Existing and Future Transport Emissions and Corresponding Energy Demand Pathways

Midlands Highway Alliance

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Outline & Agenda

How manage rapid changes to UK vehicle fleet?

- Vehicle fleet is currently undergoing rapid changes, with proliferation of electric and hybrid vehicle models (particularly cars, LGVs, but also HGV)
- Current rate of uptake of low/zero emission (LEV/ZEV) vehicles not being adequately captured in large-scale data; e.g. EFT
- Could potentially lead to increasing uncertainty in future years, where projections are not in-line (either +ve or-ve) with net zero targets

Can we use better data?

How do we confidently project this fleet to future years?

Can we integrate necessary detail?

Agenda

Introduction

- Policy and Strategy
- Net Zero and NAQS
- Emissions Rates

Baseline

- Data sources
- Annual mileage and vkm

Stock & Data

- Variation
- Validation
- Energy

Projections

- Decarbonisation Pathways
- AECOM In-house Stock Models
- Behaviour & Policy

Summary & Conclusions

- Insights
- Conclusions

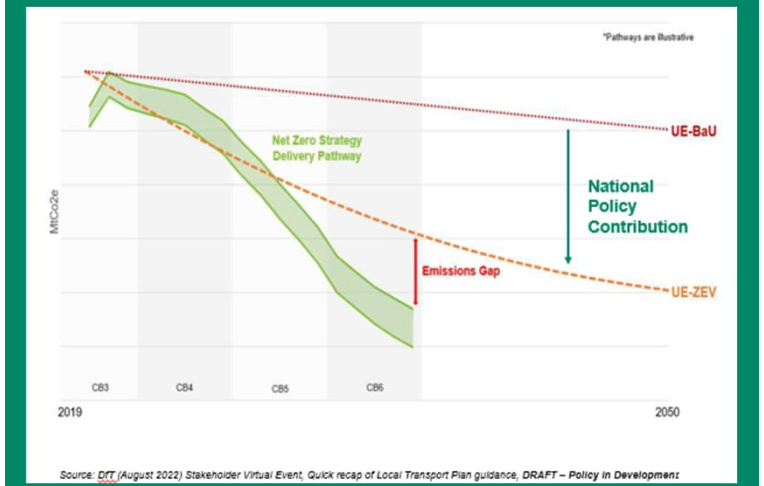
Introduction

Climate and CO_2
Compliance
Health
Emissions Rates

Legislation & Policy Targets

Quantifiable Carbon Reduction

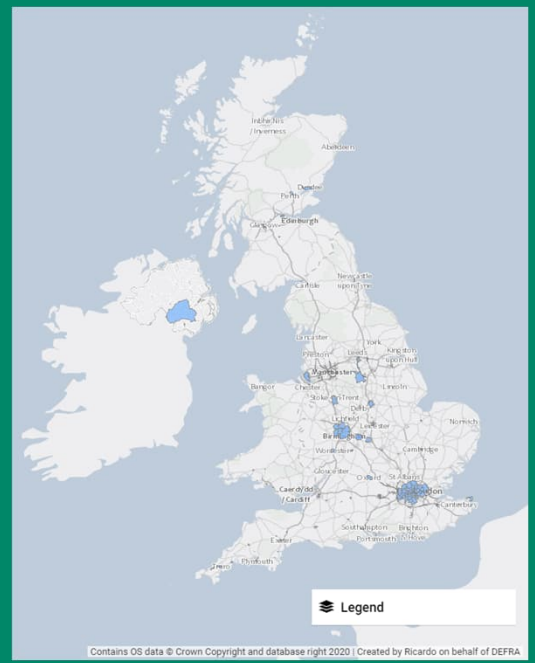
Carbon Dioxide eq. (CO2e) emissions are projected to fall significantly in all scenarios. This is largely driven by the anticipated uptake of EVs.



Source: DfT (August 2022) Stakeholder Virtual Event, Quick recap of Local Transport Plan guidance, DRAFT – Policy in Development

Local Air Quality Management

Primary concern is Outdoor or Ambient air quality
Legally binding limits to certain pollutants based on their impact on health



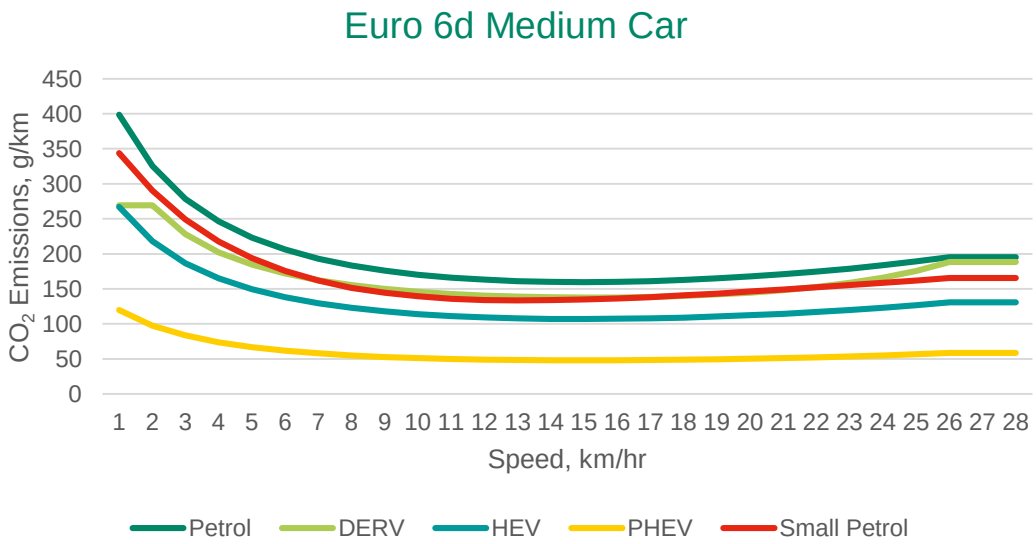
Ecology & Habitats

Nitrogen deposition (N-dep) as a result of road traffic emissions (NO_X & NH_3) are of increasing concern to *Natural England.*

Emissions Rates

EMEP/EEA air pollutant emission inventory guidebook 2023 and 1.A.3.b.i-iv Road Transport Appendix 4 Emission Factors 2022 used in COPERT v5.7 and amendments in v5.8.

Consistent with the DEFRA Emissions Factors Toolkit v12.0.1, which includes UK-specific factors.

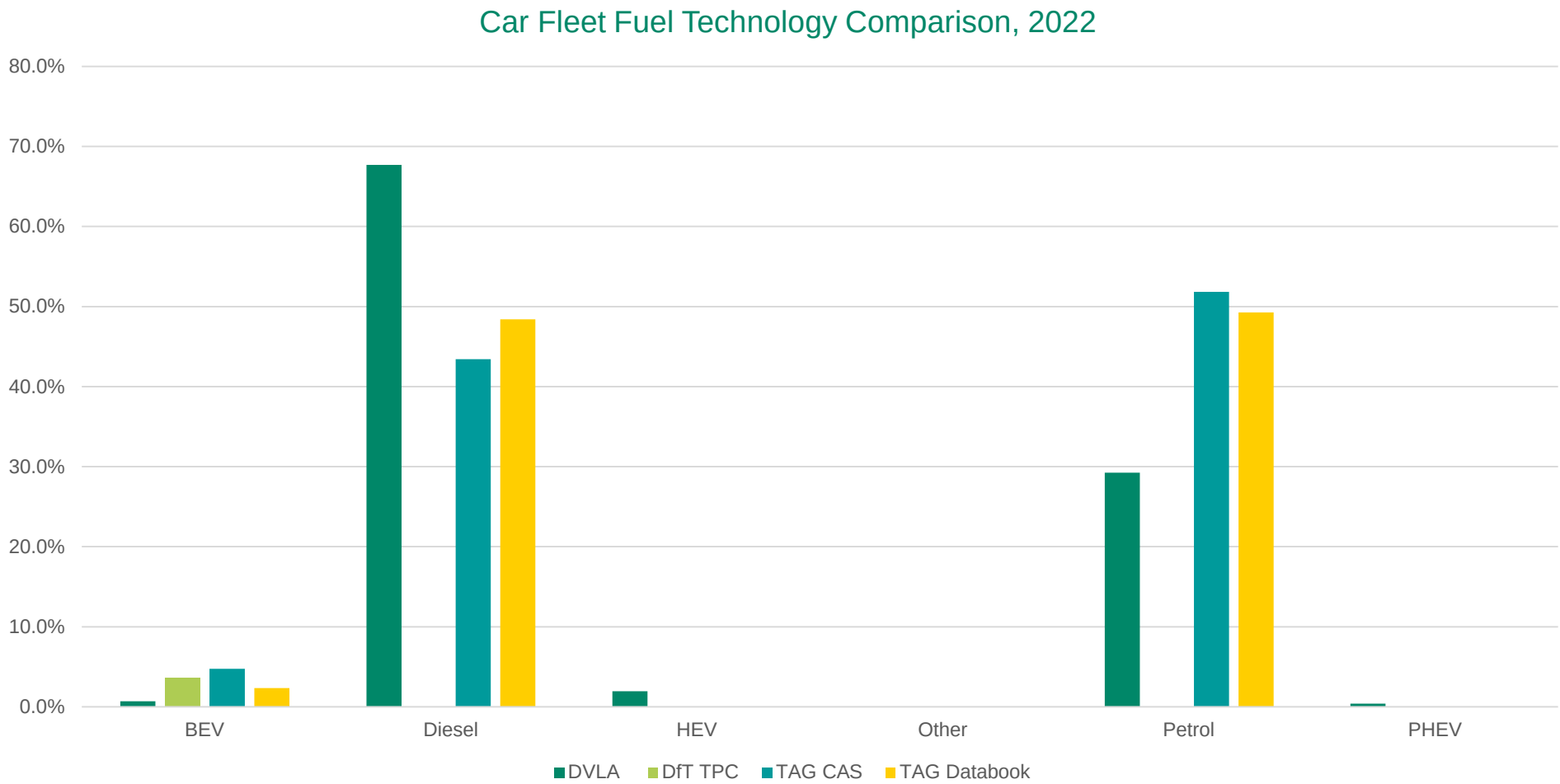


https://www.eea.europa.eu//publications/emep-eea-guidebook-2023
https://www.eea.europa.eu/publications/emep-eea-guidebook-2019/part-b-sectoral-guidance-chapters/1-energy/1-a-combustion/road-transport-appendix-4-emission/view

