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Introduction

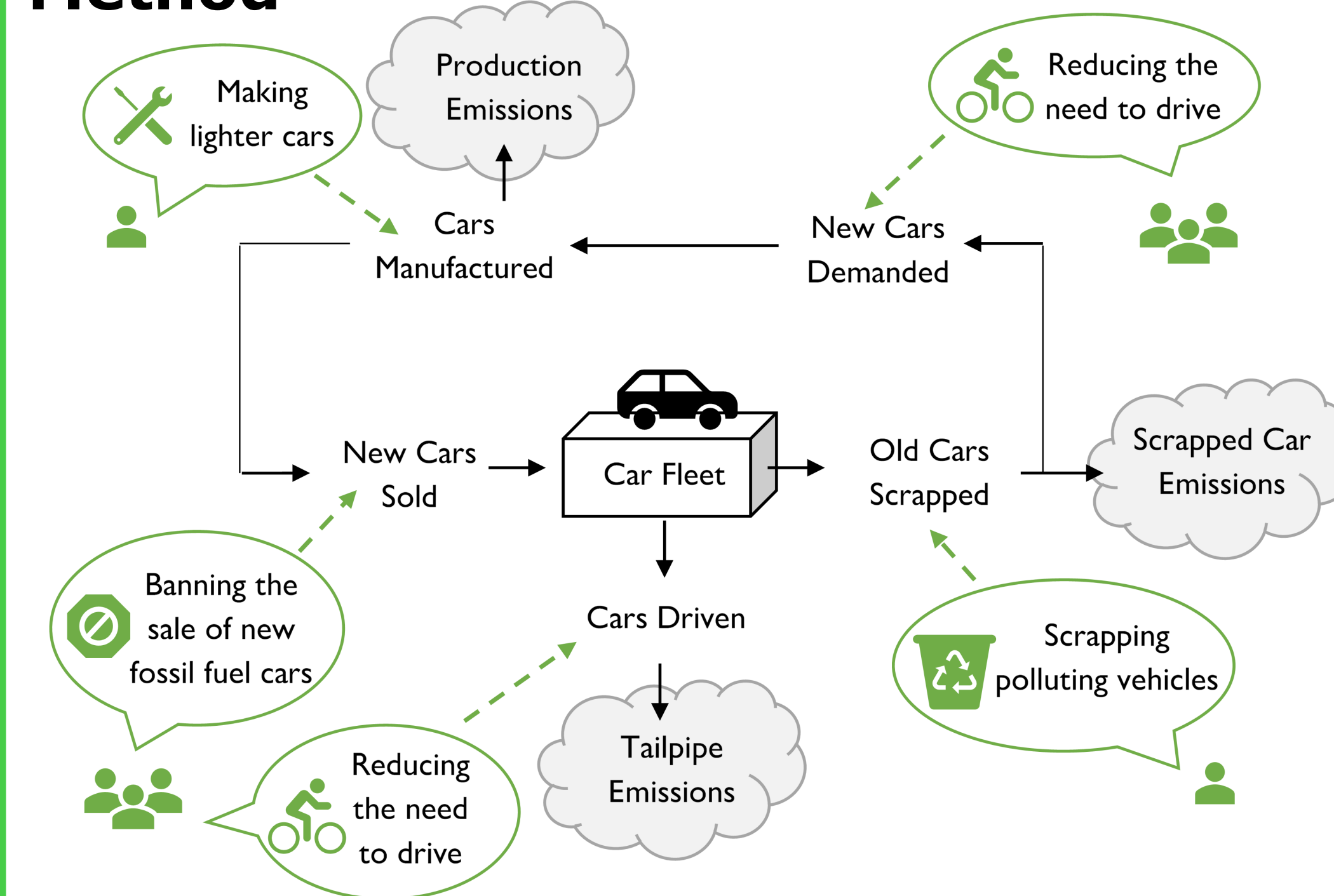
Passenger car transport remains one of the largest sources of a city's greenhouse gas emissions. Thus, it is imperative to transition to low-emission vehicles. This transition can be accelerated through policy interventions. However, there is little evidence on which policies produce the least emissions during the transition.

