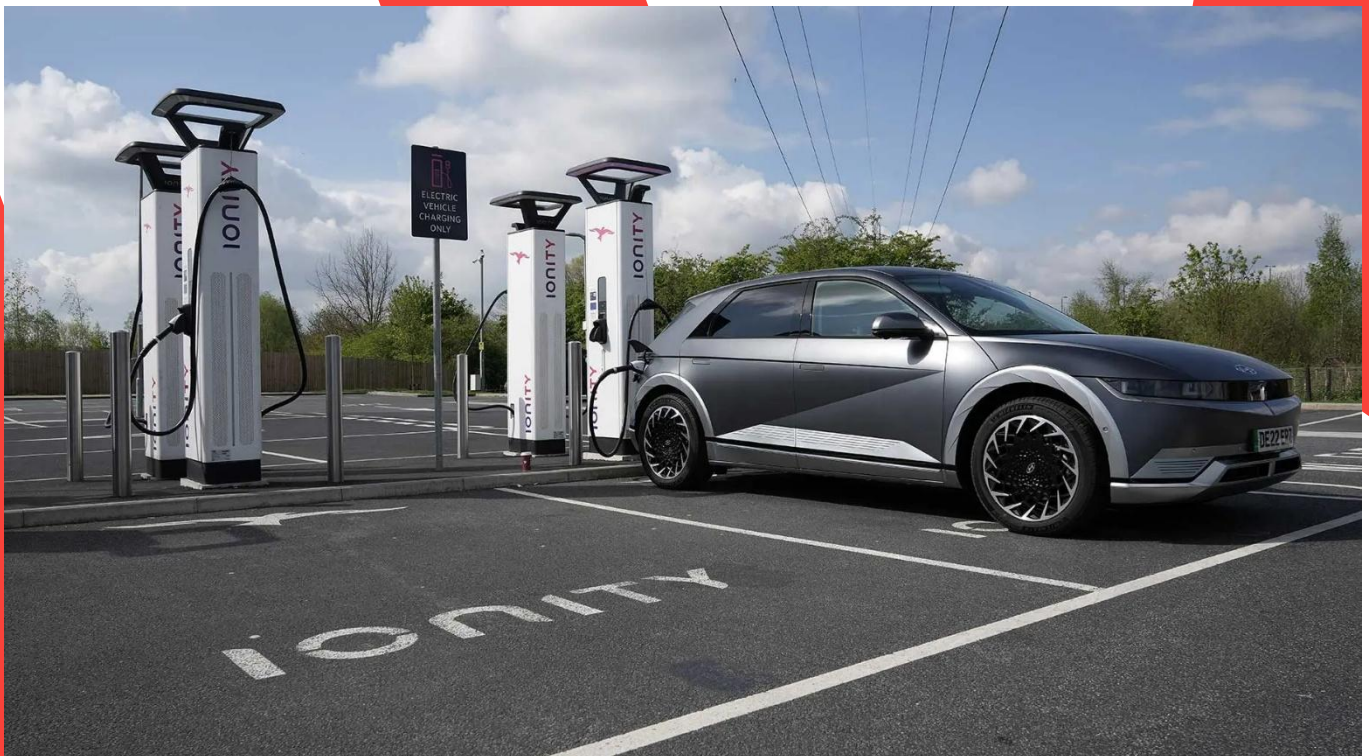




Clean Air Fund & CBI Economics

Air Quality and Health Impact Assessment of the ZEV Mandate Consultation Options

21st October 2026



1. Introduction

The Department for Transport (DfT) has issued a consultation document on a review of the current Zero Emission Vehicle (ZEV) Mandate. This review sets out four potential alternative options to the current mandate which has an 80% headline sales target by 2030 for cars and 70% for vans. The alternative options set out are as follows:

- Option 1 – 70% headline target for cars and 60% for vans
- Option 2 – 60% headline target for cars and 50% for vans
- Option 3 – 50% headline target for cars and 40% for vans
- Option 4 – 80% headline target for cars and 70% for vans, but with extended flexibilities

DfT have raised a question in the consultation on what the air quality impacts of these different options might be compared to the current mandate. This report sets out to provide evidence to address this question, using the following two step approach:

- Use of the National Atmospheric Emissions Inventory (NAEI) road transport model to provide the total national car and van emissions (for NO_x and PM_{2.5}) for each of the options out to 2050
- Calculating the related health impacts of each option compared to the current mandate covering:
 - Mortality – Life Years Lost (LYL) per tonne of emissions
 - Morbidity – Quality Adjusted Life Years (QALY) lost per tonne of emissions
 - Morbidity – Number of hospital admissions per tonne of emissions
 - The monetisation of these health metrics

Section 2 sets out the method and results from the emissions assessment, section 3 provides the details and results of the health impact assessment and section 4 provides a summary of the results and key conclusions.