Baseline

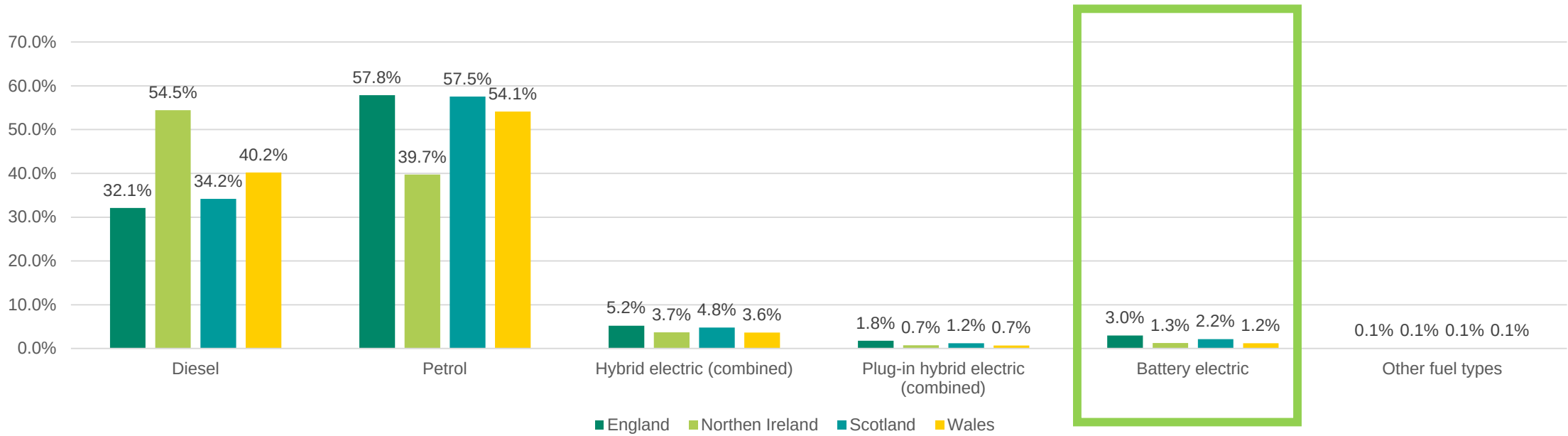
Data sources
Annual mileage

UK Data Sources



Overview of DVLA current vehicle fleet dataset

- DVLA publish dataset containing historical information on vehicle registrations every quarter for the UK
- These datasets include:
  - vehicle type (e.g. car, LGV, etc)
  - fuel technology (petrol, diesel, hybrid, plug-in hybrid, battery electric)
  - year of first registration
  - ONS Region, upper/lower tier Local Authority of first registration
- This provides an accurate quantification of the current vehicle stock and may be tailored to specific study / assessment area
- Then, can project forward using an accurate baseline.



DVLA vs EFT and fleet projection overview

- With an accurate current fleet, can project forward with more certainty

- Simple comparison of DVLA (more accurate current fleet) with EFT (DEFRA/DfT, Basic Split) for England vehicle fleet

    - DVLA in 2021, ~**2.0**% of total car fleet is already battery electric (~1.6% if overall fleet is ~80% cars)
    - DEFRA/DfT in 2021, ~**0.6**% of overall fleet is battery electric cars (only rising to **2.0**% in 2025)
    - DEFRA/DfT ~34% battery electric cars in overall fleet in 2050 – needs to be nearer to 90-100% to achieve net zero

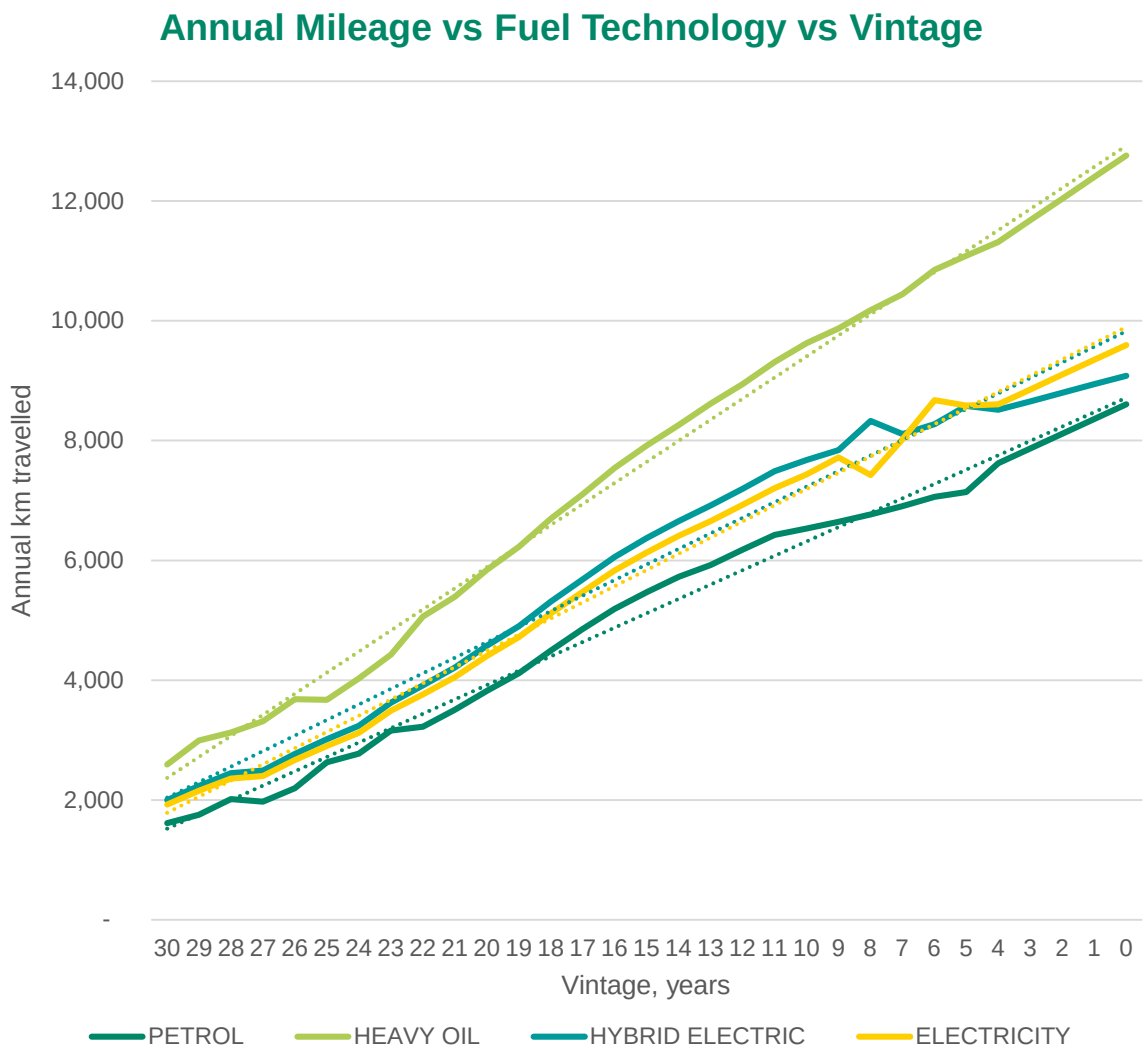
- And for total hybrids (non-plug-in hybrid and plug-in hybrid)

    - DVLA: ~**5.3**% of total car fleet is hybrid (~4.2% if 80% cars)
    - DEFRA/DfT : ~**3.6**% of overall fleet is hybrid

Projections

- From this starting point, calculate year-on-year growth rates for each fuel technology using published decarbonisation projections (DfT) – more details on the specifics of this later
- Then, use these growth rates to re-calculate the fleet vehicle/fuel splits for future years
- This highlights the difference between different tools and datasets that may not align to the latest policy plans

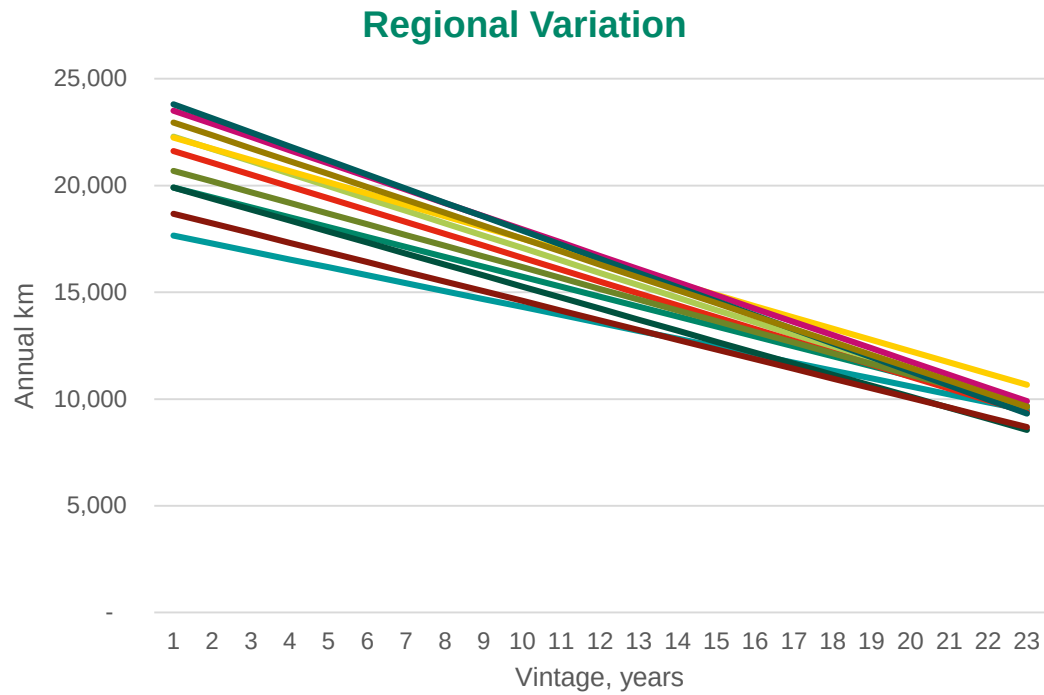
Vehicle-km



Source: CSO (2024) & DfT

Annual mileage decreases predictably with age:

- Spatial variation
- Trends have been consistent across several years
- unclear atm whether demand or technology determines annual mileage
- E.g. how will BEV mileage change in future as it replaces ICE?

