

# THE ImpEE PROJECT

IMPROVING  
ENGINEERING  
EDUCATION

## Road Transport



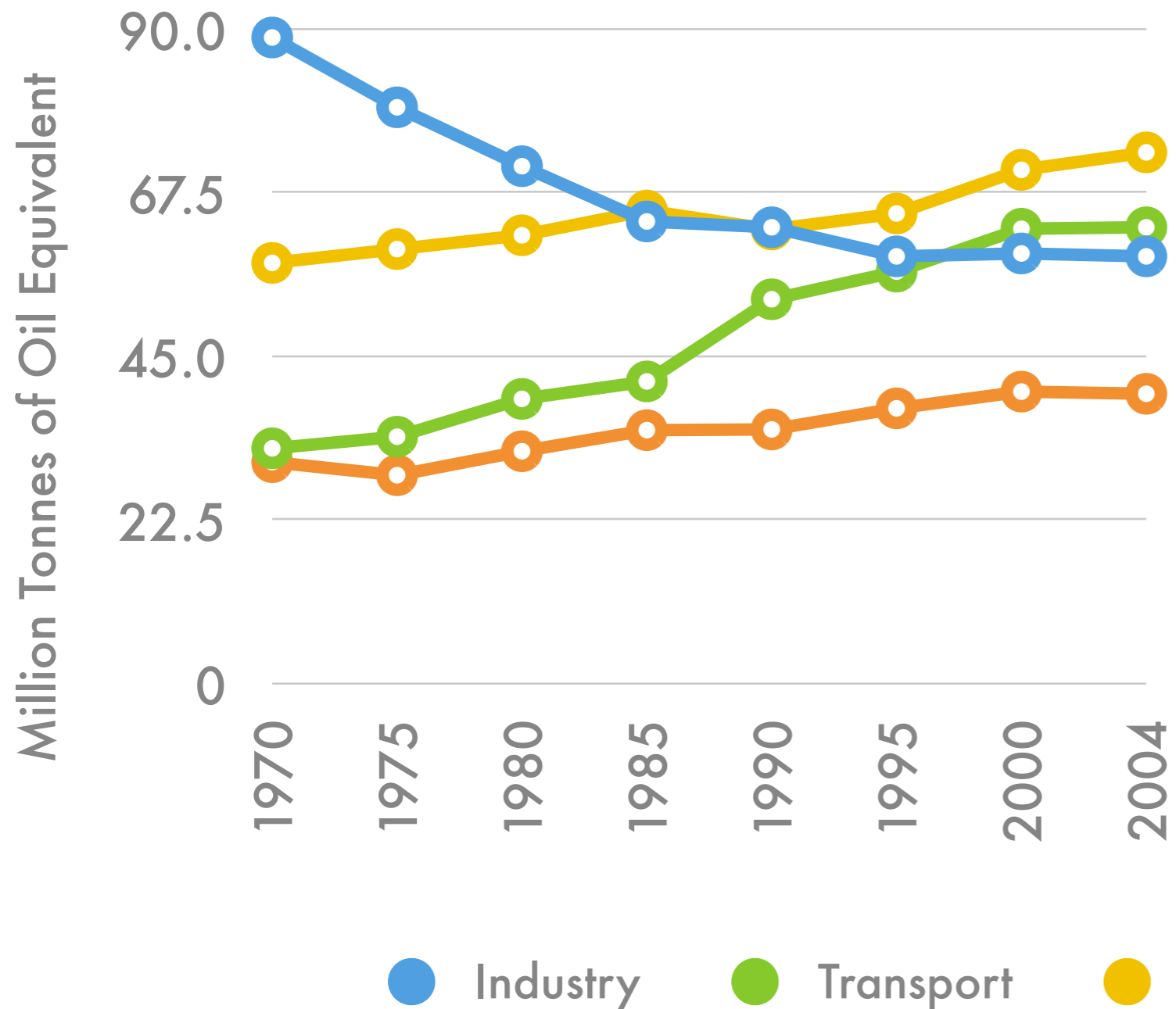
# Road Transport



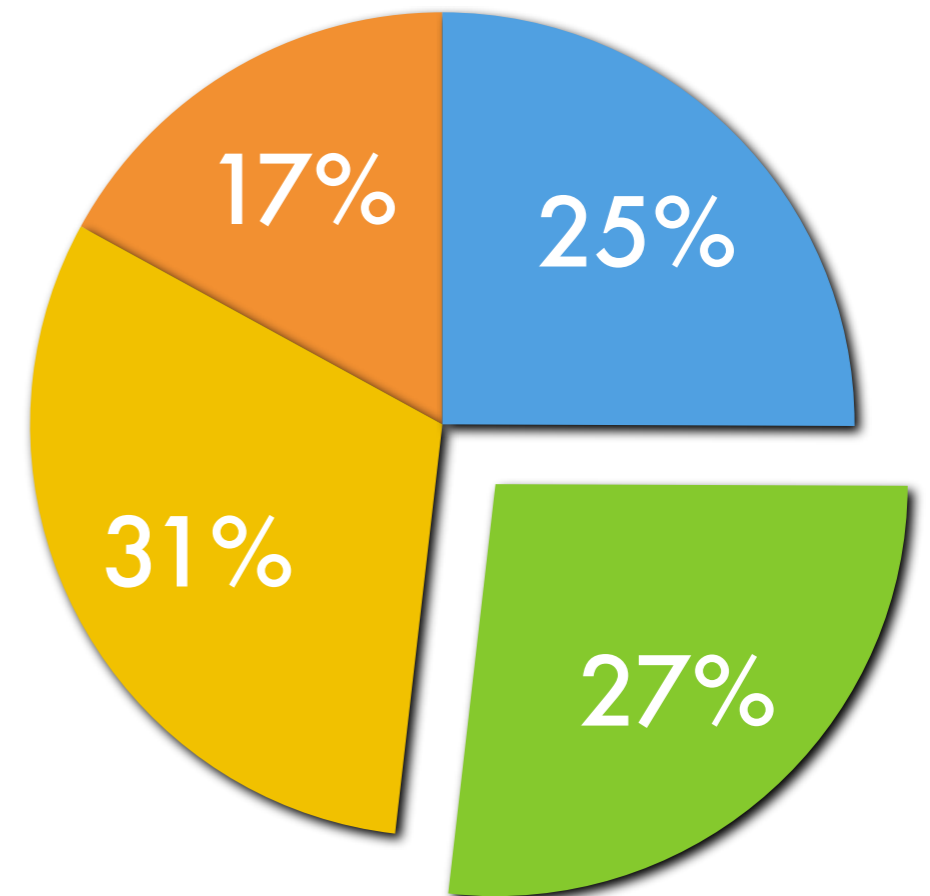
- It goes without saying that motor cars are very common and wide spread in our society
- As a result, they are inevitably going to have a strong influence on our society's sustainability through energy consumption, greenhouse gas emissions and unintended social impact
- At the same time, let us not forget that road transport has very positive economic and social benefits to our society
- This resource provides figures for some major quantifiable issues and points out other relevant factors. It explores the role that engineers can have in this topic