2. Emissions assessment

2.1 Development of the emissions scenarios

The scenarios were modelled using the NAEI road transport model to estimate total UK NO_x and PM_{2.5} emissions from cars and Light Goods Vehicles (LGVs) between 2024 and 2050. The headline target vehicle sales trajectories for the current mandate and Options 1 to 3 were taken directly from the corresponding tables in the DfT consultation. These sales trajectories were applied consistently within the NAEI transport model for both cars and vans (LGVs) to model the evolution of the fleet, while the remaining NAEI assumptions, including vehicle survival, mileage by age and emission factors, were retained.

Option 4 has the same headline sales trajectory as for the current mandate but extends the flexibilities allowed in archiving this target from 2030 out to 2034. However, the flexibilities have not been considered for modelling the current mandate (only the headline target), nor is there any information on flexibilities for options 1 to 3. Therefore, to assess the extended-flexibilities option in a comparable way to the other options, we have made the following assumptions: the ZEV sales share is equal to the current-mandate trajectory between 2024 and 2027 (as no change will happen before then) and then a linear trajectory was then applied between the 2027 value and 100% ZEV sales in 2035. This constructed scenario represents a reasonable reduction in the sales trajectory relative to the current mandate, to reflect a greater and continued use of these flexibilities.

The current-mandate scenario was used as the principal comparator because the assessment examines the effects of changing the current policy. It assumes that ZEVs account for all new car and van sales from 2035. This scenario differs from the published NAEI baseline, which incorporates the mandate targets only to 2030 and does not assume 100% ZEV sales from 2035. The published NAEI projections also adjust vehicle kilometres by fuel to align with DfT fuel-activity projections. This adjustment was not applied here, allowing the effects of the alternative sales trajectories to be compared on a consistent basis. The current mandate results therefore do not reproduce the published NAEI baseline.

2.2 Emission results

The scenarios included in the emissions assessment and their corresponding assumptions are summarised in the table below.

Table 1 Emissions modelling scenarios and assumptions

Modelling scenario	Report description	Corresponding assumption/source
current	Current ZEV Mandate	ZEV sales trajectory from Table 1 of the DfT consultation. The headline 2030 targets are 80% for cars and 70% for vans. This is the main comparator for the assessment.
option-1	Option 1	ZEV sales trajectory from Table 2 of the consultation, with headline 2030 targets of 70% for cars and 60% for vans.
option-2	Option 2	ZEV sales trajectory from Table 3, with headline 2030 targets of 60% for cars and 50% for vans.
option-3	Option 3	ZEV sales trajectory from Table 4, with headline 2030 targets of 50% for cars and 40% for vans.

Modelling scenario	Report description	Corresponding assumption/source
co2-transfers	Option 4: partial use of extended flexibilities	ZEV sales follow the current-mandate trajectory up to 2027, followed by a linear increase from the 2027 value to 100% in 2035. This represents a reduction in the headline sales target relative to the current mandate to reflect the use of the extended flexibilities available under Option 4.

Figure 1 and Figure 2 show the modelled NO_x and PM_{2.5} emissions from cars and LGVs under each scenario. The scenarios produce the same or very similar emissions in the initial years because they share a common starting fleet and the alternative sales trajectories have not yet materially affected the fleet composition. They subsequently diverge as differences in ZEV sales affect the rate at which petrol and diesel vehicles are replaced, before gradually converging towards 2050.

For NO_x, emissions decrease substantially under all scenarios. The current mandate produces the lowest emissions during the transition, while Option 3 produces the highest. Option 2 produces the next-highest emissions, followed by the partial-flexibilities scenario and Option 1.

The absolute differences between scenarios are much smaller for PM_{2.5} than for NO_x. This is because electrification removes exhaust emissions but does not eliminate non-exhaust emissions, including tyre and brake wear. Differences in the rate of ZEV uptake therefore have a smaller effect on total PM_{2.5} emissions.

Figure 1 NO_x emissions from cars and LGVs by scenario and year (kilotonnes).