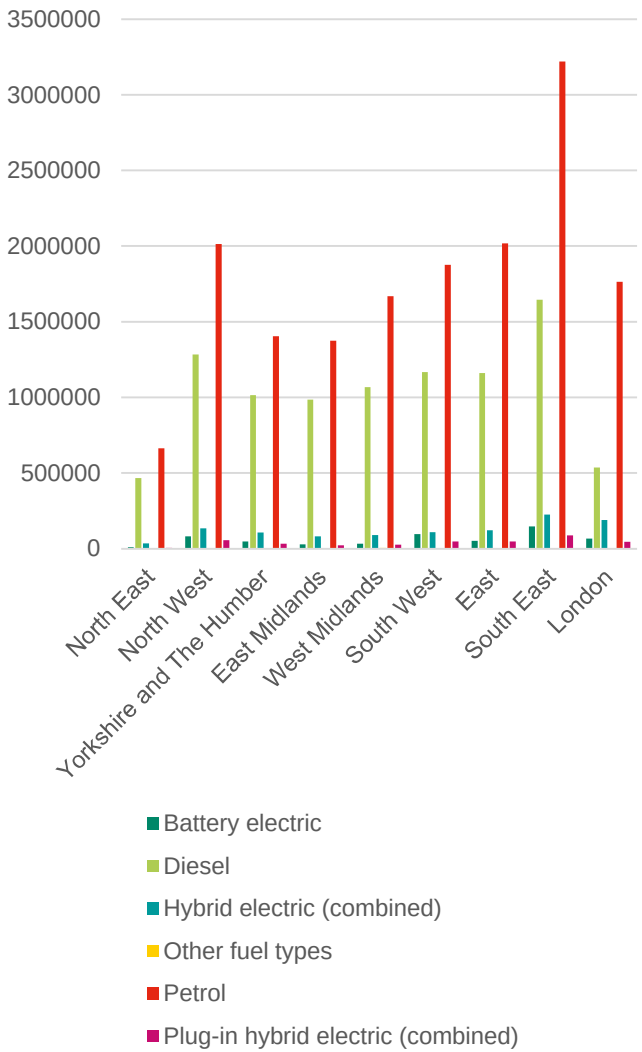


Stock Data

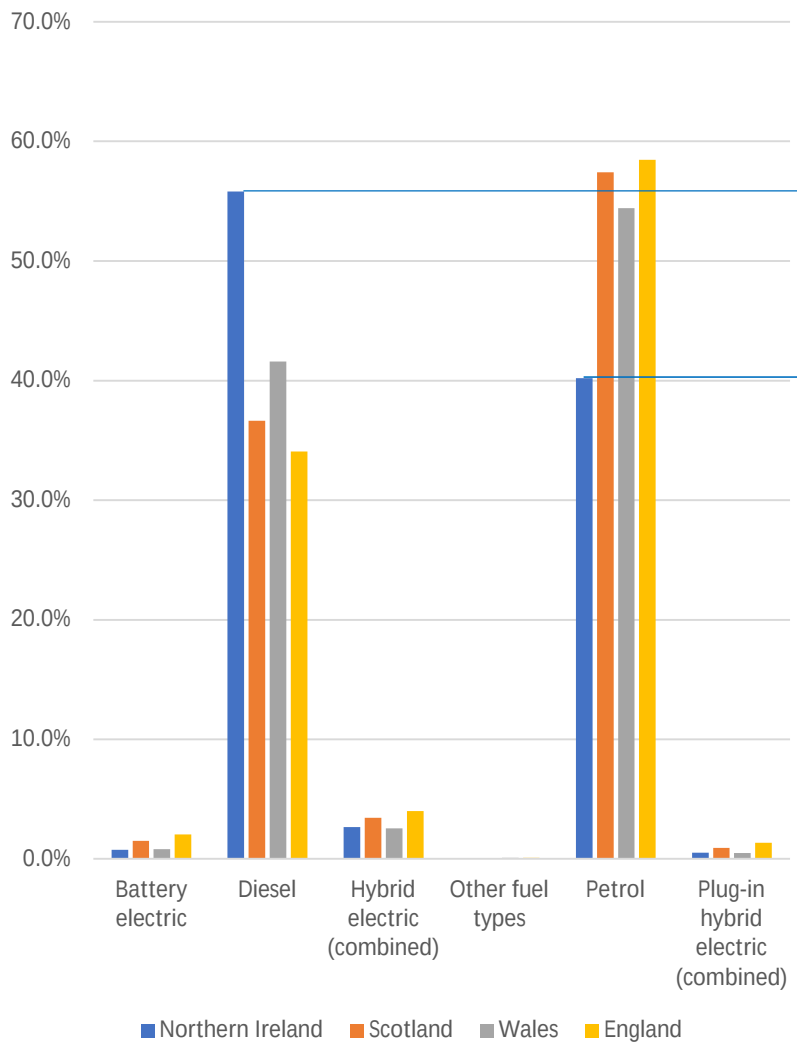
Regional Variation
Validation

Regional Variation

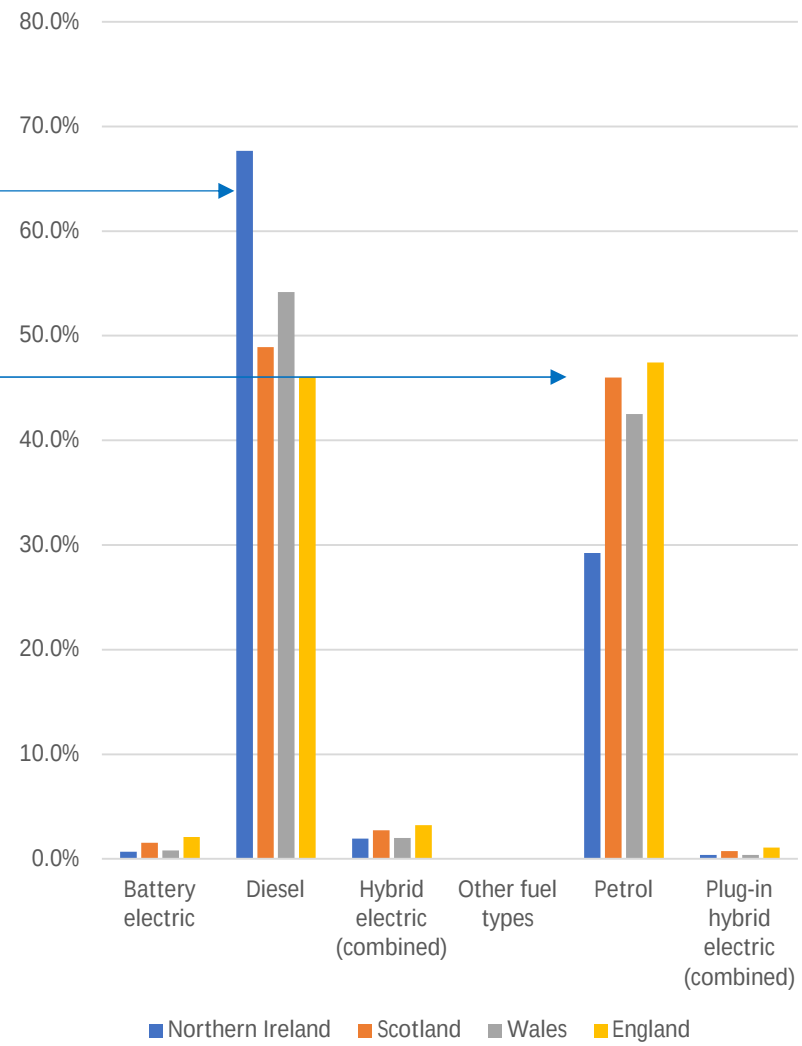
Regions



Registered fleet, not adjusted for vkm

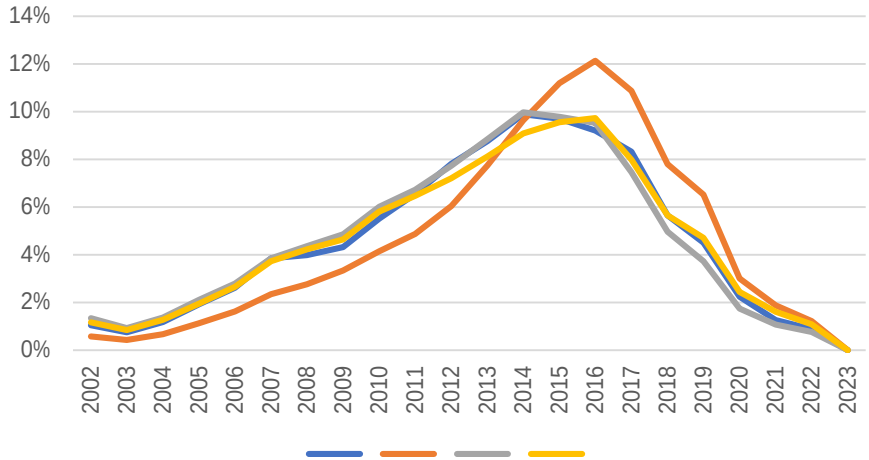


Registered fleet, adjusted for vkm, 2022

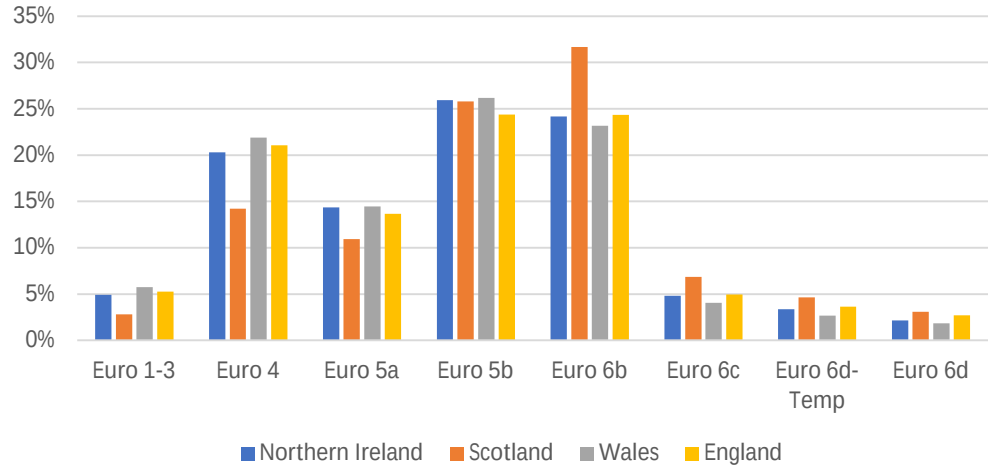