# Transportation Energy

Final Energy Consumption by Sector (UK), 1970-2004

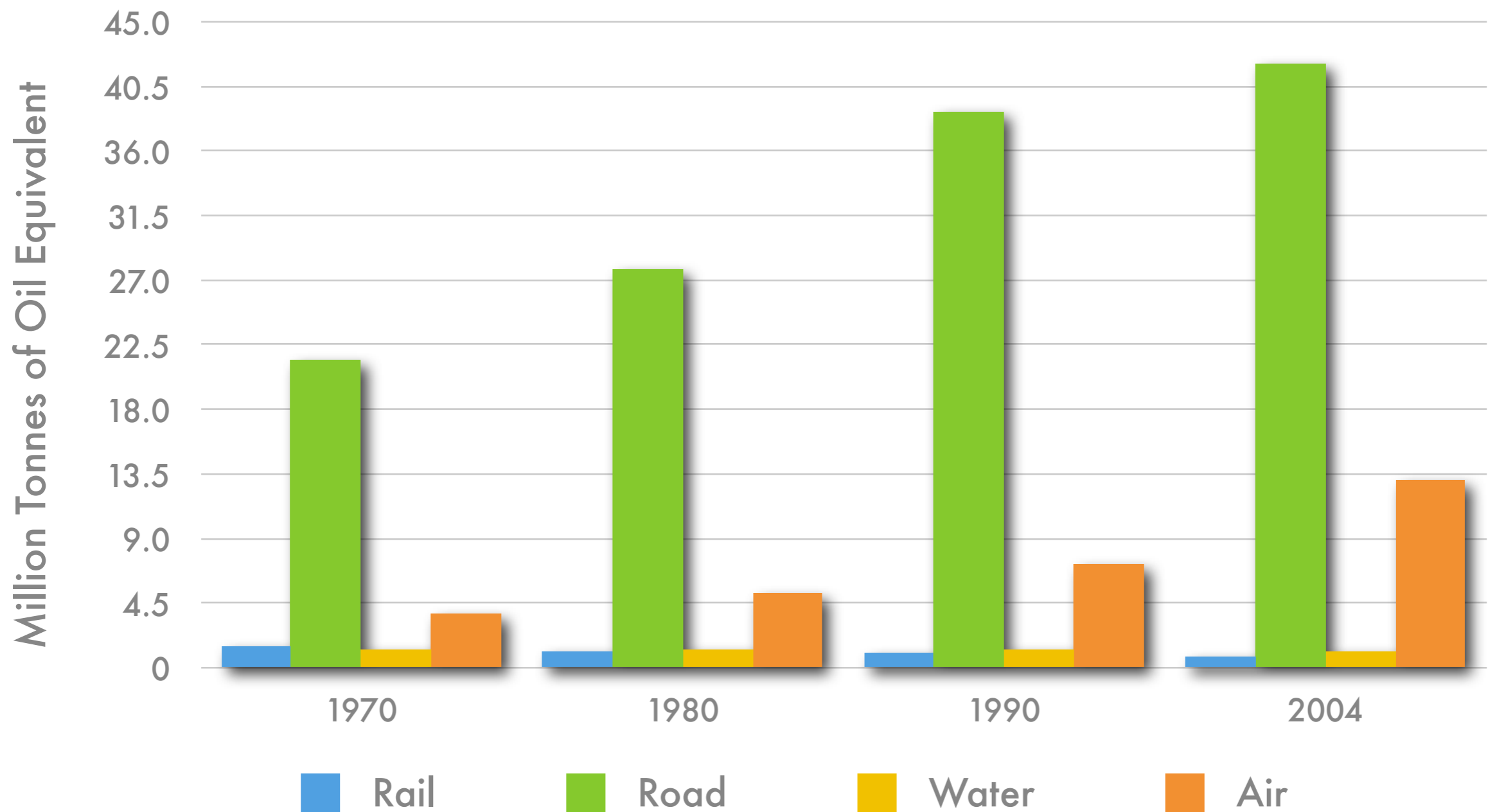


Final Energy Consumption by Sector, 2004



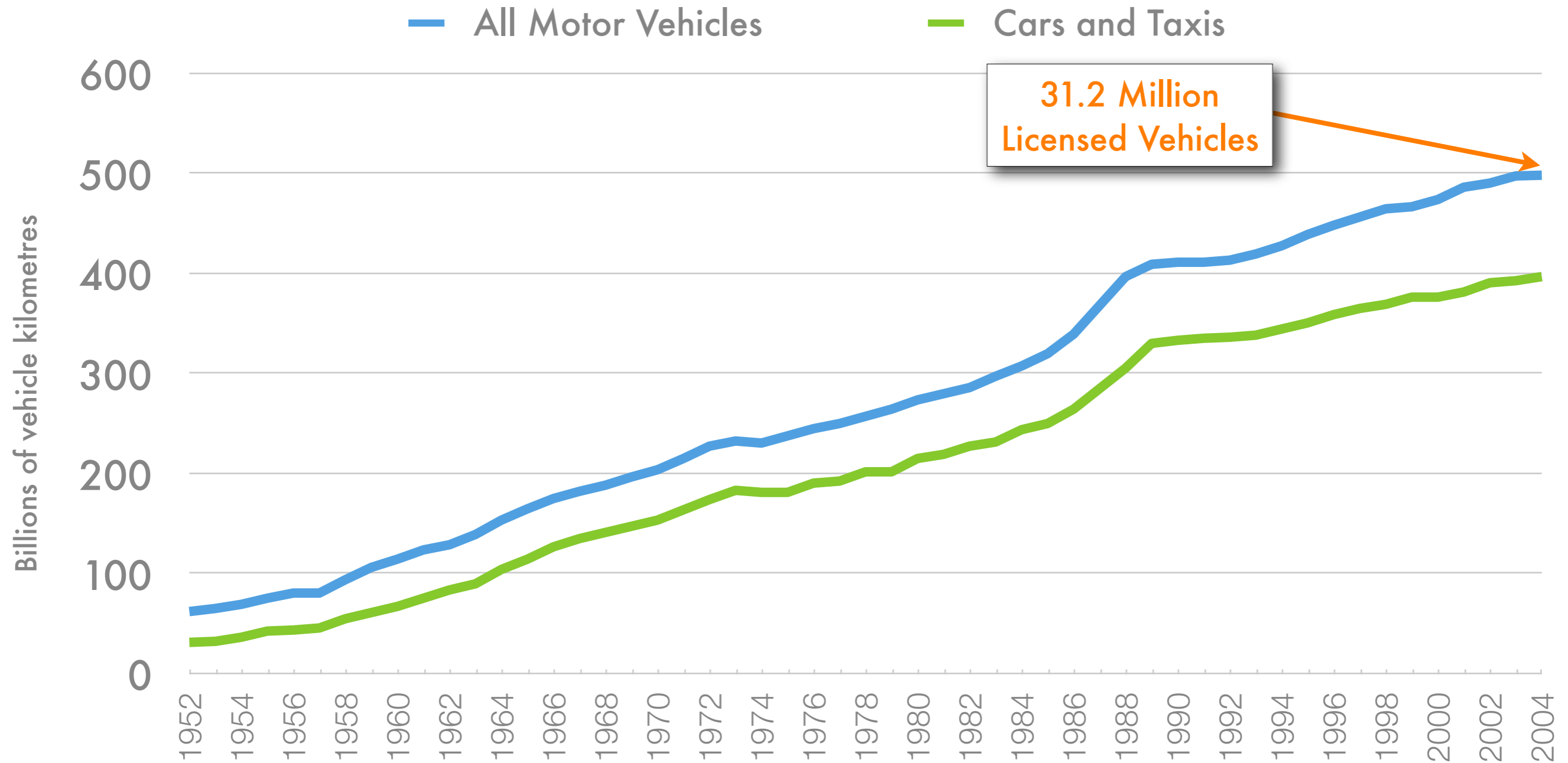
# Energy by Transportation Type

Transport energy consumption by type of transport