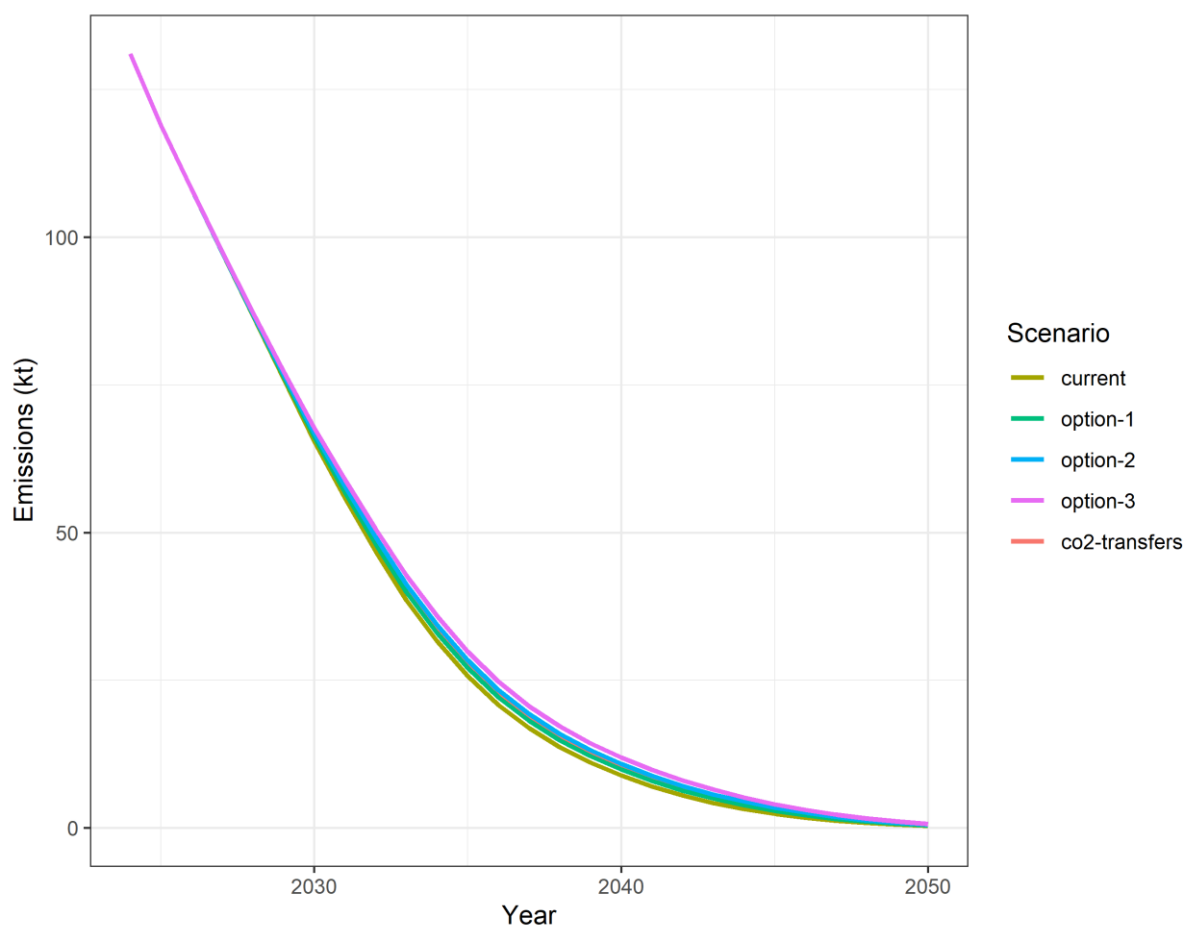