Age Profiles

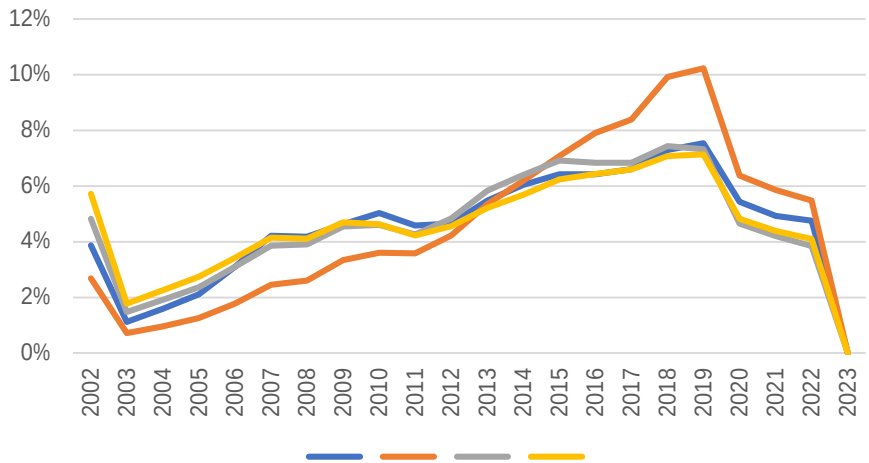
Diesel Vintage, 2022



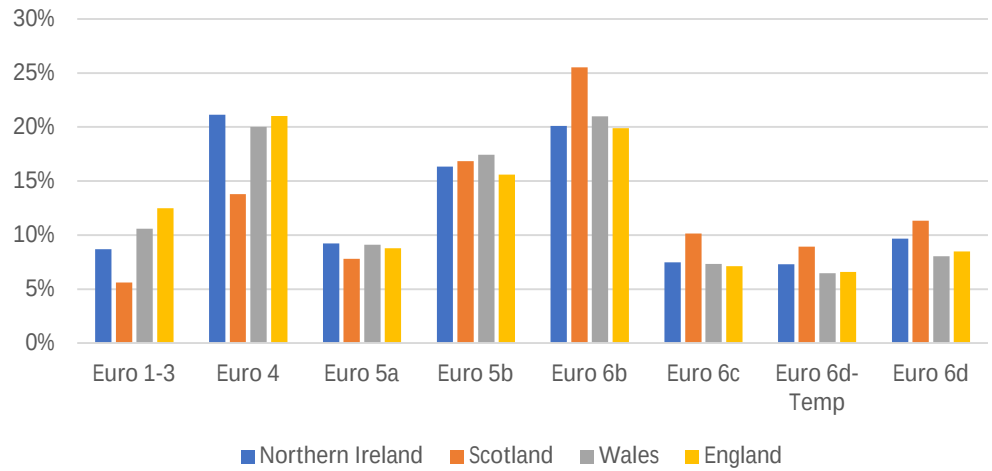
Diesel Car Euro



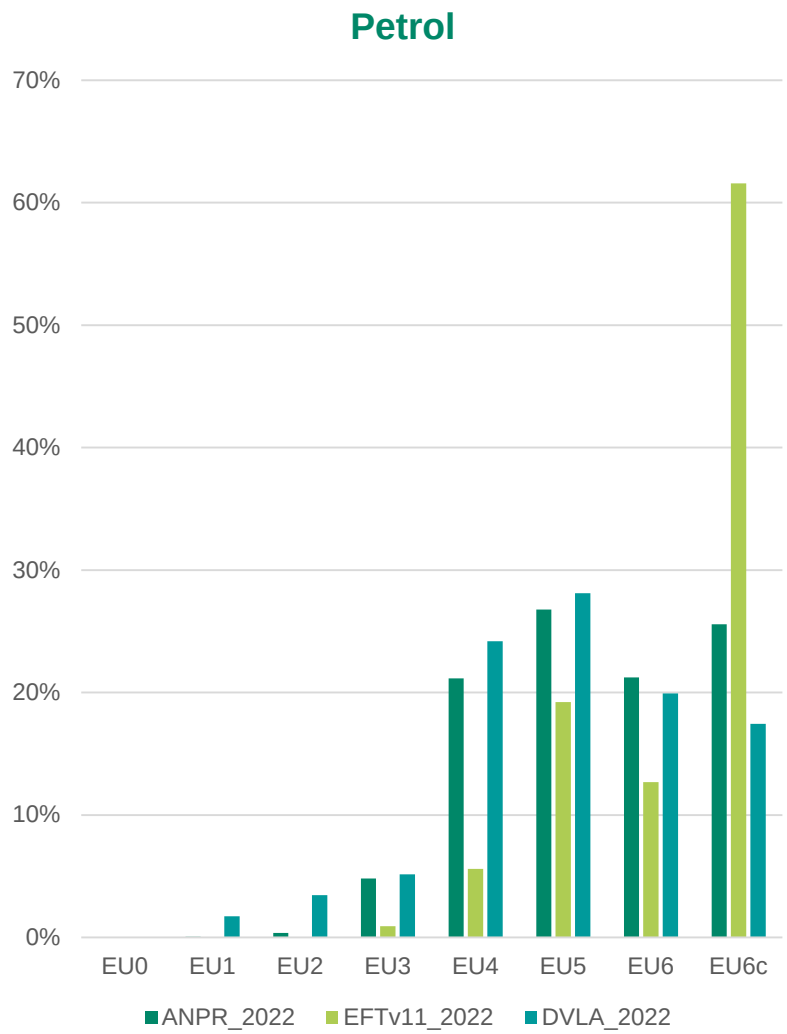
Petrol Vintage, 2022

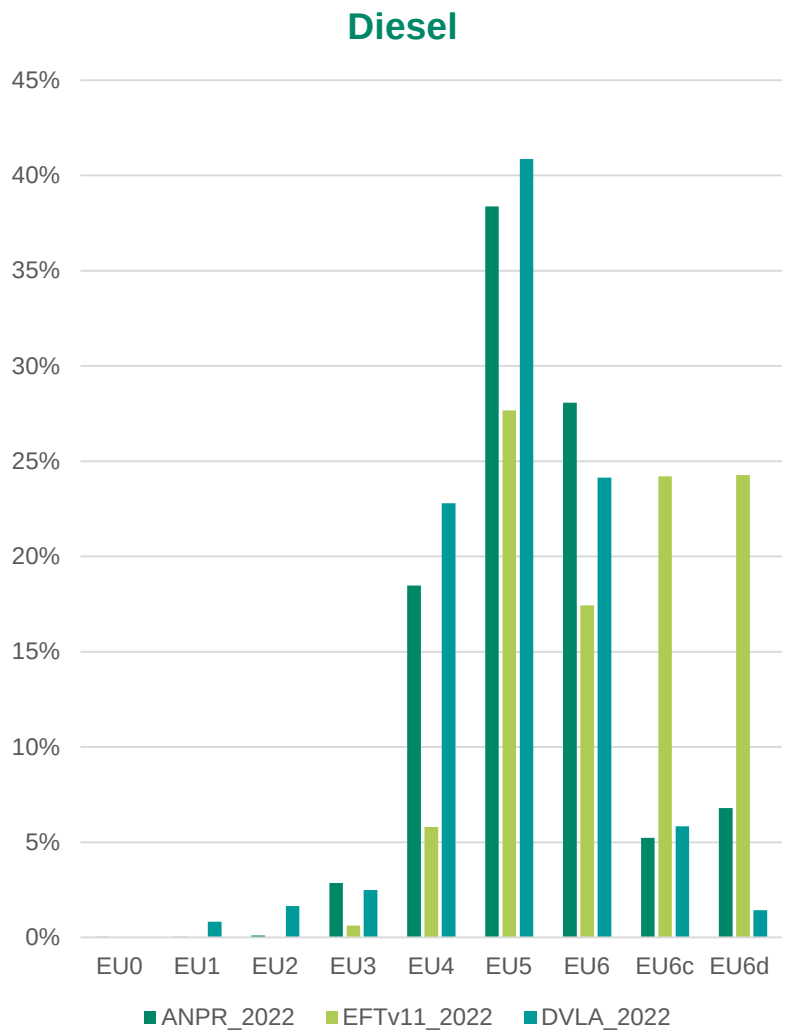


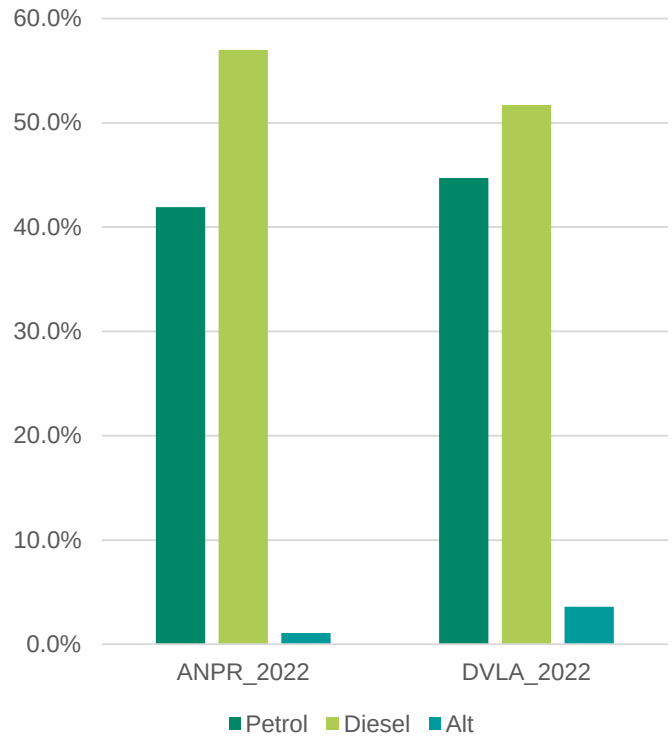
Petrol Car Euro



Validation



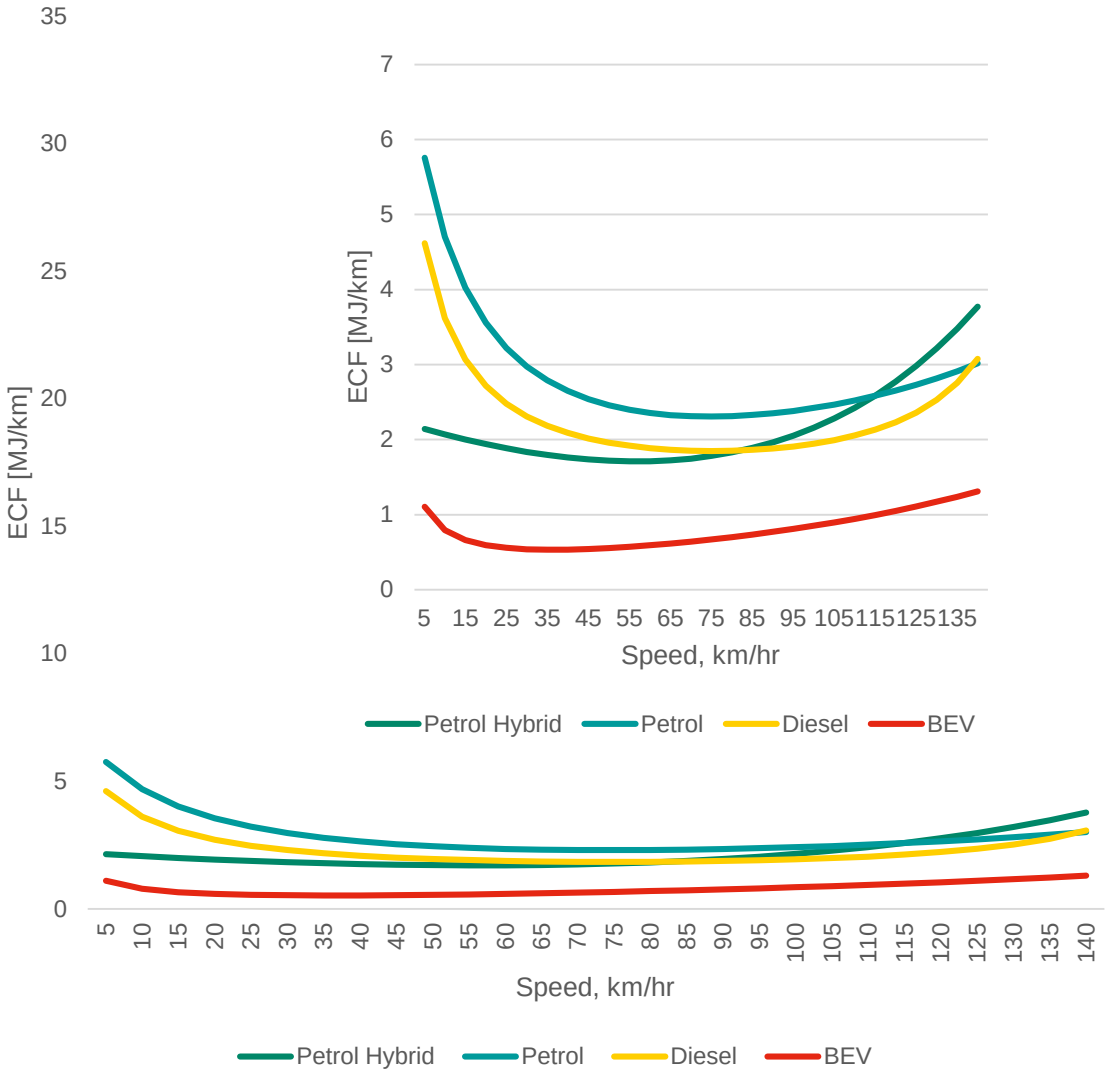




