

Heaven or Hell: What Are the GHG Emission Implications for Light-Duty Vehicles of Autonomy and Ride-Hailing?

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As has been well documented by academics and industry, the transportation sector is currently undergoing a profound transformation in the way that vehicles are powered, owned, and operated. The complex interdependence of these transformations, as well as the fact that we are studying them concomitantly with their development, makes them particularly difficult to predict. Recent studies such as that by Regina Clewlow and Gouri Shankar Mishra have shown preliminary evidence that ride hailing has shifted travel miles dramatically away from traditional forms of transport such as public bus and rail service, biking, and walking, and towards ride hailing services, resulting in a significant increase in vehicle miles traveled (VMT).

At the same time, fleet ownership business models may have a significant impact on manufacturing emissions and vehicle efficiency. Hatch and Gorman consider the greenhouse gas (GHG) implications of various light-duty transportation business model adoption scenarios, including the effects on manufacturing inputs, technology improvements, and total VMT.

To achieve these estimates, the authors build upon the two vehicle adoption cases elaborated in Peter Fox-Penner, Will Gorman, and Jennifer Hatch's 2018 study "Long-term U.S transportation electricity use considering the effect of autonomous-vehicles: Estimates & policy observations," comprising an energy-intensive case and a policy case. The authors also examine two electric grid emissions scenarios as the basis for modeling efforts — one in which the EIA estimate of emissions intensity for the grid out to 2050 is used, and another in which the authors apply a 95 percent linear decarbonization of the grid by 2050.

The authors then employ three different scenarios of autonomous vehicle adoption as discussed above, moderating the number of vehicle manufactures to supply total VMT for the fleet. The three model scenarios are: a taxi or "sharing" model, where 6.7 vehicles are replaced by one taxi vehicle; traditional individual ownership, where the standard total fleet volume applies; and an accelerated fleet turnover or "lease" model, where vehicles are retired at twice the current rate of traditional vehicles.

The results of the authors' modeling efforts show that, as in previous efforts to predict the GHG impacts of autonomous vehicles, there is a fairly large range of outcomes, ranging from a 20 percent reduction in GHG emissions by 2050 to an 80 percent reduction by 2050.

Even if the United States converts to 100 percent electric vehicles, the result is a 20 percent reduction in GHG by 2050, if an appetite for ever-newer technology, a desire for individually owned passenger vehicles, and a lack of policies to curb VMT growth persist. The impact of a desire for new vehicle models is illustrated in figure 5, where, even under a policy scenario in which driving impacts are curbed, the emissions from autonomous vehicle production are significant enough to nearly double total vehicle emissions. On the other hand, in another scenario, the authors find an 80 percent reduction in vehicle emissions by 2050. The remaining emissions in this scenario are almost entirely from the remaining ICE vehicles in the total vehicle fleet.