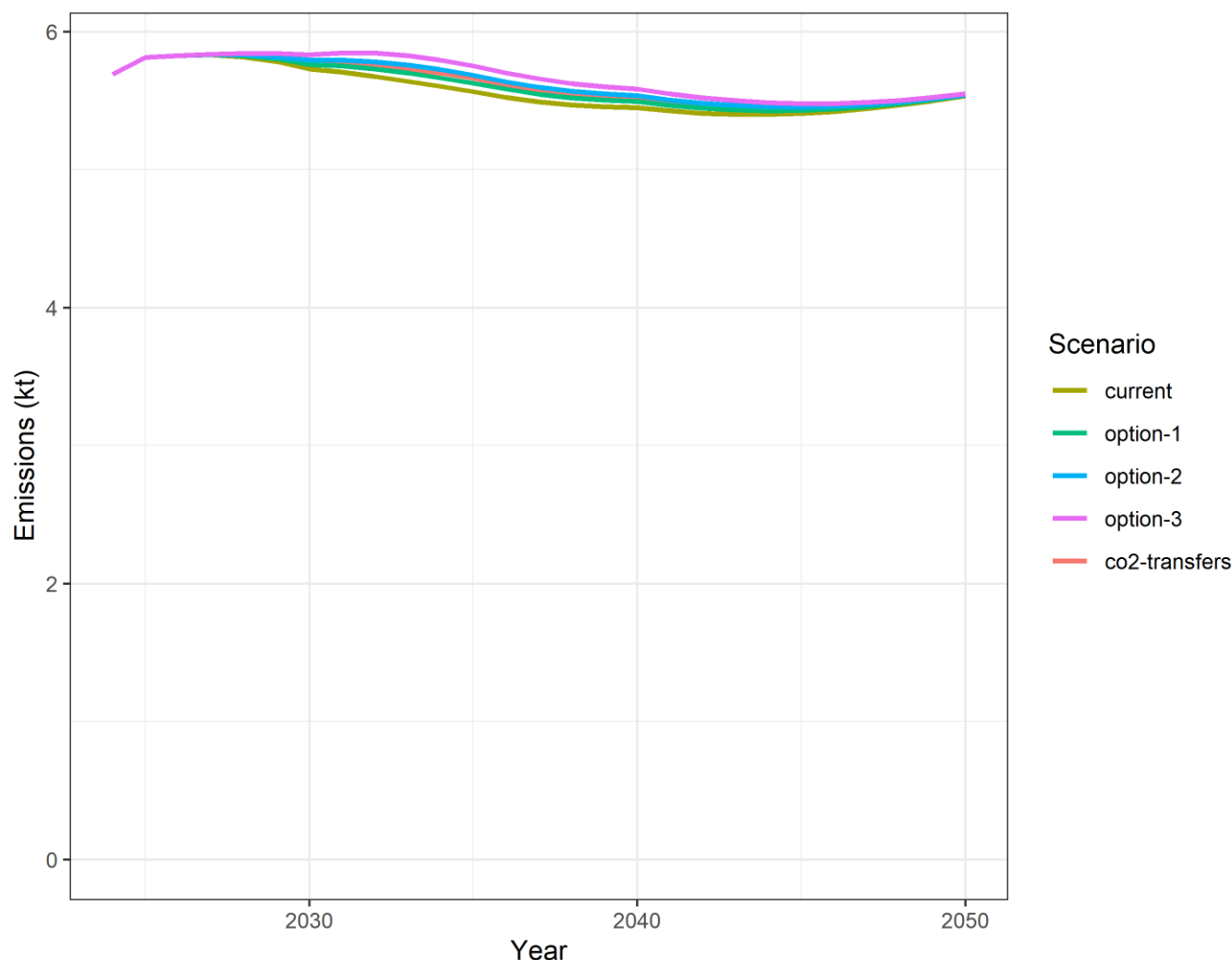