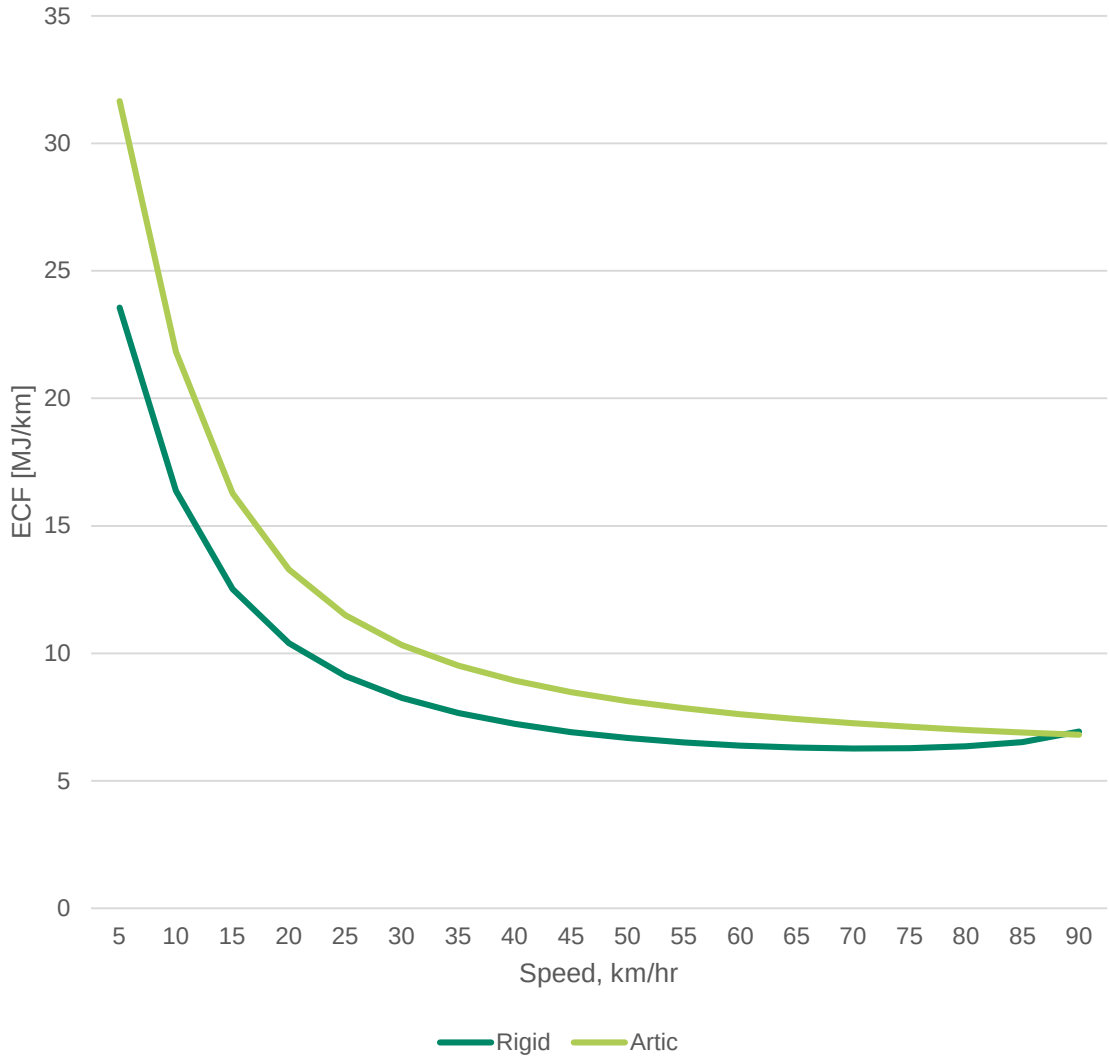
Source: DVLA (2024) & DEFRA (2025) Emissions Factors Toolkit

Energy Consumption

Car Energy Consumption



HGV Diesel Energy Consumption

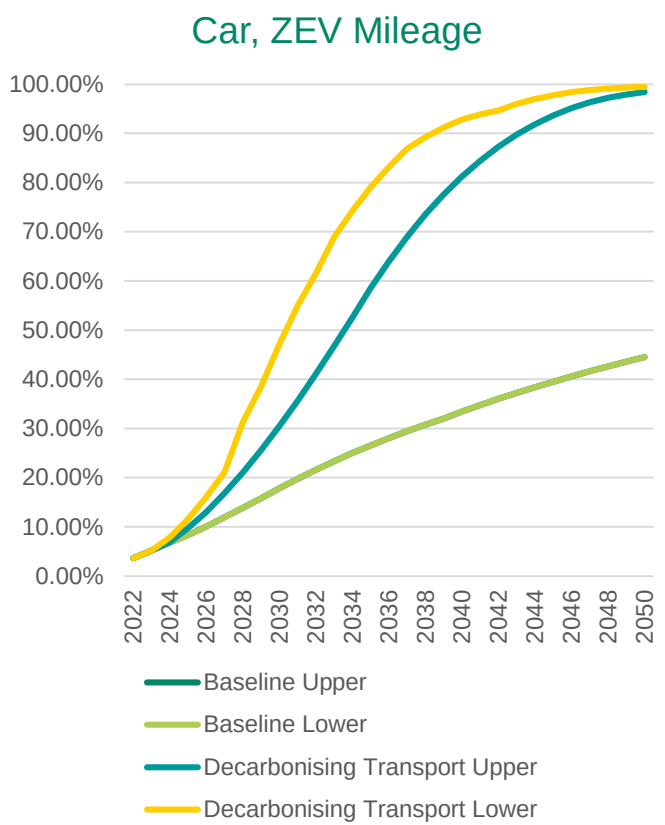


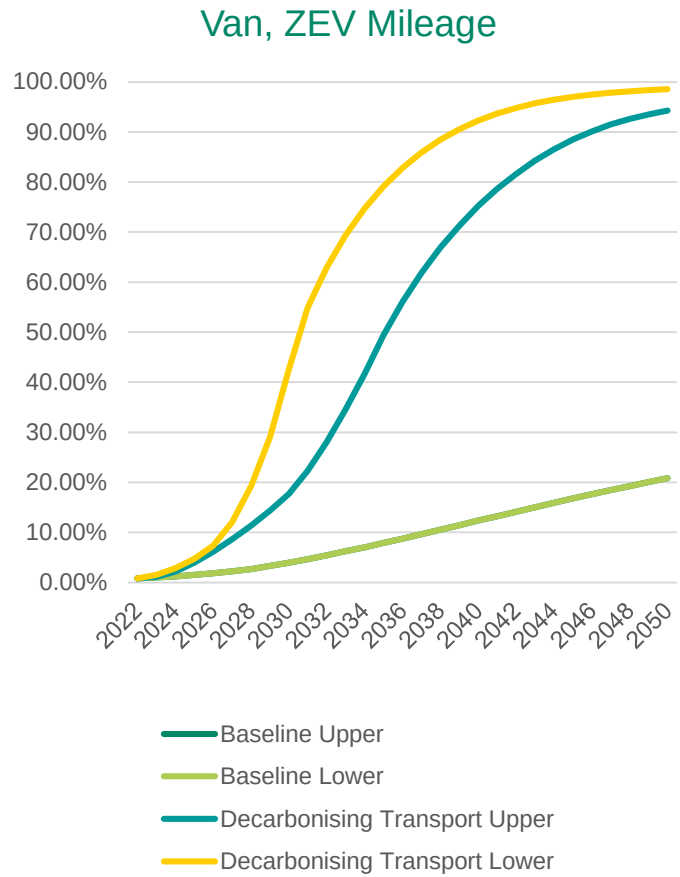
Source: EEA (2023) EMEP/EEA air pollutant emission inventory guidebook 2023