Research Questions

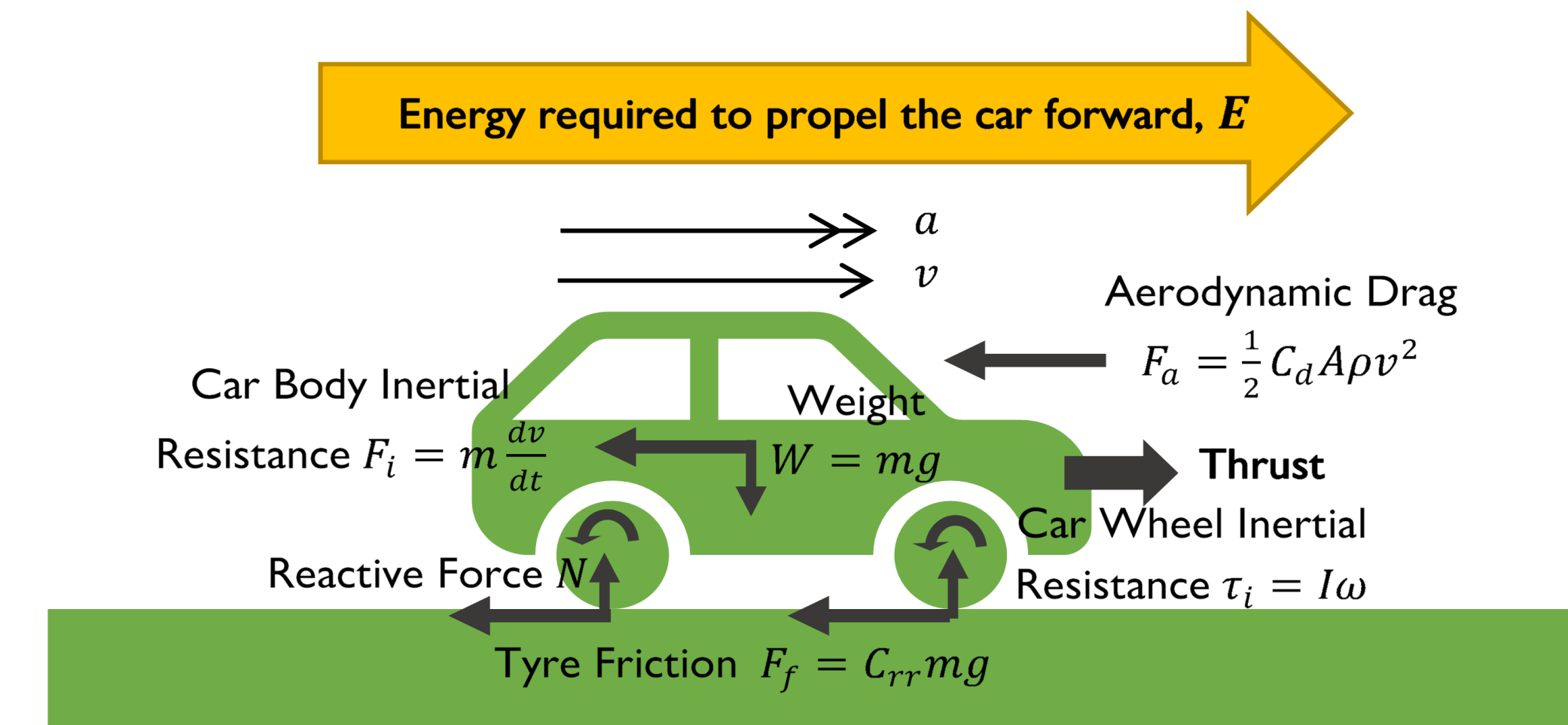
This study seeks to answer:

1. Which policies should be implemented to produce the least tailpipe, electricity, manufacturing and scrappage emissions?
2. Which policies require the least energy demand on the electrical grid in the future?