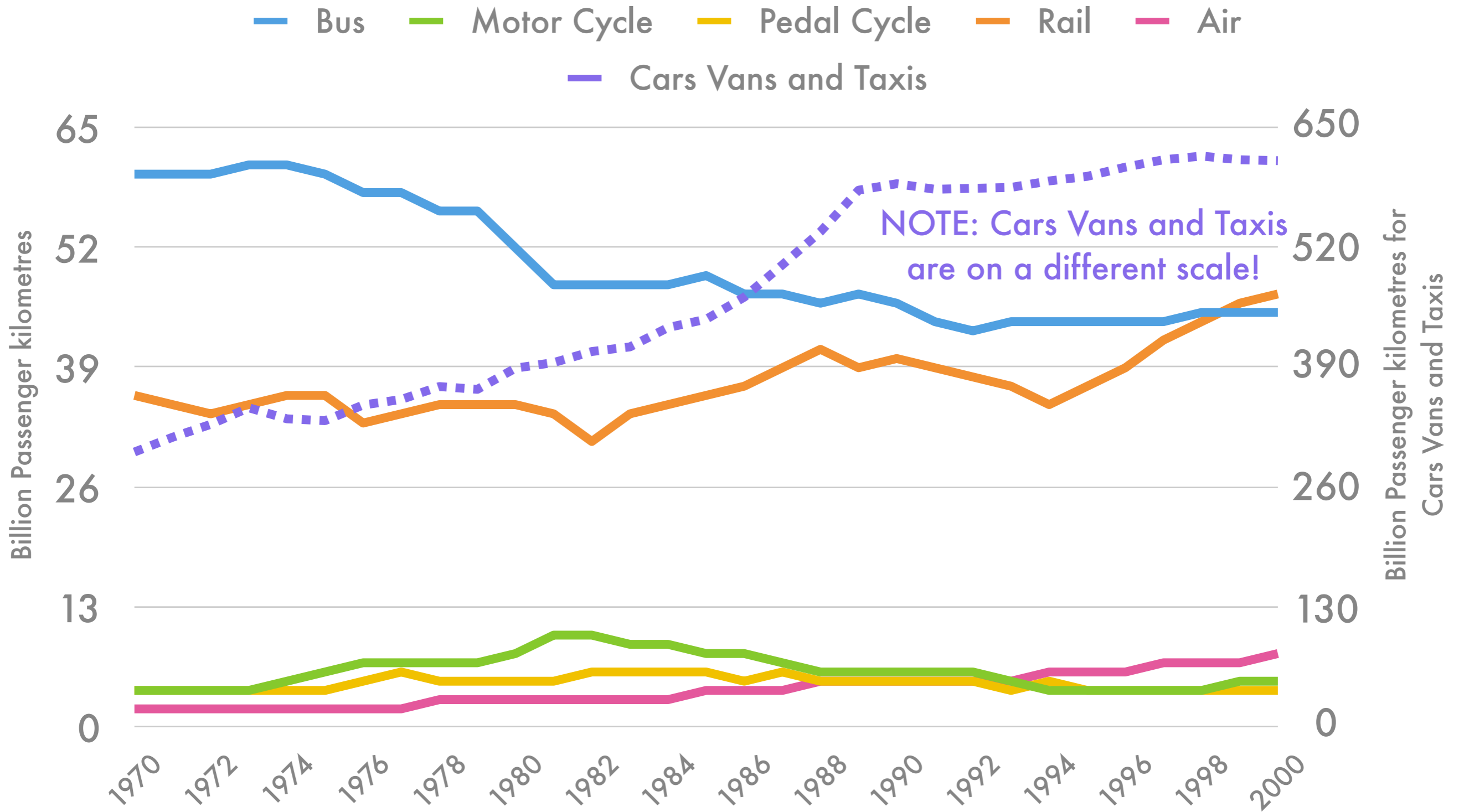


# UK Road Usage



UK Road Traffic has increased **8-Fold** in the last 50 years, there are **31.2 million** registered vehicles, but overall road length has only increased by a 25%.