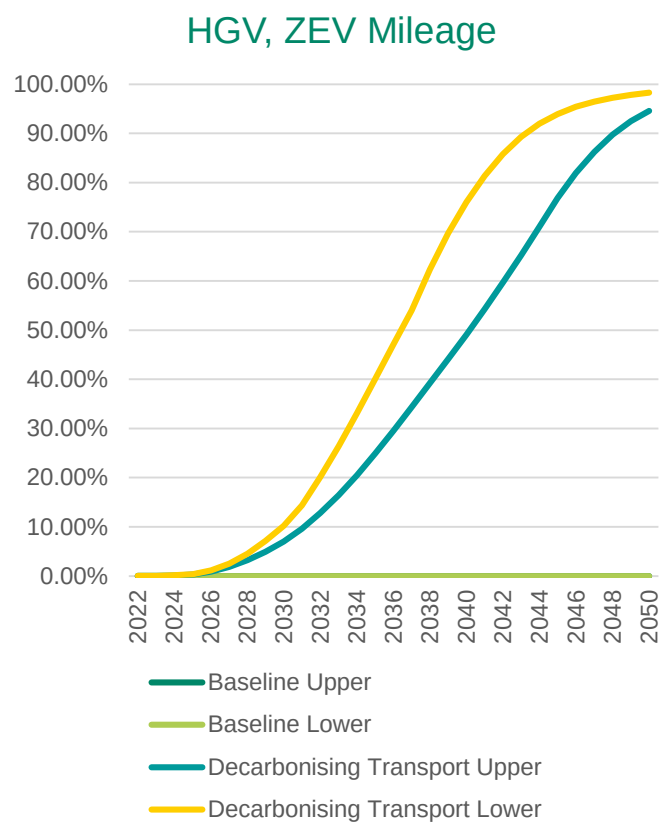
Projections

Decarbonisation Pathways
AECOM In-house Stock Models
Behaviour & Policy

UK Transport Decarbonisation Pathways







Energy pathway

ICE petrol, diesel, biofuel
Hybrid, plug-in hybrid
Battery electric

Mineral, biological, waste

Grid, charging infrastructure

Source:DfT (2023) Transport Decarbonisation Plan

New Sales, National Profile

Prioritising EV as preferred technology
UK and EU legislation overlapping

2030

UK mandate to end sales of new, non-EV ICE LDV

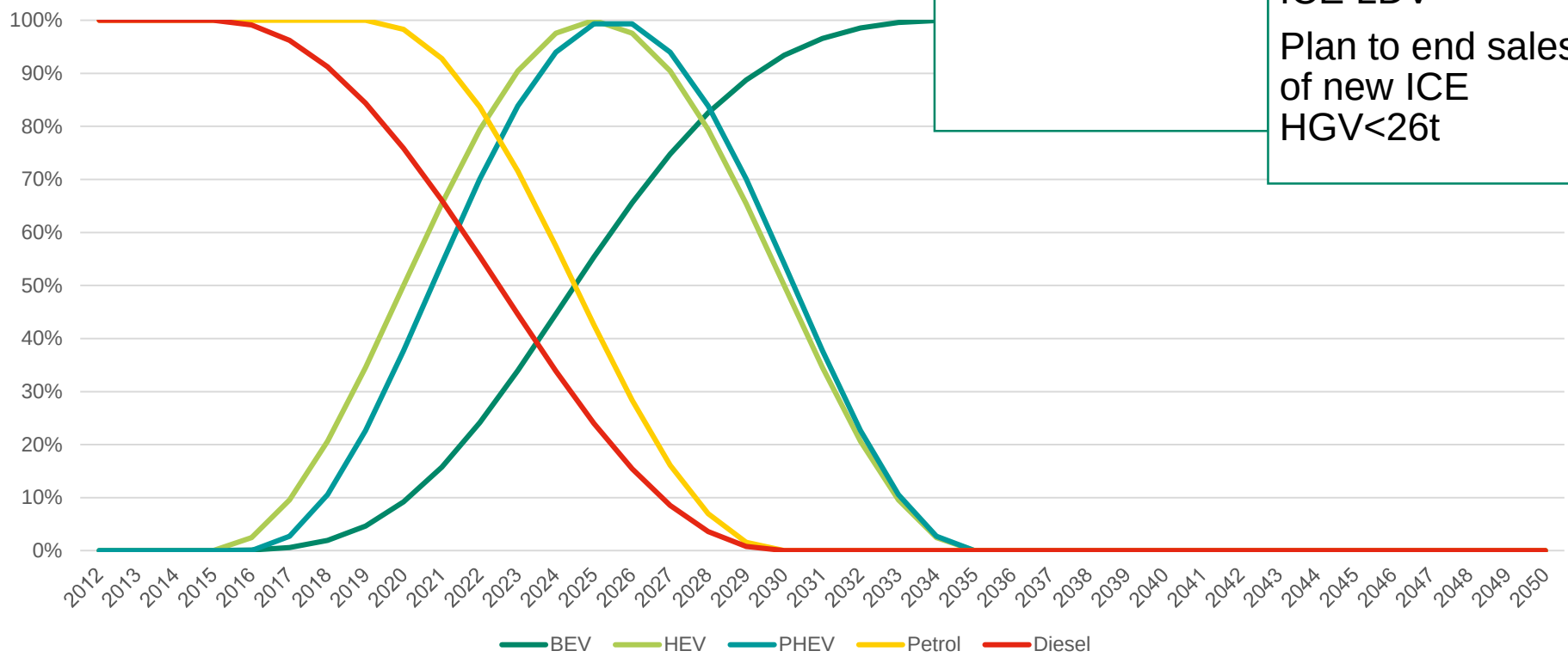
2035

UK Mandate to end sales of all ICE LDV

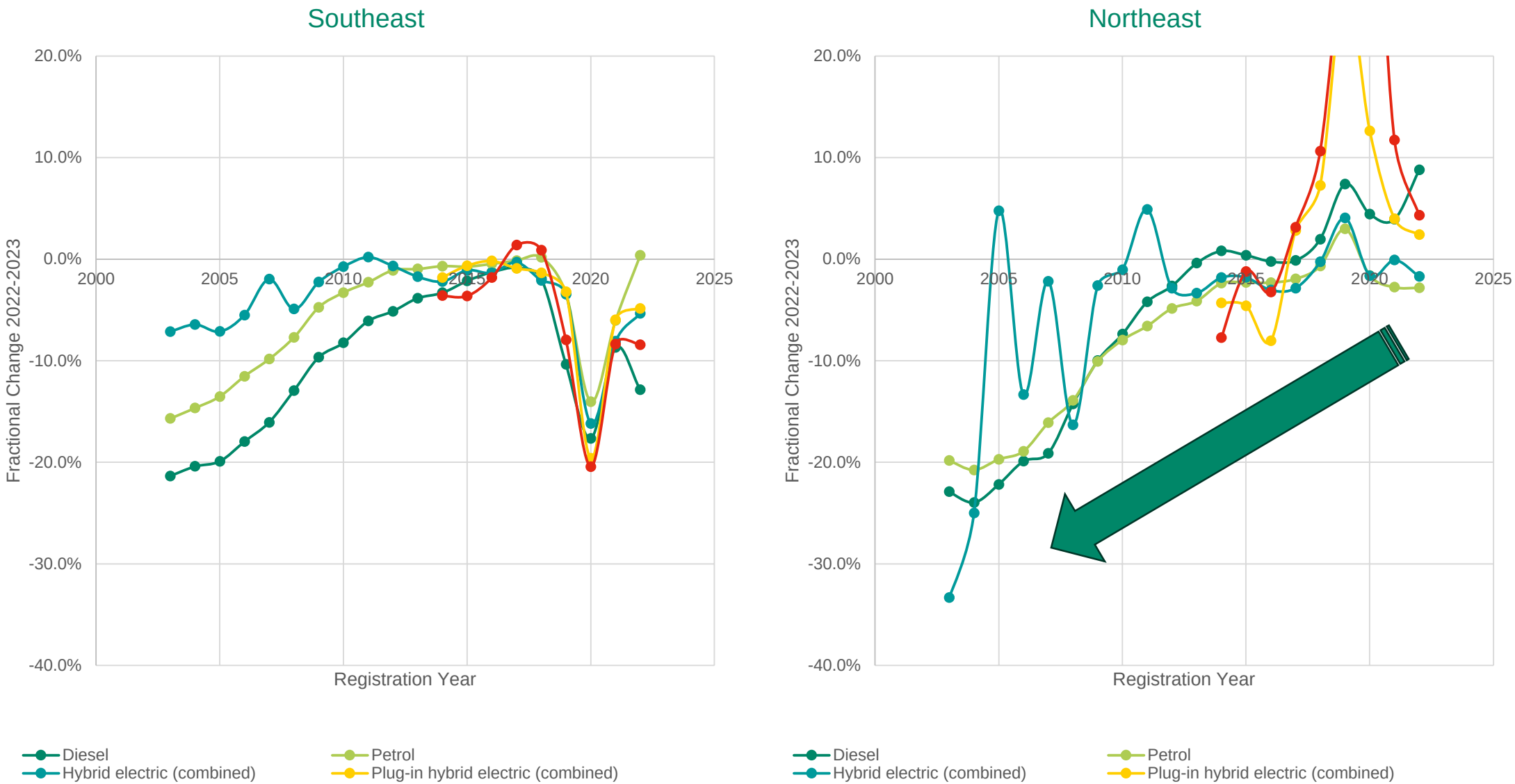
Plan to end sales of new ICE HGV<26t

2040

Plan to end sales of all ICE HGV

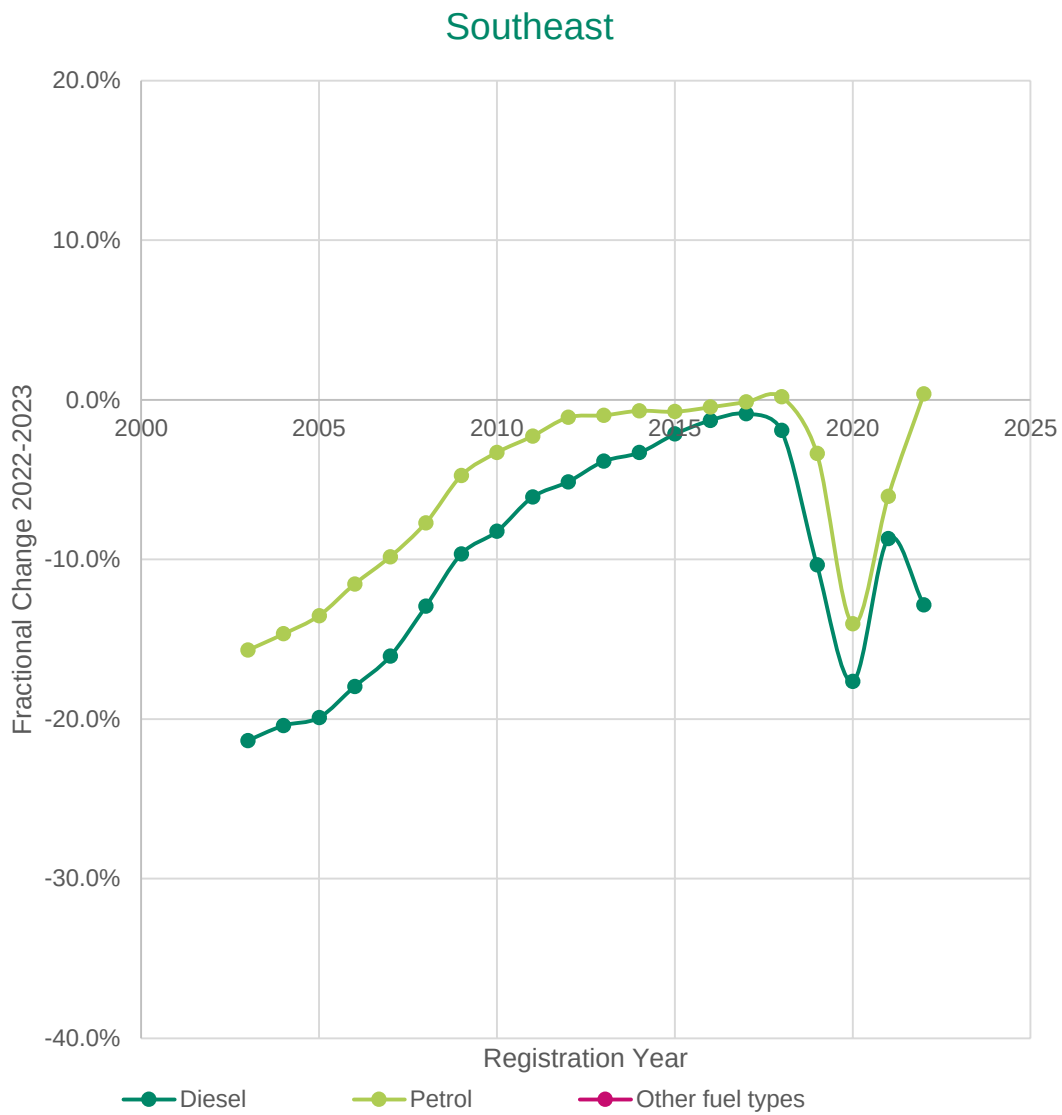


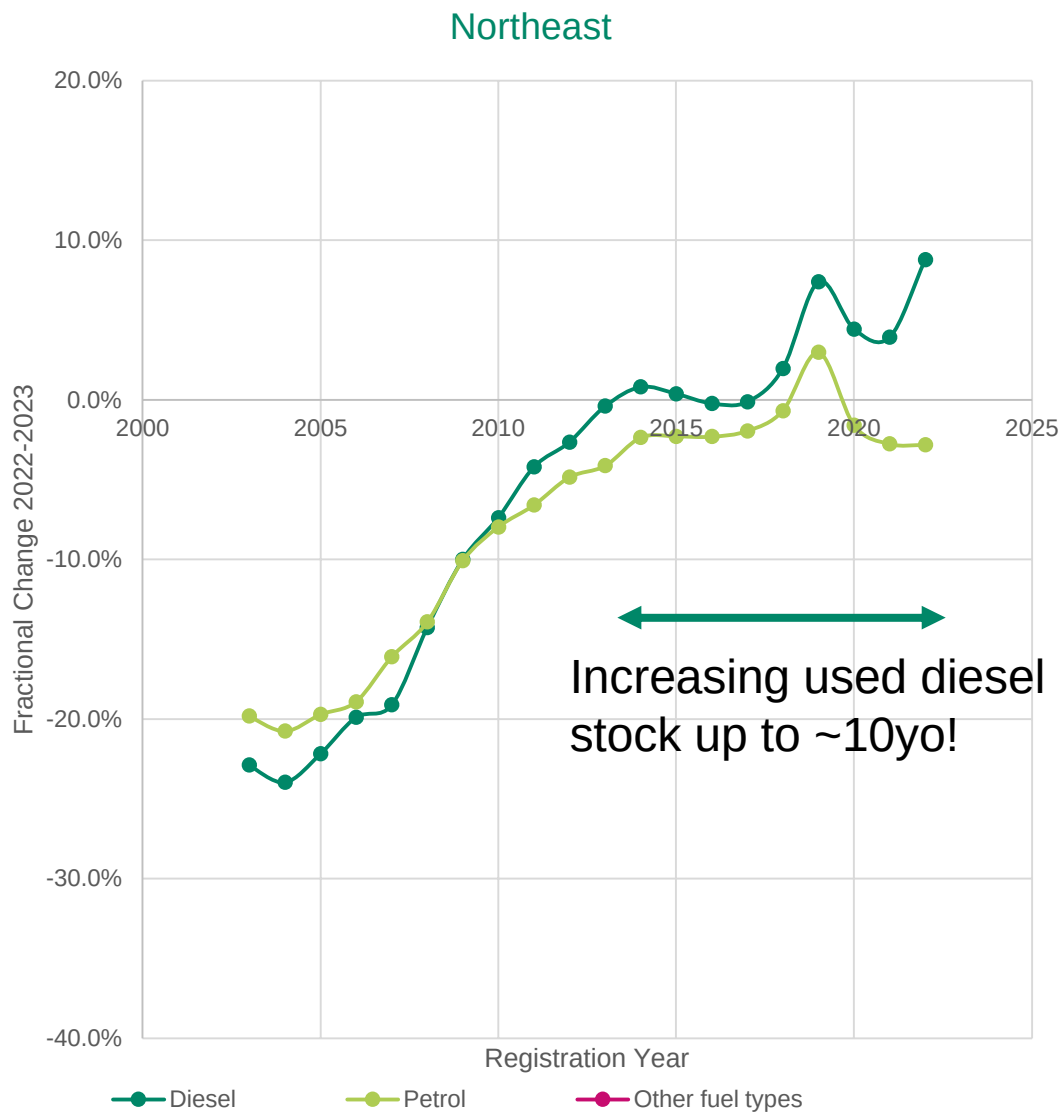
Survival & Retention



Source: DVLA (2024) VEH9901, Licensed road using cars and light goods vehicles by local authority, body type, fuel type, CO2 band, keepership, and year of first registration

