Full electrification of Uber and Lyft vehicles would provide only modest benefits to society, study shows

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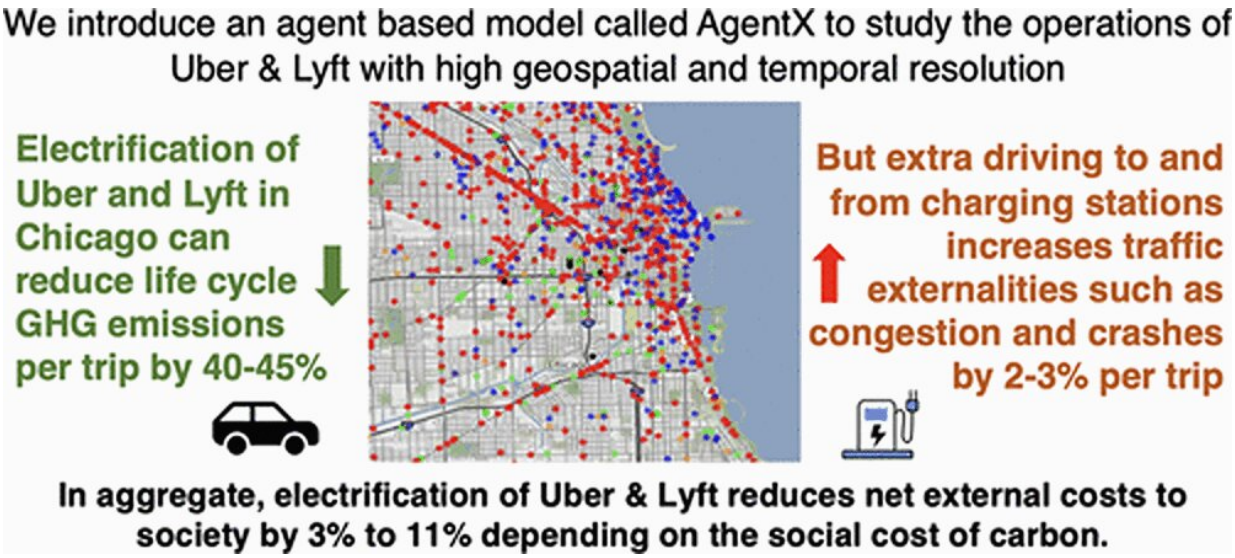

Graphical abstract. Credit: *Environmental Science & Technology* (2023). DOI: 10.1021/acs.est.2c07030

Both Uber and Lyft ride-hailing services have pledged to fully electrify their vehicle fleets by 2030 in the United States.

The move would eliminate tailpipe pollution while shifting emissions to the power plants that provide electricity to charge EV batteries, likely resulting in a significant drop in overall emissions of climate-warming

greenhouse gases.

Good news all around, right? Hold on.

A new study from researchers at the University of Michigan and Carnegie Mellon University estimates that the overall benefits to society of switching ride-hailing vehicles from gasoline to electric would be very modest—on average, a 3% gain per trip when other "costs on society" are factored in.

Those societal costs include increased traffic congestion, collision risk and noise due to Uber and Lyft drivers traveling to and from fast-charging stations, according to the study published online in the journal *Environmental Science & Technology*.

"Our simulation showed that electric vehicles drive greater distances without a passenger than do gasoline vehicles, since EVs have to travel to chargers more often than gasoline vehicles have to refuel," said study senior author Parth Vaishnav, assistant professor at U-M's School for Environment and Sustainability.

"Furthermore, fast chargers are not as ubiquitous as gas stations, which means EVs have to travel farther each time they refuel than gasoline vehicles."

In their simulation, the researchers used a new high-resolution model called AgentX with real-world Uber and Lyft trip data collected in the Chicago area from 2019 to 2022. Chicago is one of the largest ride-hailing markets in the country, and the number of daily trips averaged roughly 300,000 prior to the COVID-19 pandemic.

The researchers modeled more than a million Uber and Lyft trips taken on weekdays, weekends and during different seasons. They included

trips taken before the pandemic started, as well as trips during the period after the widespread rollout of vaccines.

A set of standard economic tools was used to express costs to society in terms of dollars. Though the study results are specific to Chicago, the findings likely apply more broadly, according to the researchers.

The study found that:

- Electrification of Chicago's ride-hailing fleets would reduce lifetime greenhouse gas emissions by 40%-45% when compared to gasoline-powered vehicles. The reduction is largely due to the greater efficiency of electric vehicles.
- Health impacts from local air pollution would increase an estimated 6%-11% per trip, on average, due to higher concentrations of local pollutants (such as sulfur dioxide, nitrogen oxides and particulate matter) from fossil fuel-burning power plants.
- Extra driving to and from charging stations would increase traffic-related harms to society (congestion, crash risk and noise) by 2%-3% per trip.
- Overall, full electrification of ride-hailing would reduce total harms to society by about 3% per trip.
- A 3% reduction in costs to society translates to about $1.5 million per year in savings for the city of Chicago. To put that number in context, ride-hailing is estimated to generate $4 million to $5 million in revenues per day in Chicago.

"It may seem counterintuitive that overall costs to society fall so little, even though greenhouse gas emissions are substantially reduced by the switch to EVs," said study lead author Aniruddh Mohan, formerly a doctoral student under Vaishnav at Carnegie Mellon and now a postdoctoral fellow at Princeton University.

"But on a per-mile basis, greenhouse gas emissions are a very small part of the total costs imposed on society by these vehicles. The costs are dominated by traffic externalities—congestion, crash risk and noise—which are directly correlated with vehicle distance traveled. And vehicle distance traveled will increase with electrification."

About 80% of the total costs to society result from traffic-related factors, while 20% are due to emissions, according to the study.

The assessment includes the cradle-to-grave costs to society of building, operating and disposing of EVs and gasoline-powered vehicles. Those lifetime costs include battery manufacturing, gasoline refining and vehicle construction.

For EVs, the researchers looked at battery size and how it affects vehicle impacts. Making smaller battery packs requires less energy and leads to lighter vehicles, both of which might lead to greenhouse gas emissions savings.

To their surprise, smaller battery packs did not help. A smaller battery pack meant that EV drivers visited chargers more often, and those additional miles canceled emissions gains from using a smaller battery pack, according to the study.

"Overall, our findings made it very clear that a large part of the damage that cars cause is unrelated to their air emissions and is therefore unlikely to be eliminated by electrification," Vaishnav said.

"Electrification is a small win for society. A bigger win would be to dramatically reduce our dependence on cars. Policies that decrease vehicle distance traveled through investments in public transit and infrastructure for biking and walking, or that reduce crash risk by improved vehicle safety, are critical."

More information: Aniruddh Mohan et al, Life Cycle Air Pollution, Greenhouse Gas, and Traffic Externality Benefits and Costs of Electrifying Uber and Lyft, *Environmental Science & Technology* (2023). DOI: 10.1021/acs.est.2c07030

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