# UK Transport Usage

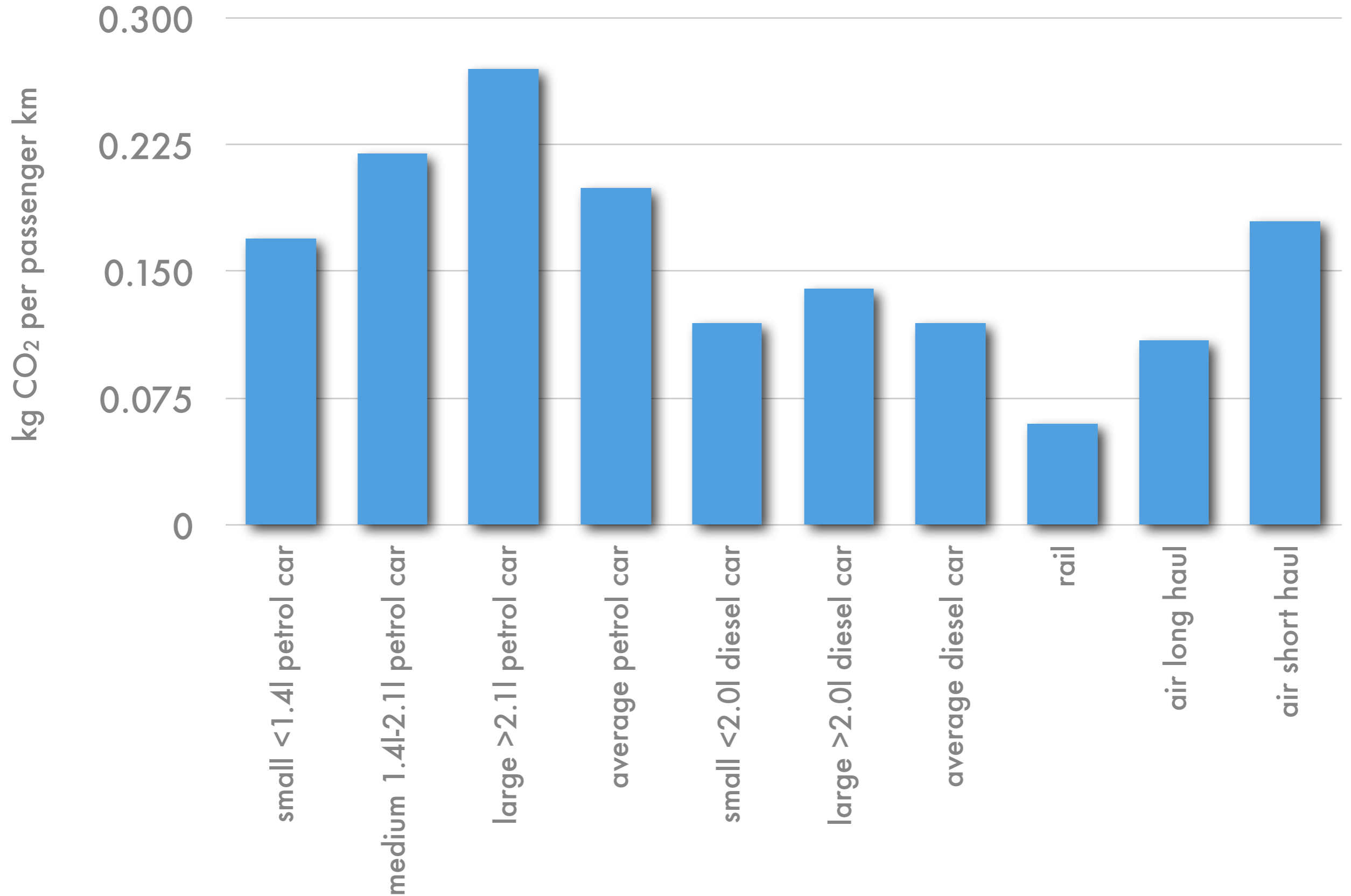


Passenger kilometer = vehicle kilometer X passengers

# Consumer Demand

- Travel time budget: research shows that the mean time travelled per day is independent of income. Worldwide it is 1-1.5 hours.
- Likewise, around the world a person devotes on average 10-15% of their income to travel.
