New rider data shows how public transit reduces greenhouse gas and pollutant emissions

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Public transit has long been an answer for people looking to leave their car at home and reduce their air pollution emissions. But now, with

better rider tracking tools, the University of Utah and the Utah Transit Authority can better answer the question: How much does public transit reduce pollution emissions?

In a paper published in *Environmental Research Communications*, University of Utah researchers Daniel Mendoza, Martin Buchert and John Lin used tap-on tap-off rider data to quantify the emissions saved by buses and commuter rail lines, and also project how much additional emissions could be saved by upgrading the bus and rail fleet. The study was conducted in cooperation with the Utah Transit Authority and the Utah Department of Environmental Quality, Division of Air Quality.

High-resolution rider data

Mendoza and his colleagues are certainly not the first to ask how much pollution public transit can save. But a couple of recent technological advances have enabled them to answer the question with a level of detail previously unparalleled.

The first is the advance of tap-on tap-off farecards that provide anonymized data on where those riders who have electronic passes enter and exit public transit. Approximately half of UTA's passengers use an electronic fare medium. "Now we can truly quantify trips in both time and space," Mendoza says. "We accounted for all of the 2016 passenger miles by scaling the farecard data, and we know which trips farecard holders make on buses, light rail and commuter rail."

The second is the General Transit Feed Specification system. It's the data source that supplies Google Maps with transit information to help users find the bus or train they need. With that data source, the researchers could track where and how often UTA's buses and trains run.

So, with high-resolution data on the movement of both vehicles and

passengers, the researchers could paint a nearly comprehensive picture of public transit along the Wasatch Front.

Balancing emissions

So, with that data, the researchers could quantify the emissions produced and miles traveled of the transit systems (TRAX light rail uses electricity produced outside the Wasatch Front, hence the emissions aren't in Salt Lake's air) and balance that with the miles traveled by passengers and the estimated amount of car travel avoided by riding transit.

On weekdays during rush hours, and in densely populated areas, the balance was clearly on the side of reduced emissions. "That tapers off significantly during the evening hours, on the outskirts of the city, and definitely during the weekends," Mendoza says. In those situations, the number of passengers and how far they rode transit did not offset certain criteria pollutant emissions. (Criteria pollutants are six common air pollutants that the EPA sets standards for through the Clean Air Act.)

For transit to improve its regional reduction in emissions, particularly $PM_{2.5}$ and NO_x, the following strategies, alone or in combination, could be employed: more daily riders per trip, more clean-fuel buses and train cars and/or fewer low-ridership trips.

What-ifs

The current study looks at the bus and train fleet as they are now, with some UTA buses around 20 years old and FrontRunner trains whose engines are rated a Tier 0+ on a 0-4 scale of how clean a locomotive's emissions are (Tier 4 is the cleanest; UTA is scheduled to receive funds programmed through the Metropolitan Planning Organizations to upgrade FrontRunner locomotives to Tier 2+). So, Mendoza and his

colleagues envisioned the future.

"What if we upgrade all these buses, some of them from 1996 or so?" Mendoza says. "They emit a significantly larger amount than the newer buses, which are 2013 and newer."

What if, they asked, UTA upgraded their buses to only 2010 models and newer, fueled by either natural gas or clean diesel? And what if the FrontRunner engines were upgraded to Tier 3?

Emissions of some pollutants would drop by 50%, and some by up to 75%, they found.

"Now, with this information, UTA can go to stakeholders and funding agencies and say, 'Look, we've done this analysis," Mendoza says. "This is how much less we can pollute.'"

Mendoza adds that taking transit offers additional benefits besides reducing air pollution. Taking transit gives riders time to read, work or listen while traveling. How does Mendoza know? He's a dedicated transit rider. "I always get to where I need to go pretty much on time and completely unstressed," he says. "I almost never drive."

More information: Daniel L Mendoza et al, Modeling net effects of transit operations on vehicle miles traveled, fuel consumption, carbon dioxide, and criteria air pollutant emissions in a mid-size U.S. metro area: findings from Salt Lake City, UT, *Environmental Research Communications* (2019). DOI: 10.1088/2515-7620/ab3ca7

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