive. At that time, less than half of all people

FIGURE 1. EV Emissions Vary by Regional Electricity Supply



For each region of the US electricity grid, UCS calculated how the global warming emissions of charging and driving an average EV compare with those of a gasoline vehicle. The miles-per-gallon (mpg) value listed for each region is the combined city/highway fuel economy rating of a gasoline vehicle with emissions equivalent to the average EV. Nationally, the average EV is equivalent to a gasoline car that gets 88 mpg.

NOTES: Regional global warming emissions are based on 2018 power plant data in the eGRID2018 database (EPA 2020b). Comparison includes gasoline and electricity fuel production emissions estimates for processes including extraction, transportation, and refining, using the GREET 2019 model (ANL 2019). The 88 mpg US average is a sales-weighted average based on where EVs were sold from January 2011 through September 2019.

EVs Benefit from a Rapidly Evolving Electricity Market

	2009	2016	2018
Share of US population living in a region rated "Best" for EVs (>50 mpg equivalent)	45%	75%	94%
Share of electricity grid regions where an EV has lower emissions than a 50 mpg gasoline vehicle	35%	62%	85%
Share of US electricity from coal-fired power plants	45%	30%	28%
Share of US electricity from wind and solar power	2%	7%	8%

The nationwide shift from heavily polluting coal-fired power plants to clean wind and solar energy is allowing people around the country to reduce their global warming emissions by driving an EV.

NOTE: Data on electricity generation resources from EPA 2020b.

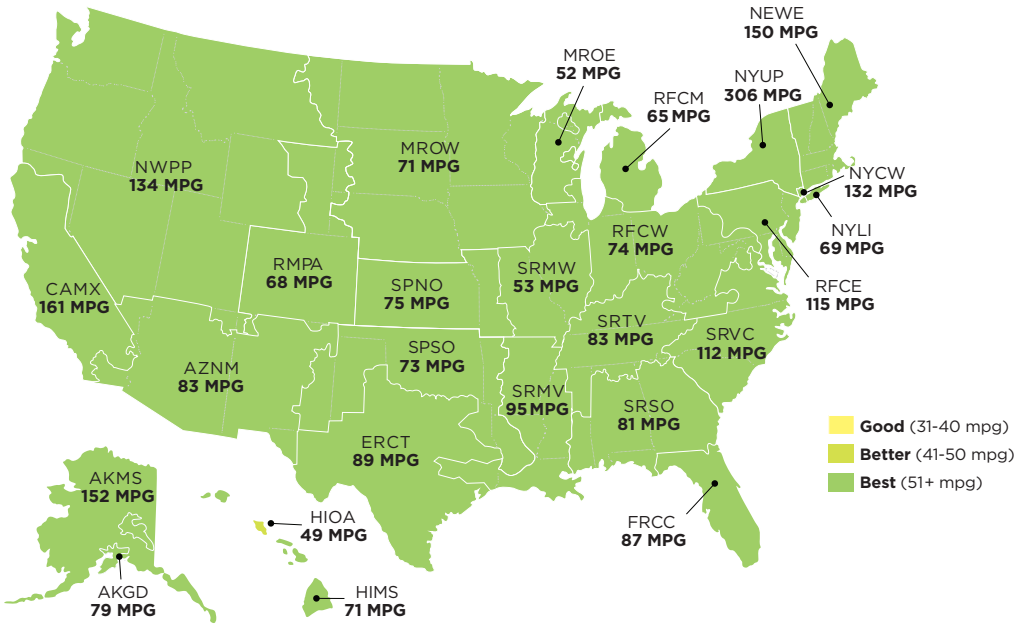
in the United States lived where an average EV produced less emissions than a 50 mpg gasoline car (Anair and Mahmassani 2012), while nearly all do now (see the table). The improvement has been driven partially by increasing EV efficiency, but even more by the reduction in electricity generation from coal-fired power plants (Richardson et al. 2017). Electricity from coal has fallen from a 45 percent share of the market to 28 percent in less than a decade. At the same time, electricity from solar and wind power has grown from less than 2 percent to 8 percent in 2018.

Car Buyers Have Even Cleaner EV Options

Our analysis shows that the average EV is cleaner than the average new gasoline vehicle everywhere in the United States. But by choosing the most efficient EV available, the difference between gasoline and electricity is even greater. For example, driving the 2020 Tesla Model 3 Standard Range Plus (0.24 kWh/mile) in California produces global warming emissions equal to a 161 mpg gasoline car, or less than a fifth of the emissions of the average new gasoline car and more than 60 percent less than even the most efficient gasoline car. In upstate New York, EV emissions can be as low as one-tenth those of an average new gasoline car. (See Figure 2.)

As the electricity grid continues to get cleaner, EVs—both new and used—will get cleaner as well. This is a distinct advantage EVs have over gasoline vehicles, whose fuel economy is fixed and, therefore, so are their emissions.

FIGURE 2. Gasoline Is No Match for the Most Efficient EV



In all but one region of the US electricity grid, driving the most efficient EV available (the Tesla Model 3) will result in lower global warming emissions than a gasoline car that gets 50 mpg. In upstate New York, emissions from driving the cleanest EV are one-tenth that of the average new gasoline vehicle.

As the electricity grid continues to get cleaner, EVs—both new and used—will get cleaner as well.

EVs Are Just a Part of the Transportation Solution

Switching from gasoline to electric vehicles is a vital strategy for reducing global warming emissions and avoiding the worst impacts of climate change, but it's only one of many solutions we need to address the US transportation sector's emissions. Because many of the cars and trucks sold this decade will be gasoline-powered, we must make sure those vehicles are as clean as possible by maintaining strong fuel economy and emissions standards (Cooke 2019). In addition, emissions standards for transportation fuels, such as the California Low Carbon Fuel Standard, can ensure the gasoline and biofuel used in gasoline-powered cars get cleaner over time (Martin 2016).

Additionally, actions we can take to reduce driving overall (whether in gasoline-powered cars or EVs) will help. Sharing rides, using public transit, and making it easier to walk and bike are all important solutions. But for trips in our personal vehicles, switching to an EV can make a big difference in global warming emissions and is one of the best actions a household can take to reduce its carbon footprint.

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