- Trend shows that as GDP / capita increases, passenger kilometres travelled increase. Therefore, growing economies demand ever higher speed transport.

# CO<sub>2</sub> Emissions by Transport Mode





# CO<sub>2</sub> Emissions by Transport Mode

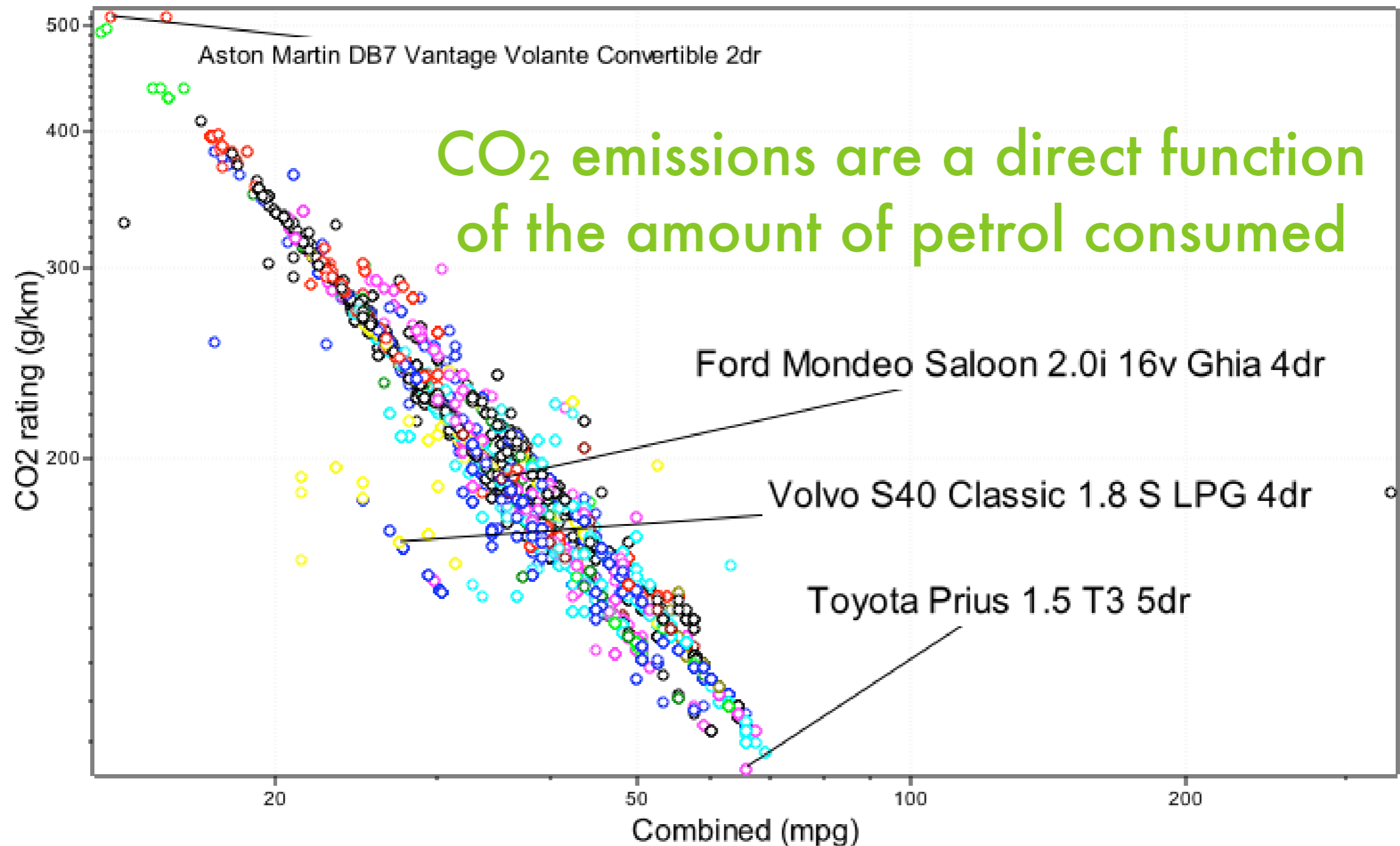
Fuel Life-Cycle Energy Consumption and CO<sub>2</sub> Emissions for urban transport modes

