Are electric cars greener? Depends on where you live

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Long thought a thing of the future, electric cars are becoming mainstream. Sales in the United States of plug-in, electric vehicles nearly doubled last year. Credible forecasts see the number rising within a decade to half a million vehicles per year, which would easily exceed sales of the Toyota Camry today.

Although the technology for electric cars is improving quickly, the industry still depends heavily on public policy - such as the $7,500

subsidy that the federal government gives everyone who buys one. The rationale for such aggressive policy support is, in part, rooted in the idea that these cars cause less pollution. Indeed, conspicuously "green" consumers dominate sales of electric vehicles, just as they did initially for hybrid vehicles such as the Toyota Prius.

But whether electric cars are actually greener depends on where the electricity comes from. Our research, along with other studies, finds that electric cars are not necessarily the environmentally friendly choice when it comes to the emissions of carbon dioxide - the pollutant of greatest concern for climate change.

It is true that electric cars have no tailpipe emissions (they don't even have tailpipes!), which means they can help clear local air. But the electricity used to charge these vehicles comes mainly from power plants that burn coal or natural gas, with coal being the biggest emitter. Other sources of electricity - wind, solar, hydro and nuclear - generate zero emissions.

Figuring out whether the electricity is more environmentally friendly than just burning gasoline directly in cars depends on statistical sleuthing to estimate changes in emissions within the overall electricity grid in response to the additional electricity needed to charge an electric car. We've done this using data on every hour of every day for recent years across the nation, and the results are striking.

Where and when electric cars are charging affects how their emissions compare with the alternatives of a conventional or hybrid car. In some places and at some times, electric cars generate more emissions. We find, for example, that charging an electric car at night in the upper Midwest will generate more carbon dioxide per mile driven than the average conventional car that burns gasoline. In contrast, electric cars in the western United States and Texas always generate lower emissions

than even a hybrid, and this arises because natural gas rather than coal tends to be used for generating the additional electricity in these regions.

Our findings are based on how electricity is actually generated and current technologies that determine the efficiency of vehicles. But how might things change in the future to affect whether electric cars will reduce emissions and therefore help address climate change? We know the fuel economy of non-electric cars will increase in the coming years. The U.S. Environmental Protection Agency has nearly doubled the average fuel efficiency goal for cars by 2025. Meanwhile, the manufacturers of electric cars are seeking to significantly increase the distance that one can drive on a charge.

But the critical driver of electric-car emissions is how the electricity is generated. And this is where the future of electric cars as a means for addressing climate change is related to the future of power plant regulations. The EPA is in the process of developing its "Clean-Power Plan" to reduce emissions from power plants. This, along with other rules, will make the electricity sector cleaner and help ensure that electric vehicles are the green choice down the road.

More than 100 years ago electric vehicles were the dominant and most promising technology for powering personal automobiles. But oil won that battle and reigned over the 20th century. Now electricity is poised to make a comeback, and might yet power the transportation sector this century. The push is due in large part to concerns about climate change, so it is important to have policies that ensure electric cars are part of the solution rather than the problem.

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