

Science for Environment Policy

What is the best way to travel if you care about global warming?

Travelling by coach or train has a lower impact on the climate than travelling by air or car, but using a small diesel car to carry several passengers can have similarly low impacts per person, new research suggests. Air travel is the worst form of transport, in terms of global warming impact, the researchers found, but the average percentage occupancy of a mode of transport significantly affects the impact per passenger.

Enabling the public to make informed decisions about which mode of [transport](#) to choose to reduce [global warming](#) impacts may lead to more 'climate-friendly' behaviour. However, providing accurate information with which individuals can use to make such decisions is not simple. For example, many existing 'carbon calculators' only account for the effects of CO₂ emissions from transport, even though other emitted gases can also have a significant effect on warming.

For this study, part-funded under the EU ECLIPSE project¹, researchers calculated the climate impact of trips of between 500 and 1000 km, comparing aeroplanes, petrol and diesel cars, coaches, and trains. To assess the climate impacts, researchers calculated the 'global warming potential' (GWP) over 20 and 100 year periods. GWP measures the effects of emissions (including CO₂ and shorter-lived gases, such as nitrogen oxides) on 'radiative forcing', the balance between how much energy reaches Earth and how much is radiated back into space.

The results showed that travelling by aeroplane had the highest climate impact, followed by petrol cars, diesel cars and finally trains and coaches. Even in a completely full aeroplane, a single passenger would have an emission of 160-215g of CO₂ (using the GWP and including other gases equivalent to the same effect) per km. This is higher than for a medium-sized car of average occupancy and three to five times higher than for the average coach or train journey.

The number of passengers had a substantial effect on the climate impact. A journey by car with only one passenger had an equivalent impact to an average aeroplane flight. However, with three or more passengers, the impact per passenger was reduced to the same as if the trip was taken by train or coach. Small diesel cars performed particularly well; with two passengers, they had an impact lower than average train or coach travel.

Short-lived gases and contrails (trails of condensed water from aircraft at high altitude) had a large effect on the climate impact estimates of aeroplanes. When shorter-lived components were included in calculations, they increased GWP by as much as 160% over the 20 year period, compared to estimates based only on CO₂ emissions. A second metric, 'global temperature change potential' (GTP), used to predict the actual temperature change as a result of these emissions, showed a less extreme effect of shorter-lived gases; after 20 years, GTP was 12% higher than CO₂ only results.

This difference between the two metrics arises because GWP predicts effects over the whole time period (and is therefore influenced by the initial pulse of short-lived gases), whereas the GTP is an 'end-point' metric that predicts the temperature at a given time after the emissions, when short-lived gases may have long since dissipated. This difference highlights the uncertainties surrounding such predictions.



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