Mode	Seats	MJ per vehicle km	kg CO <sub>2</sub> per vehicle km	MJ per seat km	Grams CO <sub>2</sub> per seat km
Electric Train	300	117	11.7	0.39	3
Diesel Train	146	74	8.8	0.50	0
Light Rail	265	47	10.1	0.18	38
Underground	555	122	26.0	0.22	46
Single Deck Bus	49	14.2	1.6	0.29	33
Double Deck Bus	74	16.2	1.9	0.22	26
Minibus	20	7.1	0.8	0.36	40
Medium-Sized Car	5	3.5	0.39	0.70	78

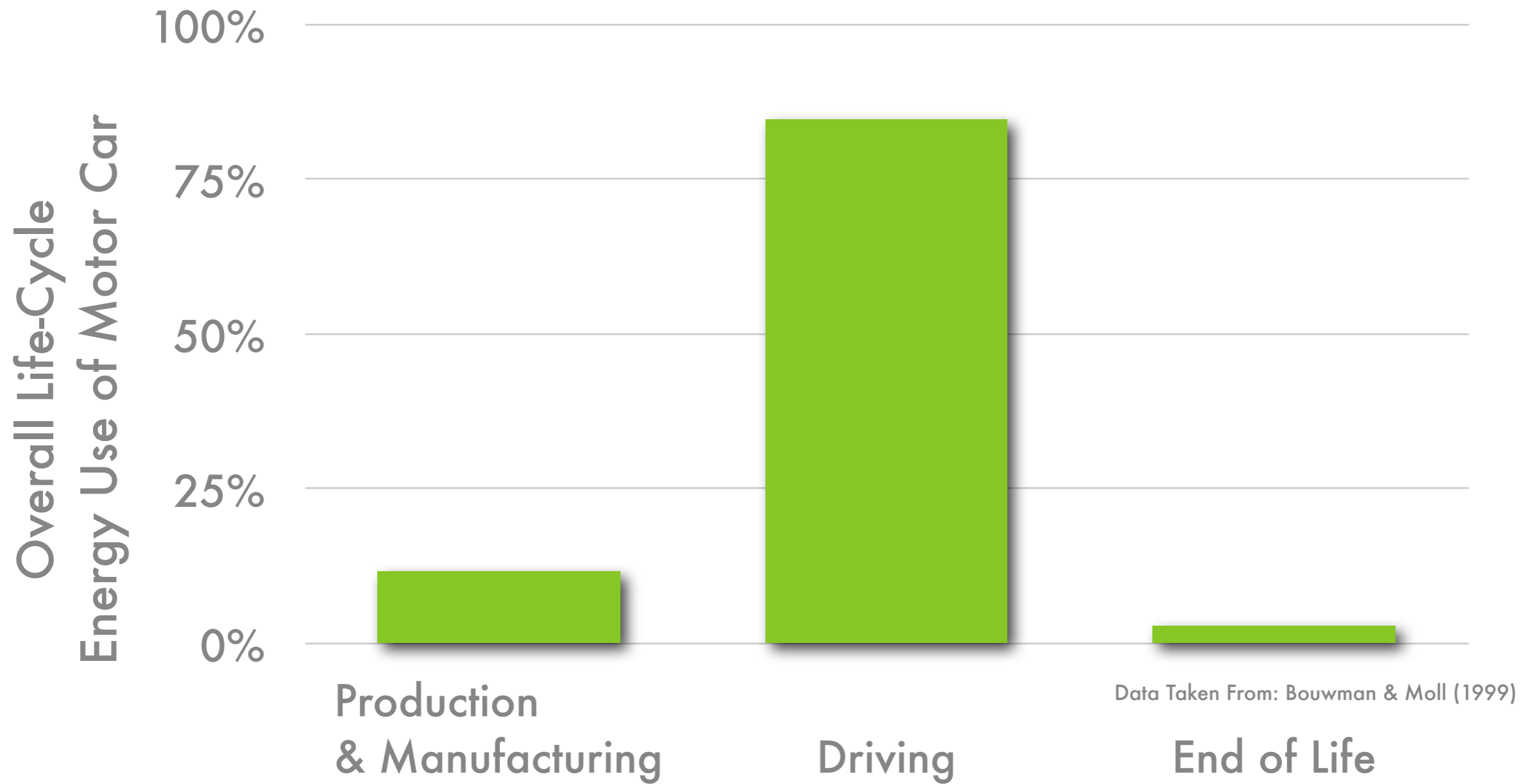
**Road transport makes up around 21% of total man-made CO<sub>2</sub> Emissions in the UK**