Survival & Retention





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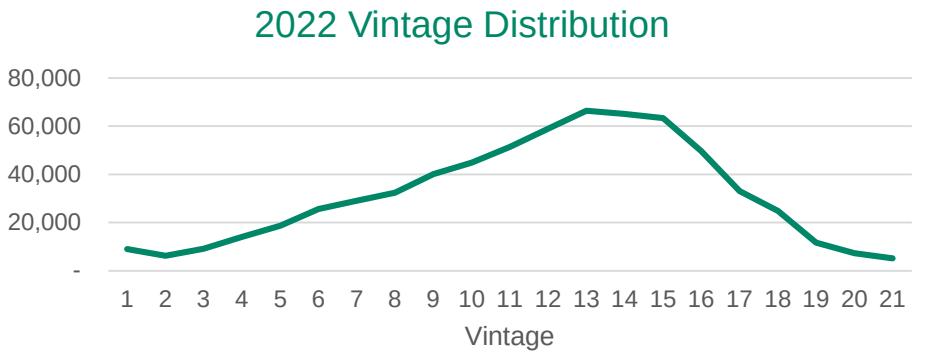
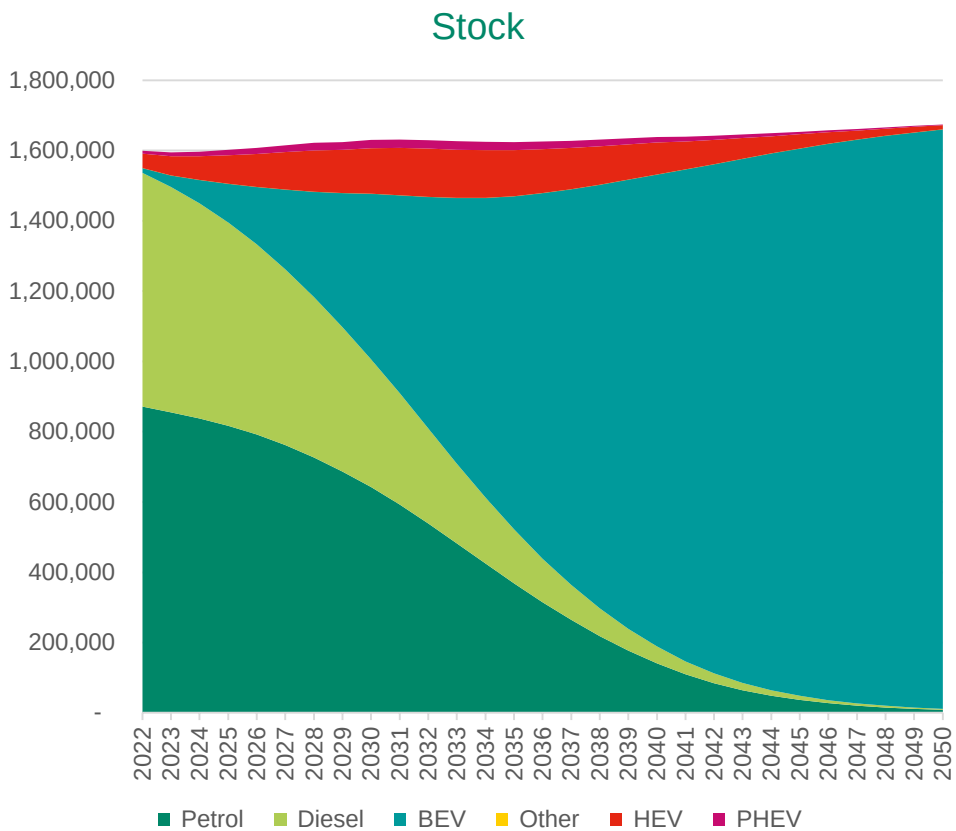
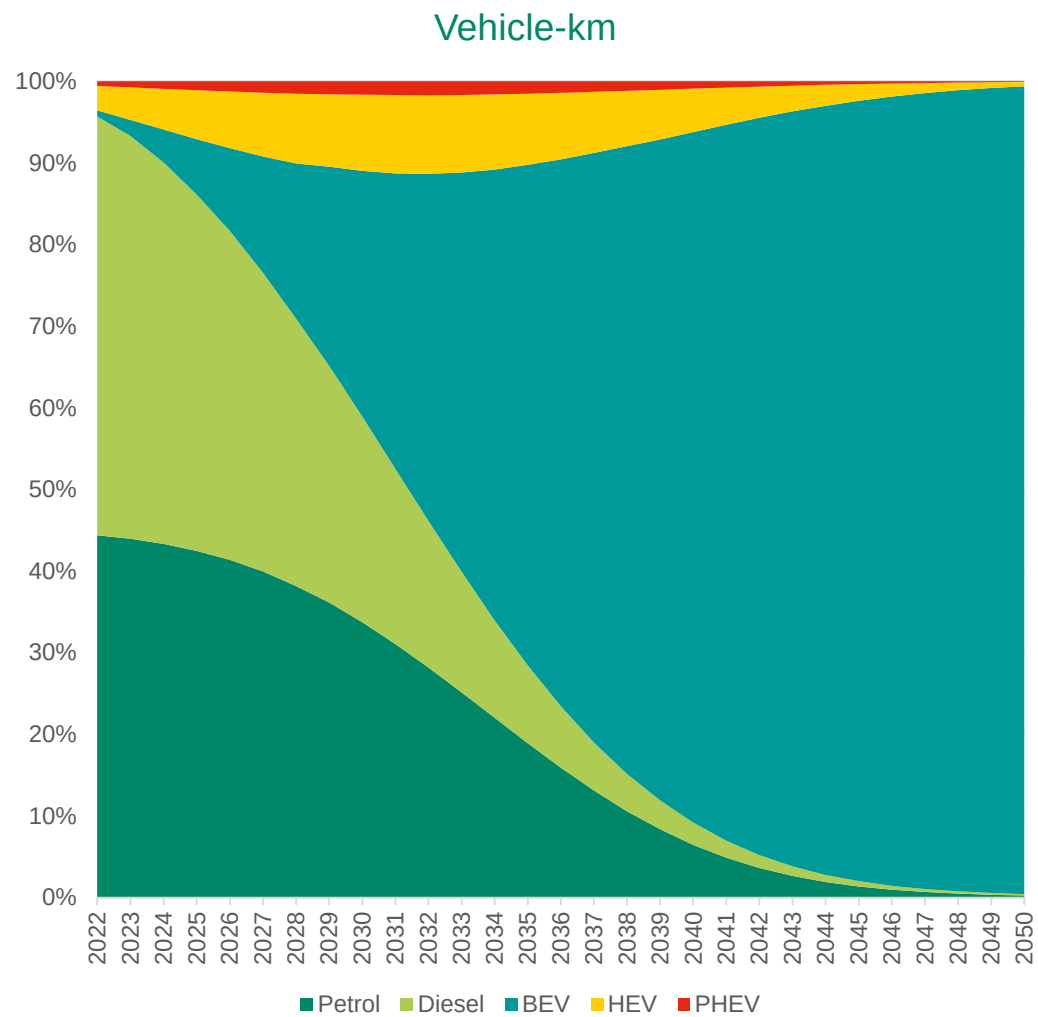
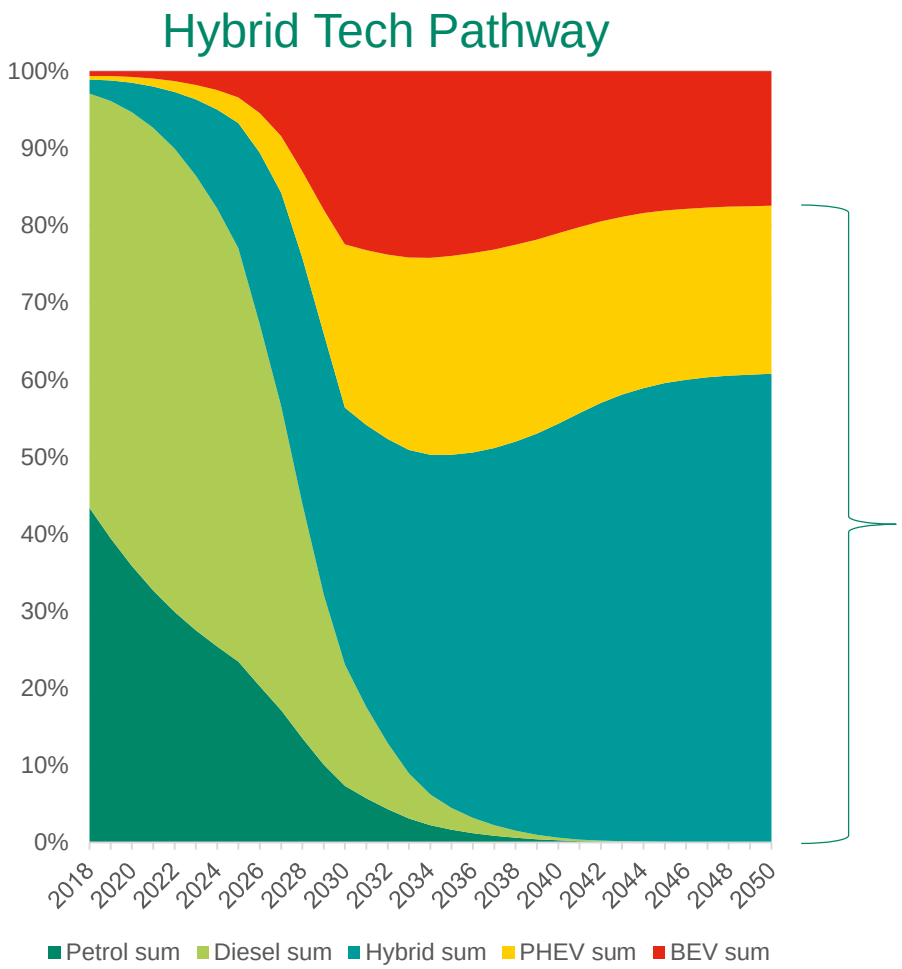
Stock & Behaviour