Figure 2 PM_{2.5} emissions from cars and LGVs by scenario and year (kilotonnes).



The differences between the scenarios are small relative to the overall emissions totals and are therefore difficult to distinguish in Figure 1 and Figure 2. Figure 3 and Figure 4 present each alternative scenario as a difference from the current mandate, making the timing and relative magnitude of the effects clearer. Positive values indicate higher emissions than under the current-mandate scenario.

For both NO_x and PM_{2.5}, the differences emerge from the late 2020s, peak in the mid-2030s and subsequently decline as the effects of the alternative sales trajectories work through the vehicle fleet. Option 3 produces the largest increase relative to the current mandate, followed by Option 2, the partial-flexibilities scenario and Option 1.

Although all scenarios reach 100% ZEV sales in 2035, differences persist because vehicles sold before 2035 remain in the fleet. The differences gradually diminish as these vehicles are replaced. The absolute differences are substantially greater for NO_x than for PM_{2.5} because non-exhaust sources continue to contribute to PM_{2.5} emissions under all scenarios.

Figure 3 Difference in NO_x emissions from cars and LGVs relative to the current-mandate scenario (kilotonnes).

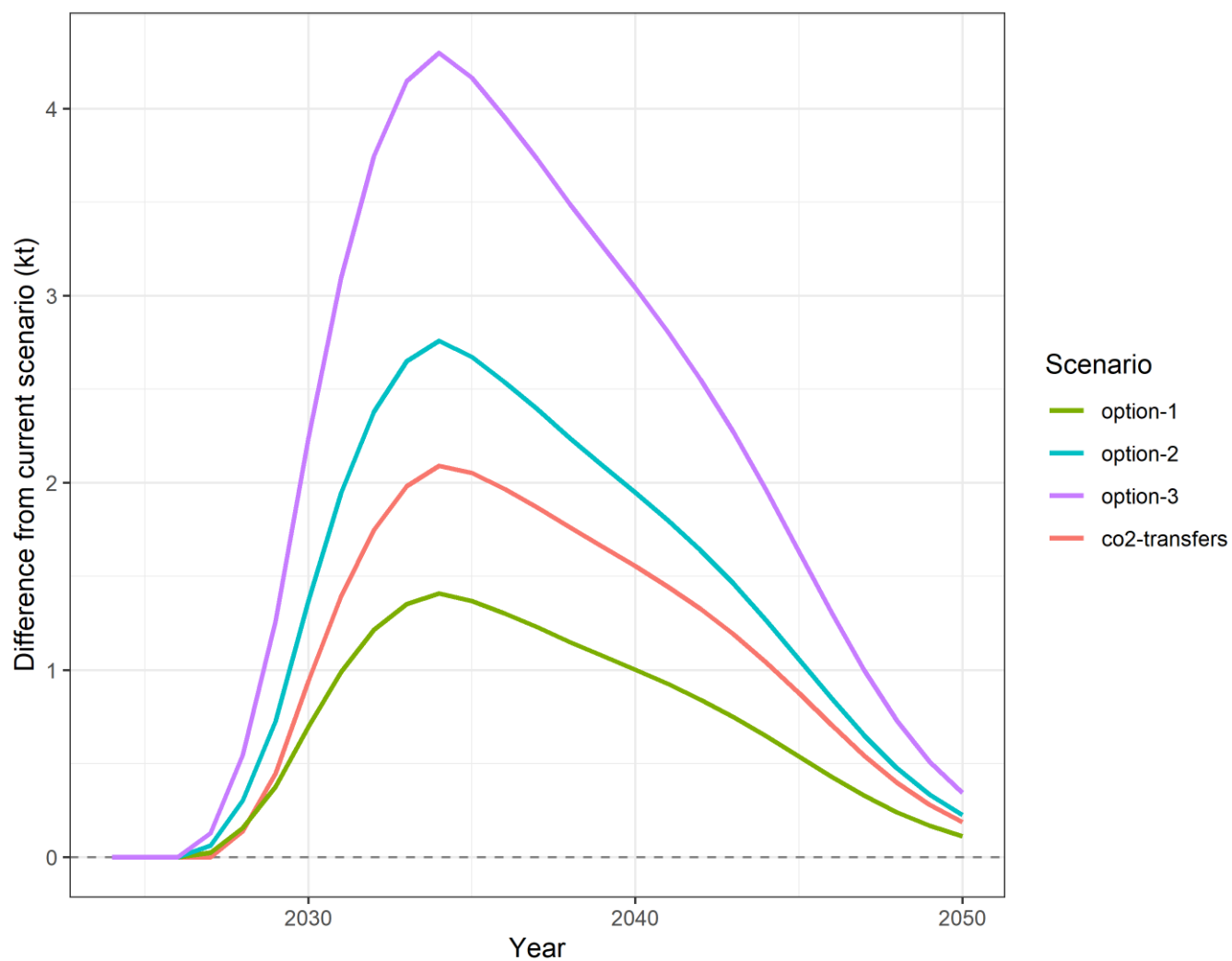


Figure 4 Difference in PM_{2.5} emissions from cars and LGVs relative to the current-mandate scenario (kilotonnes).

