Train can be worse for climate than plane

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True or false: taking the commuter train across Boston results in lower greenhouse gas emissions than travelling the same distance in a jumbo jet. Perhaps surprisingly, the answer is false.

Planes, trains or automobiles... The worst emitters may surprise you (Image: R. G. Williamson/Rex Features)

A new study compares the "full life-cycle" emissions generated by 11 different modes of transportation in the US. Unlike previous studies on transport emissions, Mikhail Chester and Arpad Horvath of the University of California, Berkeley, looked beyond what is emitted by different types of car, train, bus or plane while their engines are running and includes emissions from building and maintaining the vehicles and their infrastructure, as well as generating the fuel to run them. (Table 1 on page 3 has a complete list of components that were considered).

Transport studies expert Abigail Bristow of Loughborough University, UK, who was not involved in the study, says it is valuable because it attempts to compare transport on equal terms. To do this, Chester and Horvath calculated how many passengers each train, plane, bus or car would carry in its lifetime and how many kilometres it would cover. The pair took into account how much each infrastructure component – such as tracks, roads and airports – is used in its lifetime.

Including these additional sources of pollution more than doubles the greenhouse gas emissions of train travel. The emissions generated by car travel increase by nearly one third when manufacturing and infrastructure are taken into account. In comparison to cars on roads and trains on tracks, air travel requires little infrastructure. As a result, full life-cycle emissions are between 10 and 20 per cent higher than "tailpipe" emissions.

Empty seats

Cars emitted more than any other form of transport with the notable exception of off-peak buses, which often carry few passengers. The researchers found that travelling 1 kilometre on a nearly empty bus during off-peak hours emits eight times more per person than taking the same bus at rush hour – suggesting peak-time commuters may suffer, but they do less harm to the environment.

The occupation level of a vehicle is an important but often-overlooked factor, says Chester. "Although mass transit is often touted as more energy efficient than cars, this is not always the case." Buses turned out to be the most sensitive to how full they were – those with only five passengers were less efficient than cars; even large SUVs and pick-up trucks.

The finding also underlined that electric trains and cars can contribute to emissions if the electricity is generated by burning fossil fuels. Passengers on the Boston light rail, an electric commuter train, were found to emit as much or marginally more than those on mid-size and large aircraft. This is in part because 82 per cent of electricity in Massachusetts is generated by burning fossil fuels.

Clearer view

The results make it easy to target attempts to cut emissions and could change how politicians think about measures to improve transportation, say the researchers.

The life-cycle emissions generated by cars, buses and aircraft are dominated by tailpipe emissions pumped out in day-to-day running of their engines. Hence, the best way to reduce emissions from these modes of transportation would be to increase fuel efficiency and push for renewable fuels.

Crisscrossing the US with a rail network, however, creates a different problem. More than half of the life-cycle emissions from rail come not from the engines' exhausts, but infrastructure development, such as station building and track laying, and providing power to stations, lit parking lots and escalators.

Any government considering expanding its rail network should take into account the emissions it will generate in doing so, Chester says. Setting up a public transportation system that only a small proportion of the population uses could generate more emissions than it cuts, he adds – especially if trains and buses are not well connected.

"New rail systems should serve as links to other transit modes, as is often the case in Europe and Japan," he says. "We should avoid building rail systems that are disconnected from major population areas and require car trips and parking to access."

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