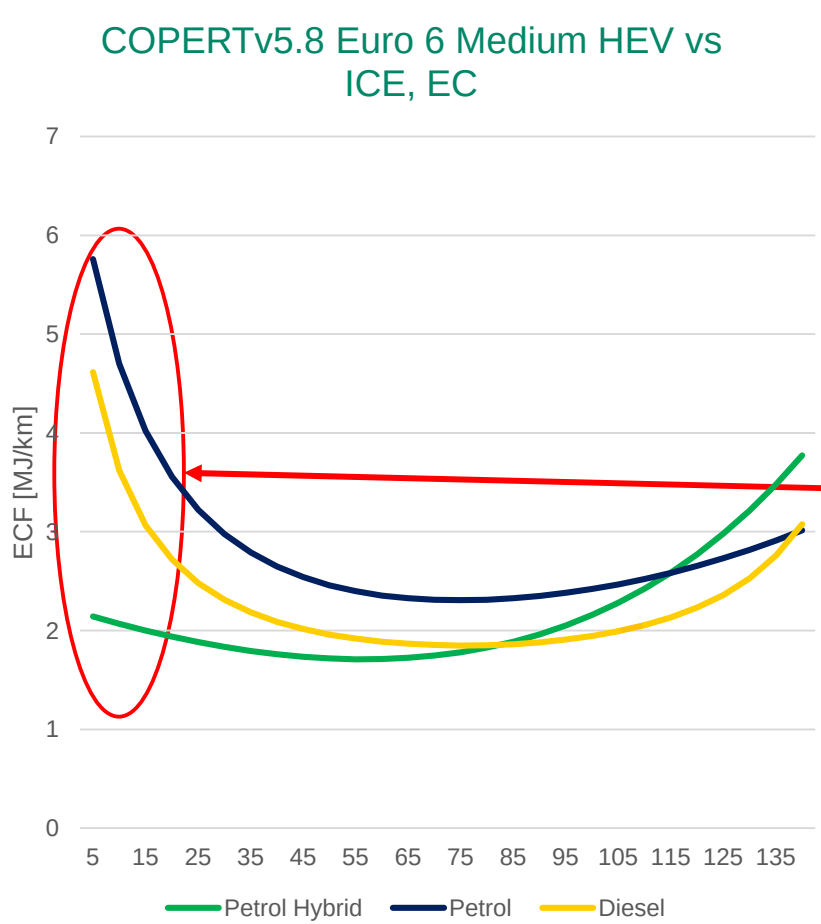


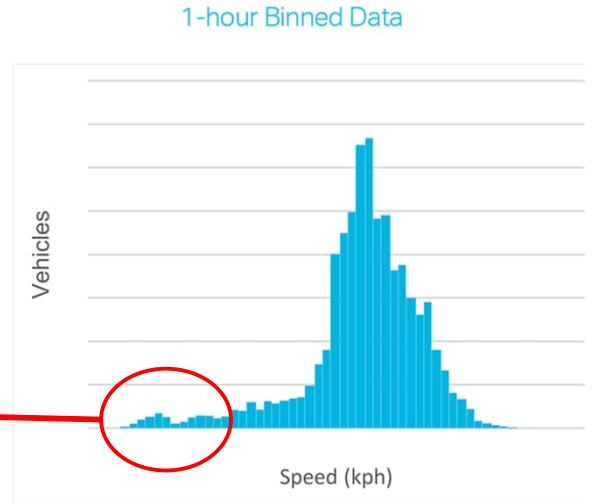




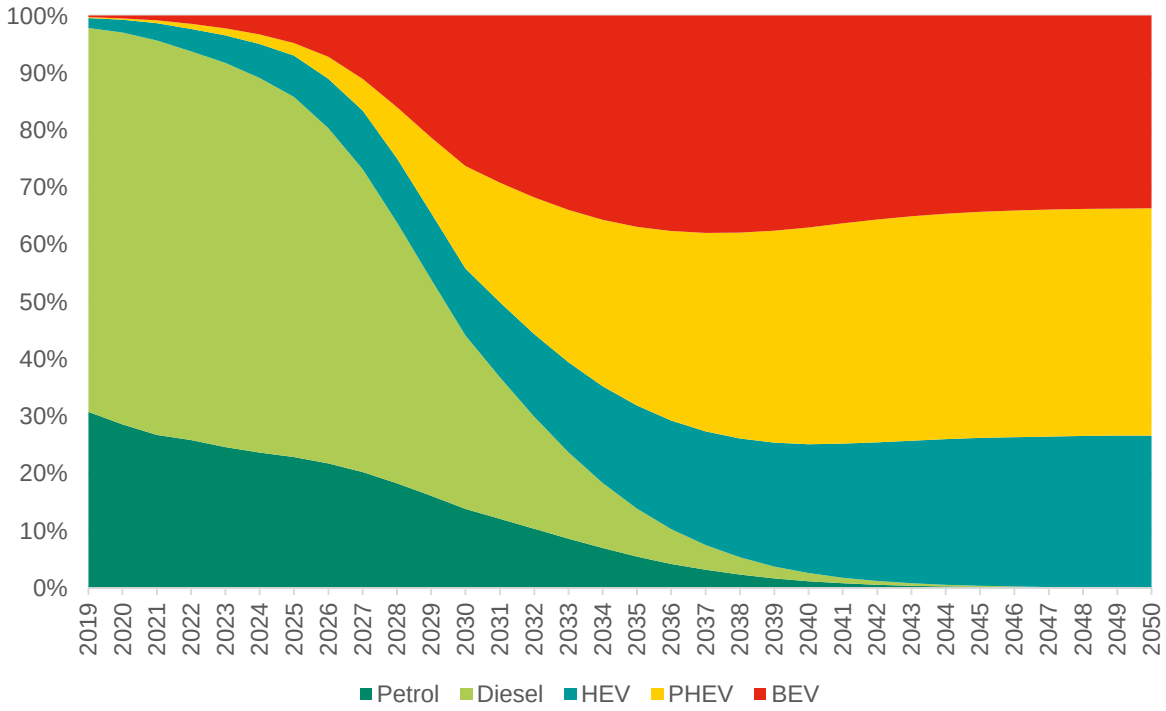
“Electrified” Emissions & Hybrid Technology

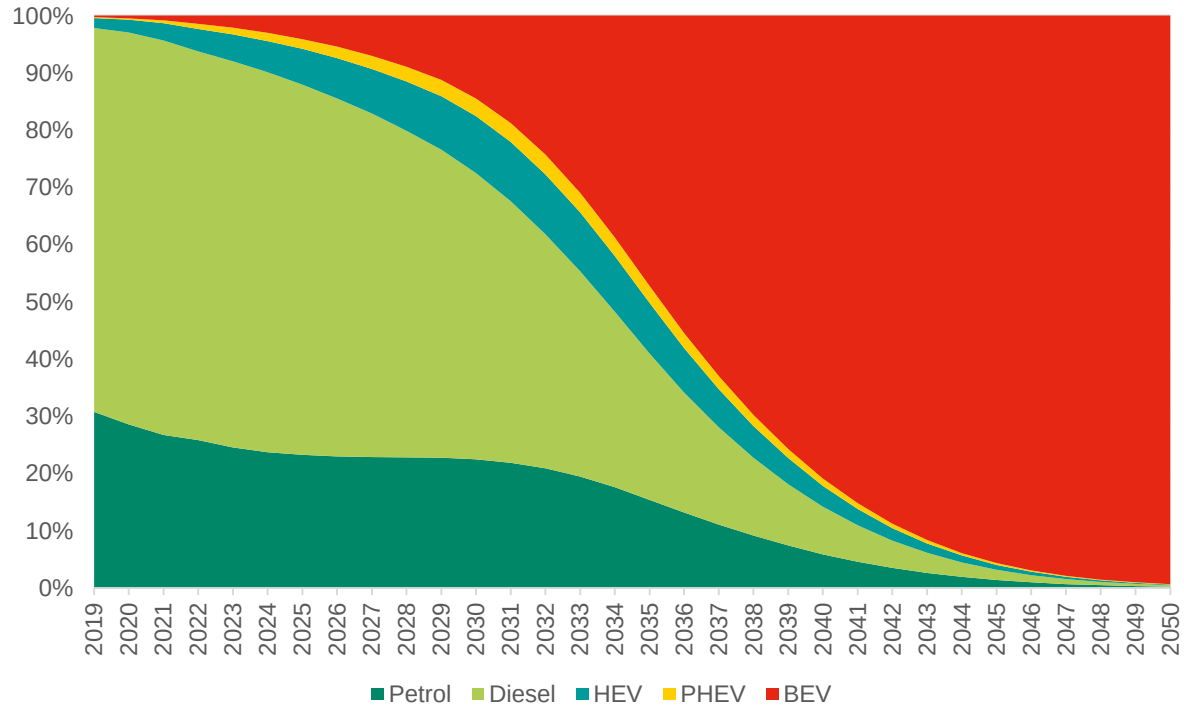






Economic vs Policy Drivers





CAP

- The proportion of diesel and petrol cars decreases steeply in future to near zero in 2041.
- The proportion of BEV increases until approx. 2035 but then decreases slightly as HEV and PHEV become more favourable
- In 2050 the overall breakdown of cars was predicted to be split relatively evenly between BEV, HEV and PHEV.

2035 ICE Sales Ban

- The proportion of diesel and petrol cars decreases in future to near zero in 2050.
- HEV and PHEV are a marginal component reaching zero in 2050.
- The proportion of BEV increases steadily until near 100% in 2050.

Source: TII / AECOM (2025) Road Emissions Model

Summary

Insights

Significant spatial variation:

- region and sub-region scales
- Baseline data and behavioural trends

Consequences of uncertainty

- Sensitivity testing
- Identifying key factors > altering rate of new sales (new vehicles) or retention (old vehicles) will affect vkm and emissions non-linearly

Disruption

- Scrappage
- CAZ
- Changes to tax benefits or grants

Identifying key factors

- Altering rate of new sales (new vehicles)
- Retention (old vehicles)
- This will affect vkm and emissions non-linearly

Behaviour assumptions

- Average mileage may be decreasing, but as a function of longer retention as the average fleet age is increasing
- No evidence that vintage:mileage ratio is changing
- We can adjust BEV ratio towards ICE average, as otherwise total vkm will decrease

Data context and objectives

- Trips vs vkm
- How to disaggregate trips to target partial journeys for mode-shift (e.g. P&R or mobility hub)

Conclusions

Net Zero 2050 should not be assumed in most areas:
- Based on current projection of policy tools;
- Applying existing behaviour trends; and,
- Assuming no further disruption.

Net Zero includes both the GHG and local air quality, with opportunities for human and ecological health

Technology adoption will inform the pathway for energy demand

Significant differences between different tools and datasets:
- They may not align to the latest policy plans
- We must recognise and understand the key sensitivities

Emissions and energy demand are a product of the stock and behaviour:
- Consider new and used vehicles, and behaviour
- Metrics should be treated carefully, where ‘vehicle-km’ and ‘trips’ are related, but different.
- Spatial variation in the baseline and future trends is essential to understand for planning future baseline and measures.

Thank you.

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