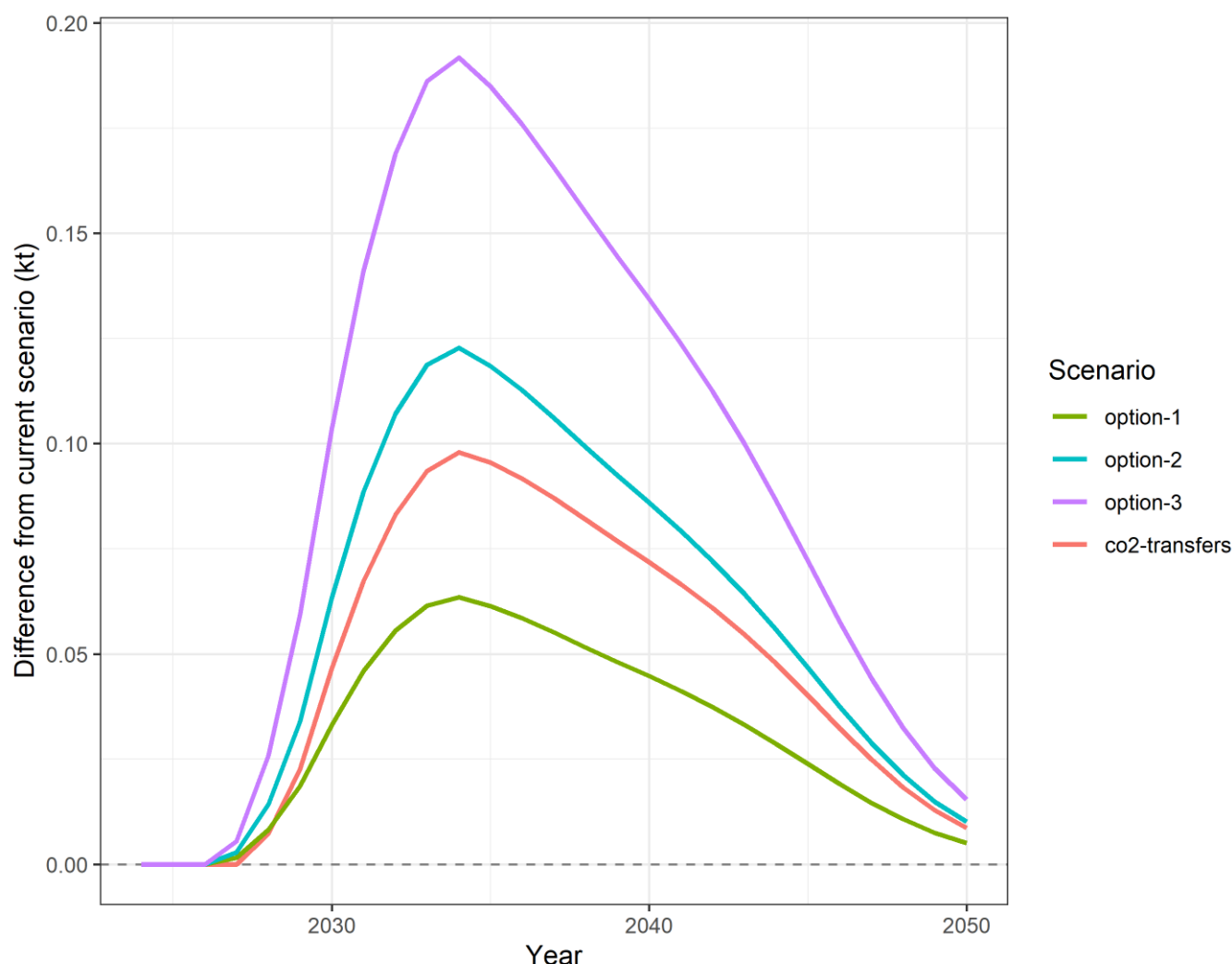


Table 2 shows the total changes in road transport emissions summed across the years 2024 to 2050 relative to the emissions projections for the current mandate and the percentage increases relative to the current mandate.

Table 2 Total changes in road transport emissions relative to the current mandate (Tonnes)

Metric	Option 1	Option 2	Option 3	CO ₂ transfers
Additional emissions of NO _x 2024-2050	18,305	35,821	56,201	27,588
Additional emissions of PM _{2.5} 2024-2050	829	1,597	2,509	1,291
Percentage increase in NO _x emissions 2024-2050	1.9%	3.7%	5.7%	2.8%
Percentage increase in PM _{2.5} emissions 2024-2050	0.6%	1.1%	1.7%	0.9%

The largest increases in emissions relative to the current mandate for all of the four options considered occurs in 2034. Table 3 shows the changes in road transport emissions in 2034 relative to the emissions projections for the current mandate and the percentage increases relative to the emissions projections for current mandate for this year.

Table 3 Changes in road transport emissions relative to the current mandate in 2034 (Tonnes)

Metric	Option 1	Option 2	Option 3	CO ₂ transfers
Additional emissions of NO _x 2034	1,408	2,758	4,298	2,091
Additional emissions of PM _{2.5} 2034	64	123	192	98
Percentage increase in NO _x emissions 2034	4.5%	8.7%	13.6%	6.6%
Percentage increase in PM _{2.5} emissions 2034	1.1%	2.2%	3.4%	1.7%

3. Health impact assessment

Road transport is a major contributor to ambient air pollution in the UK, particularly in urban areas where traffic intensity is highest. Vehicle activity is a dominant source of ambient nitrogen dioxide (NO₂, derived from NO_x emissions) and a significant contributor to ambient particulate matter (PM_{2.5} and PM₁₀), pollutants that are closely linked to adverse health outcomes. Due to the proximity of roads to homes, schools and workplaces, emissions from vehicles disproportionately affect urban populations, making transport emissions a critical determinant of public health outcomes.

Exposure to poor air quality is linked to a wide range of adverse health effects, including reduced lung function, exacerbation of asthma and other respiratory conditions, cardiovascular disease, and increased risk of premature mortality. Importantly, individuals may experience health impacts even in the absence of immediate or noticeable symptoms. Long-term exposure to air pollution has been reported to contribute an estimated 28,000–36,000 premature deaths every year in the UK¹. Furthermore, analysis of traffic-related pollution estimates between £22.6 billion and £71.3 billion of imposed health costs on the UK economy each year².