(RAC Report 2003)

# CO<sub>2</sub> and Fuel Economy



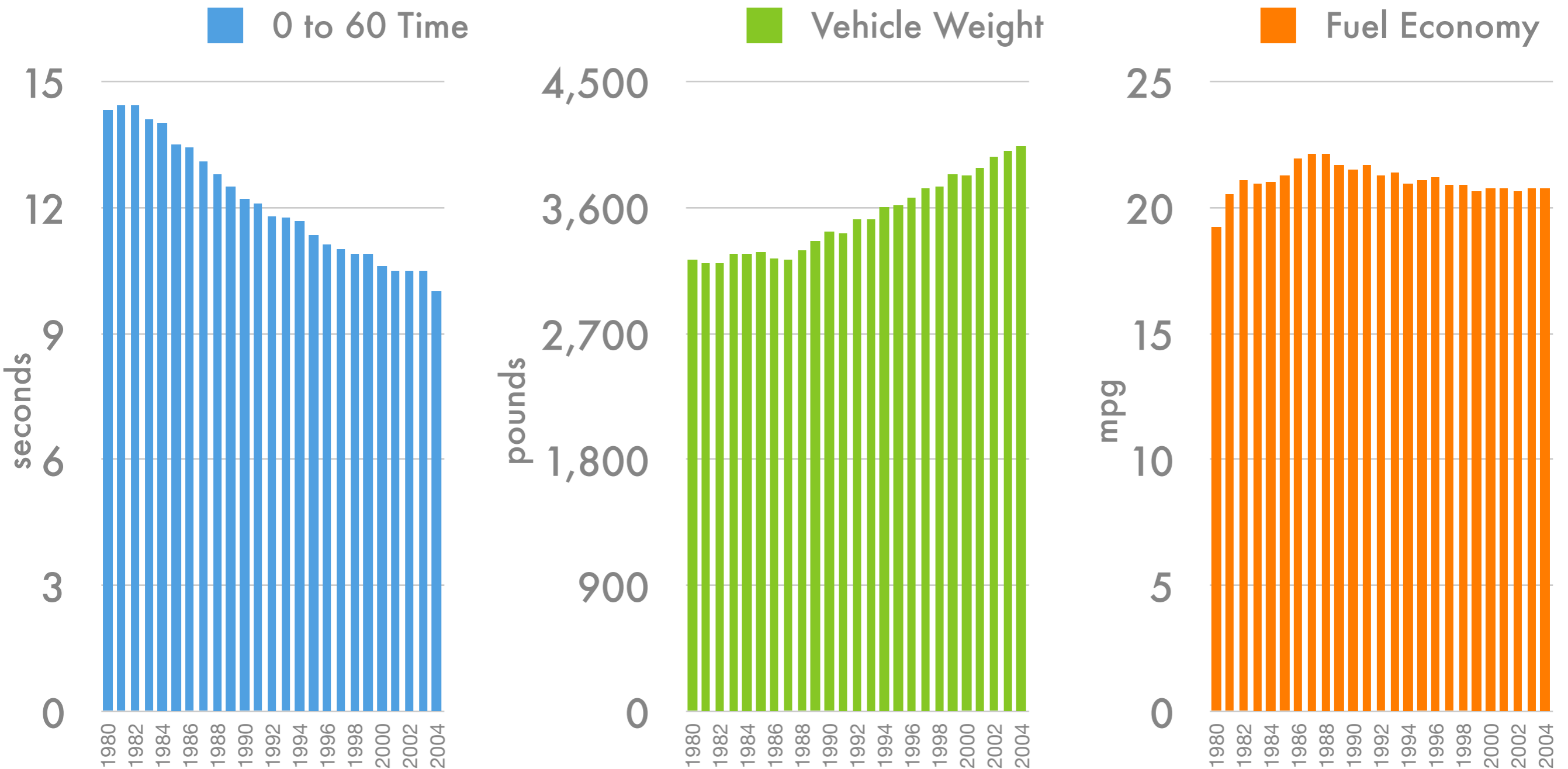
# Motor Car Life-Cycle



In a typical motor car's life, the **Use Phase** (driving and maintenance) dominates energy consumption at 85%. This is typical of **durable goods**. The average car in OECD countries lasts for 13 years and travels 120,000 miles.