Method



Building a computer model of London's car fleet

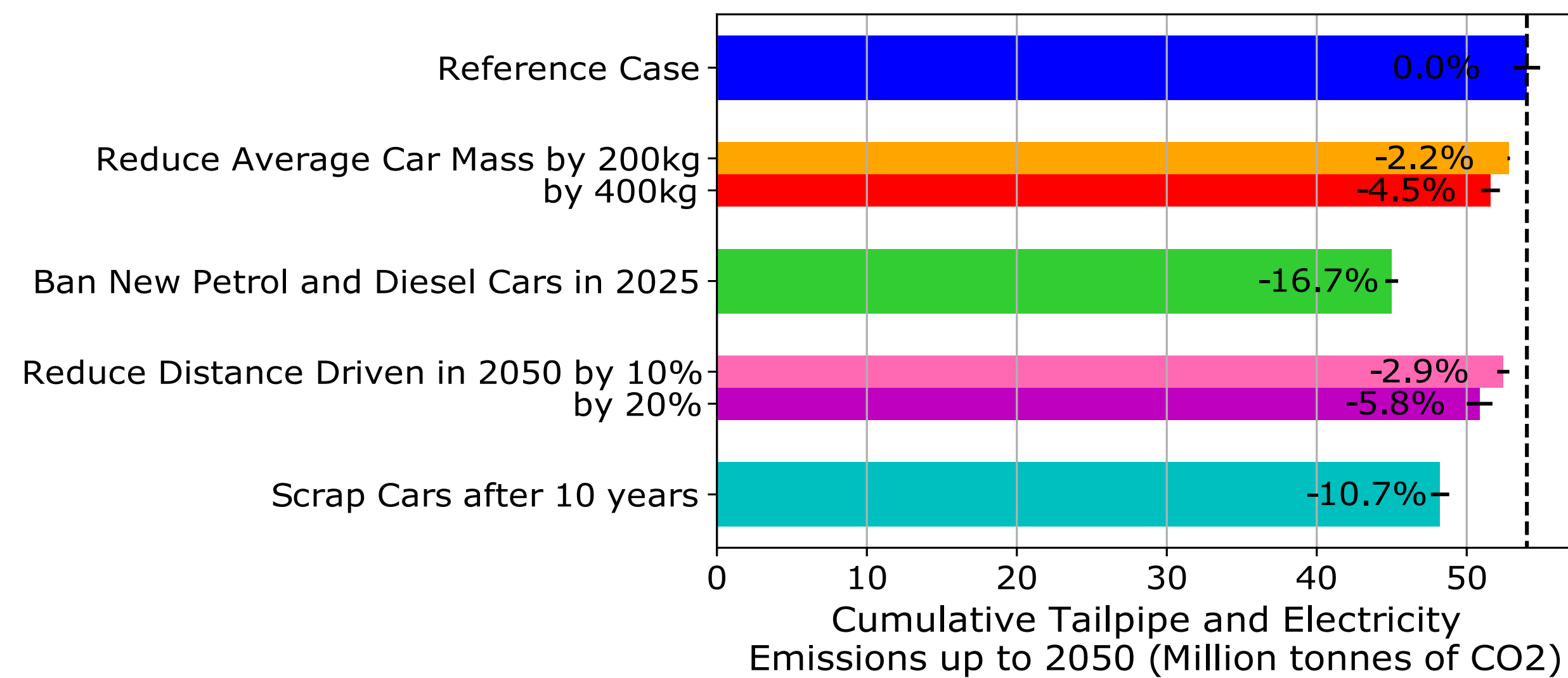


How does the energy needed to power a car change as its mass changes?