3.1 The damage cost approach

Defra provides guidance on methods that can be used for air quality appraisal³. These methods can be used to assess the health and other benefits of improvements to air quality and provide a valuation for these benefits. The Defra guidance outlines an Impact Pathway Approach that can be used for detailed air quality assessments. This involves steps to quantify the impact of changes in emissions on concentrations, calculate the health and other impacts and finally apply valuations for these impacts. The guidance also provides what is described as a Damage Cost Approach⁴. Damage costs provide direct valuations for changes in emissions. Damage costs have been calculated by using generalised relationships between emission rates and ambient concentrations to calculate the impacts and valuations per tonne of emissions.

In the analysis presented here we have used Defra's published damage cost values for emissions of NO_x and PM_{2.5} and have used these to calculate annual and total valuations for the scenarios modelled. The values are expressed in 2025 prices and a health discount rate for future years is applied (1.5% per year for the first 30 years of the appraisal). We have used the damage costs provided for national road transport emissions in our assessment. The values for 2025 are listed in Table 4.

Table 4 National road transport damage costs - Central values

Pollutant	National road transport damage cost (£ 2025 per tonne)
NO _x	13,631
PM _{2.5}	121,222

¹ <https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution>

² https://www.cleanairday.org.uk/files/the_health_costs_of_air_pollution_from_cars_and_vans_20180518.pdf

³ <https://www.gov.uk/government/publications/assess-the-impact-of-air-quality>

⁴ <https://www.gov.uk/government/publications/assess-the-impact-of-air-quality/air-quality-appraisal-damage-cost-guidance>

3.2 Health metrics

The damage costs cover a range of different impacts, but the overall valuation is dominated by the impacts on human health. The largest impacts are the mortality and morbidity associated with long-term exposure to air pollutants. The most recent damage cost guidance, that was published in December 2025, also provides estimates for the values of several health metrics associated with air pollution changes expressed as changes per tonne of emission. These metrics capture the underlying health effects of air pollution in non-monetary terms, such as Life Years Lost (LYL) lost, Quality Adjusted Life Years (QALY) lost and numbers of hospital admissions. These metrics represent the intermediate health outcomes underpinning the damage cost calculations. The intermediate metrics are:

- Mortality – Life Years Lost (LYL) per tonne of emissions
- Morbidity – Quality Adjusted Life Years (QALY) lost per tonne of emissions
- Morbidity – Number of hospital admissions per tonne of emissions

The Defra damage cost guidance provides values for these metrics for the national total damage costs. We have combined information from the guidance with more detailed information provided in the 2025 damage cost technical report⁵ to calculate values for the health metrics consistent with the national road transport damage costs. These values are listed in Table . In contrast to the damage costs, the health metrics are not discounted, the impacts in future years are assumed to be the same as in the starting year. The emissions of NO_x contribute to the health metrics and damage costs directly via the concentrations of NO₂ and indirectly via the formation of secondary inorganic aerosol, a component of PM_{2.5} and the formation of ozone (O₃). The Defra damage cost guidance also includes a health metric for mortality associated with short term exposure to O₃. We have not included this metric in our analysis because it makes a very small contribution to the total health related damage costs.

Table 5 Undiscounted intermediate health metrics consistent with road transport damage costs – Central values

Health Pathway	Metric	Units	Pollutant Emitted	
			NO _x	PM _{2.5}
PM _{2.5} + NO ₂	Mortality attributable to long-term exposure	LYL/tonne	0.150	1.462
PM _{2.5} + NO ₂	Morbidity attributable to long-term exposure	QALY lost/tonne	0.093	0.633
PM _{2.5} + NO ₂ + O ₃	Hospital admissions	Admissions/tonne	0.009	0.032

3.3 Health impact results

3.3.1 Damage costs

We have calculated the damage costs associated with the projected values of total UK emissions of NO_x and PM_{2.5} from cars and LGVs for the current, options 1, 2 and 3 and the CO₂ transfers scenarios (option 4 extended flexibilities) described above. As noted above, we have used the published national road transport damage cost estimates to calculate these damage costs. Values are expressed in 2025 prices and have been calculated for each year from 2024 to 2050 and then summed across all the years for the central damage cost estimates provided by Defra. The damage costs per year decline between 2024 and 2050 for all scenarios as the projected emissions decline. The total damage costs, summed across the years is between £25 and 30 billion for the current mandate and for the various scenarios. The contributions to the total damage cost from NO_x and PM_{2.5} are broadly similar. This is because while the

