A new study suggests that a 50 per cent reduction in road transport emissions as a result of using more electric vehicles will result in a cooling effect on the climate. The researchers compared the overall impact on climate and air quality of sourcing electric power for vehicles from zero carbon sources, such as wind and solar power, and sourcing it from standard power plants.

Road transport and power plants contribute to climate change by emitting long-lived CO₂ and short-lived pollutants. Non-CO₂, short-lived pollutants also contribute to air pollution and include ground-level ozone and the fine aerosol particles: sulfates, organic carbon and black carbon. CO₂, ozone and black carbon contribute to global warming, but sulfates and organic carbon reflect the sun’s heat back into space, causing a cooling effect.

Road transport produces large emissions of black carbon and other pollutants that create ozone. Power plants emit large quantities of CO₂ and of sulfur dioxide, which is transformed into sulfate aerosols. Different combinations of these warming and cooling pollutants create a complex picture.

American researchers investigated what would happen to the climate if enough Plug-In Hybrid electric vehicles were used to achieve a 50 per cent reduction in tailpipe emissions from road transport, both in the US and globally. This emissions target is unlikely to be met with current technologies, but may be achievable in future with technological improvements.

Two sets of scenarios considered the impact of both CO₂ and non-CO₂ pollutants on climate change when energy required for this reduction came either from a clean source of energy with zero carbon emissions, or from electricity supplied by fossil-fuelled power plants. The scenarios were considered over 20-year and 100-year periods. For all scenarios, the researchers estimated whether emissions from road transport and power generation would have a warming or a cooling effect on the climate.

The results suggest that a 50 per cent reduction in road transport emissions will have a cooling effect on the climate, over both the short and long term. But the degree of cooling varies according to whether energy comes from clean sources or fossil fuels. If the extra electricity for the electric vehicles comes from a zero carbon energy source, then for the global scenario:

- over 20 years a cooling effect on the climate is achieved (measured as −82 milliWatts (one thousandth of a Watt) per square metre (mWm²)).
- over 100 years a greater cooling effect is achieved (measured as −176 mWm²). Significant cooling is caused by reductions in ozone and black carbon.

If the extra electricity for the electric vehicles is generated from fossil-fuel power stations, then for the global scenario:

- over 20 years a cooling effect on the climate is still achieved (measured as −146mWm²) largely due to the cooling effect of the sulfate pollution.
- over 100 years a cooling effect on the climate is again achieved (measured as −162mWm²) largely due to the cooling effect of the sulfate pollution.

Although the increase in CO₂ emissions from the extra output of the power generation sector cancels out some of the reductions in CO₂ emissions from the road transport sector, additional sulfate emissions from power plants have a counteractive effect, which results in an overall cooling effect. However, sulfates also have harmful effects on air quality and human health. Any air quality control measures to reduce aerosol pollution, particularly from the power and industry sectors, will need to consider how reductions in aerosols will inadvertently have a warming impact. This means that there needs to be even greater reductions of other pollutants that contribute to climate warming including CO₂, ozone, black carbon and methane.


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Theme(s): Air pollution, Climate change and energy, Sustainable mobility