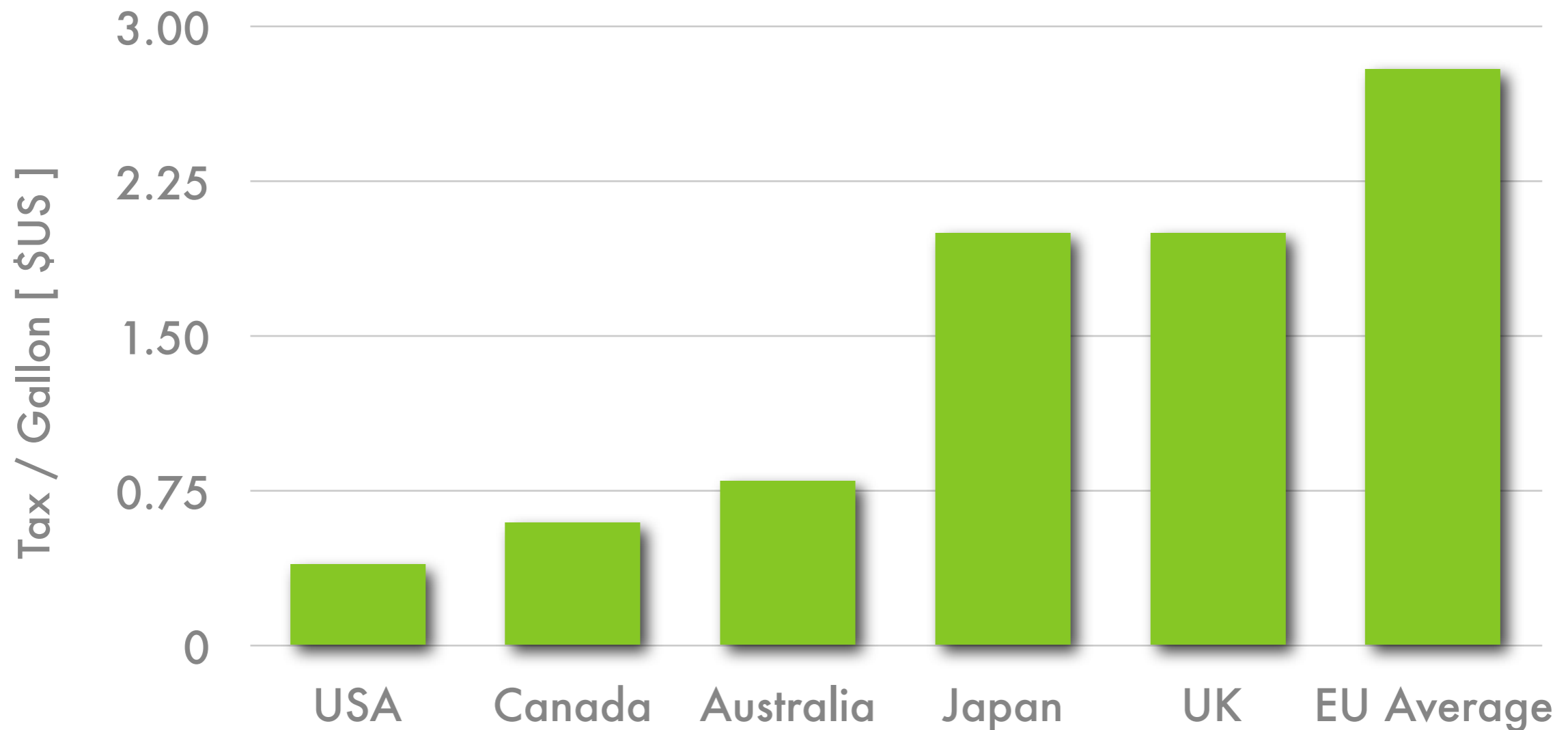
# Technical Solutions: Improved Efficiency

Efficiency does not equate effectiveness  
US EPA Data Averages for Light Vehicles 1980-2004



# Social Policy: Tax

Unleaded Petrol Tax Price, 2001



Does the big difference in petrol tax between Europe and the US partially explain the difference in private car ownership: **450 cars/1000 people** in EU and about **700 cars/1000 people** in the US?

# Social Policy: Public Transport

Intelligent transport systems such as timed entry freeways and on-board traffic directors could reduce congestion and increase the mean speed of automobiles by 15%



# A global viewpoint

- New technologies may come to market first in China
- In 2005, China has six of the world's ten most polluted cities.
- The market for replacing batteries in electric bicycle with fuel cells is likely to be the earliest to be commercialised.

# Summary

- Road Transport impacts the environment by consumption of non-renewable fossil fuels and emissions, society by unintended consequences
- Road transport is also hugely beneficial to society and the economy
- As engineers, solutions include social systems (public transport) and technological improvements (hybrid cars, engineering for sustainable design).



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