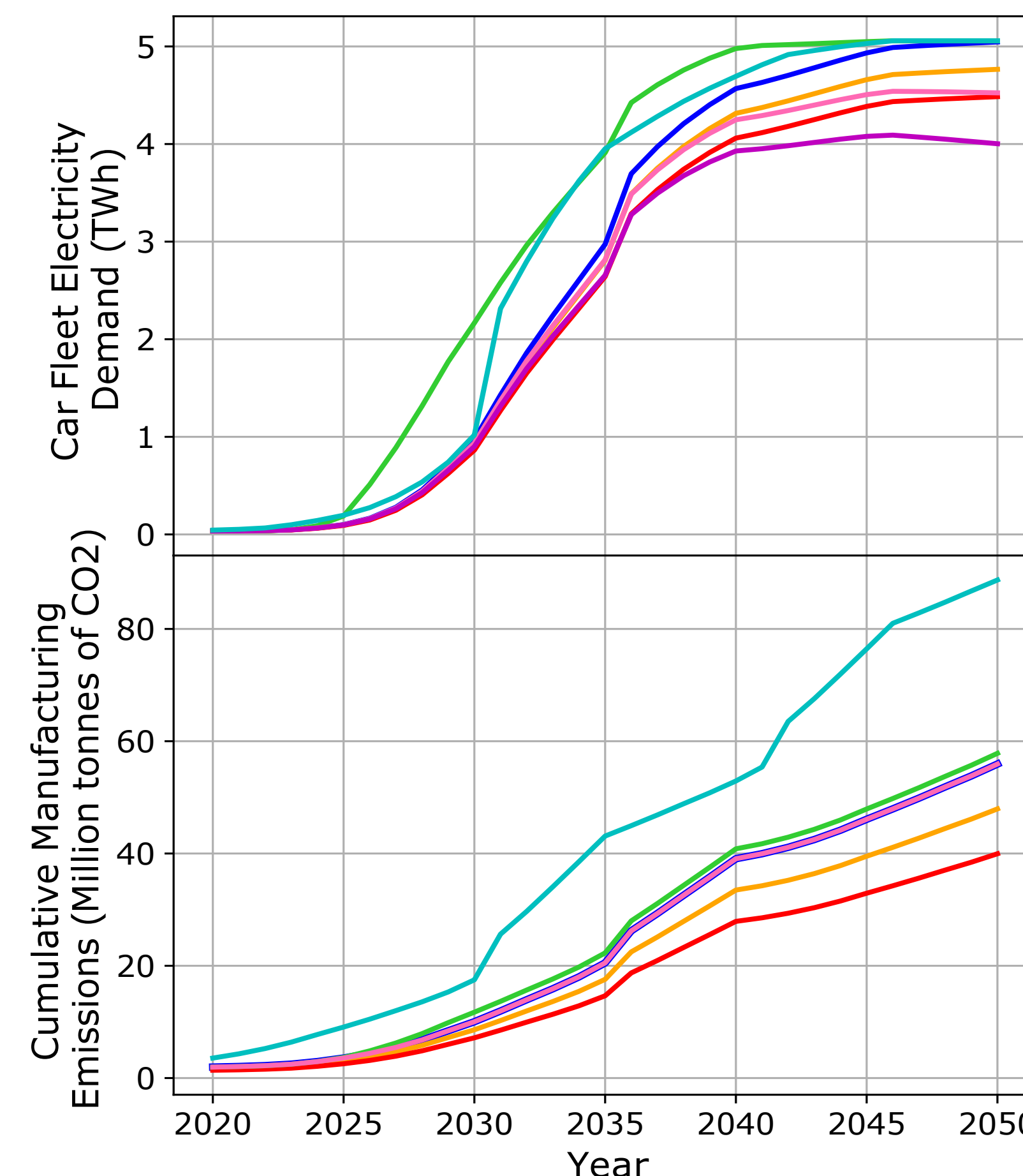
$$\frac{dE}{dm} = \frac{d}{dm} \int \left(m \frac{dv}{dt} + C_{rr}mg + \frac{1}{2} C_d A \rho v^2 \right) \cdot v dt$$

Building a physics model of a car's energy consumption

Results and Discussion



- Reducing the average mass of cars in London by 200kg decreases manufactured cumulative emissions by 14%.
- Reducing distance driven in London by 10% in 2050 only decreases tailpipe emissions by 2.9% but decreases the demand on electricity by 10%.
- Although scrapping cars at after 10 years reduces tailpipe emissions by 11%, emissions from manufacturing are increased by 5 times this value.



Conclusion

- Both the ban on the sale of fossil fuel cars in 2025 and the average car mass reduction by 200kg decrease total emissions by approximately 8 million tonnes of CO2. However, the 2025 ban may not be feasible due to electric car supply. Instead, to reduce the average mass of cars in London, systems such as vehicle weight taxation can be implemented.
- For decreasing the future load on the electricity network from electric vehicles, policies that reduce the need to travel are most effective, such as improving public transport and cycling infrastructure.
- The early scrapping of cars, such as through scrappage programs and taxation on old vehicles, increases a city's emissions due to production emissions. The increase in emissions from manufacture is 5 times any decrease in tailpipe emissions.