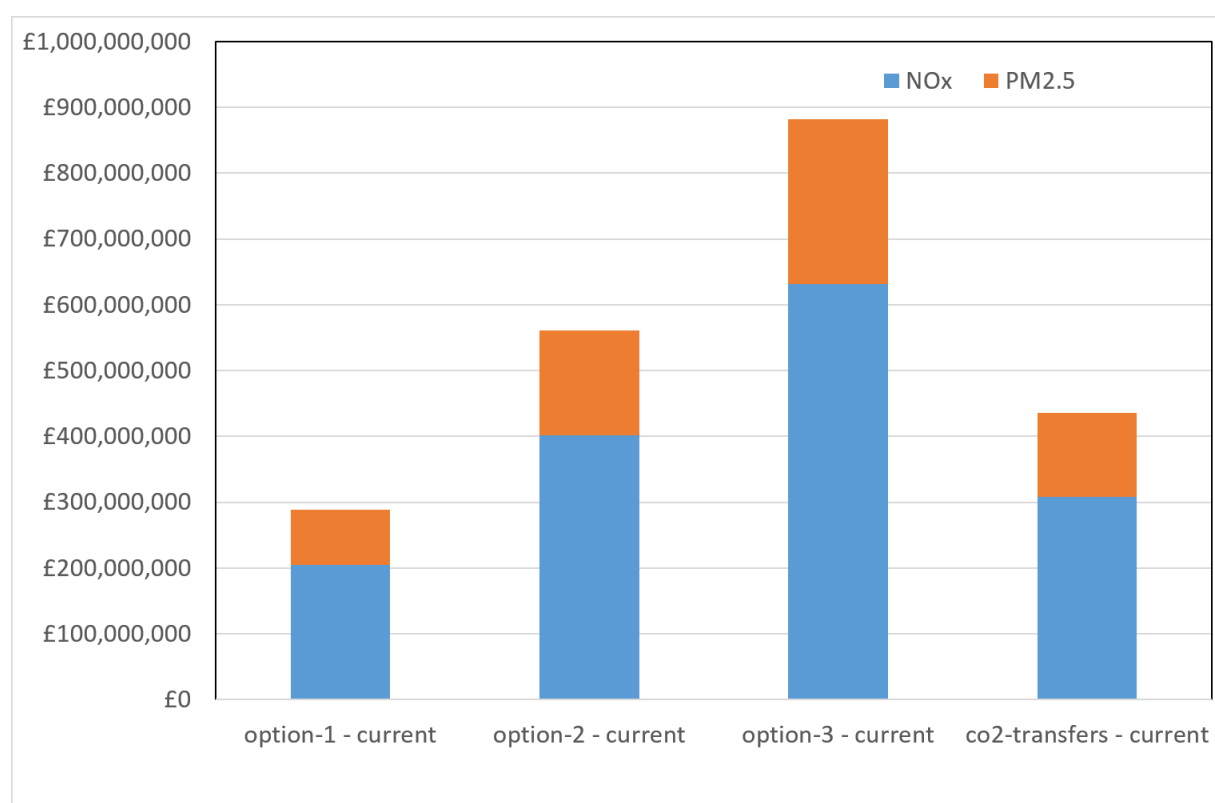
⁵ https://uk-air.defra.gov.uk/assets/documents/reports/cat05/2512151700_Damage_cost_update_2025_Defra_FINAL.pdf

NO_x emissions are greater than those for PM_{2.5}, the damage costs per tonne for PM_{2.5} emissions is much greater than the damage costs per tonne for NO_x.

Figure 5 shows the damage cost totals for the different options relative to the current mandate. The changes in damage cost relative to the current scenario are larger for NO_x than for PM_{2.5}. This reflects the greater proportional impact of EVs on NO_x emissions than on PM_{2.5} emissions. This is because of the dominance of non-exhaust emissions for PM_{2.5}, which, in contrast to exhaust emissions, are not removed by electrification.

The increase in damage costs for options 1, 2 and 3, and the CO₂ transfers scenarios reflect the increase in projected emissions for these scenarios compared to the current mandate. The increase for the option 3 scenario is larger than for the other options.

Figure 5 Central damage costs for emissions from cars and LGVs relative to the central scenario 2024-2050 (£ 2025)



The Defra damage cost guidance provides values for low and high sensitivity cases in addition to the central damage cost estimates. The low and high sensitivity estimates illustrate the possible range of damage cost values and reflect high and low confidence intervals for the concentration response functions used to estimate impacts and high and low valuation estimates for the impacts amongst other things. Table 6 shows the central, low and high damage cost estimates for the options relative to the current scenario.

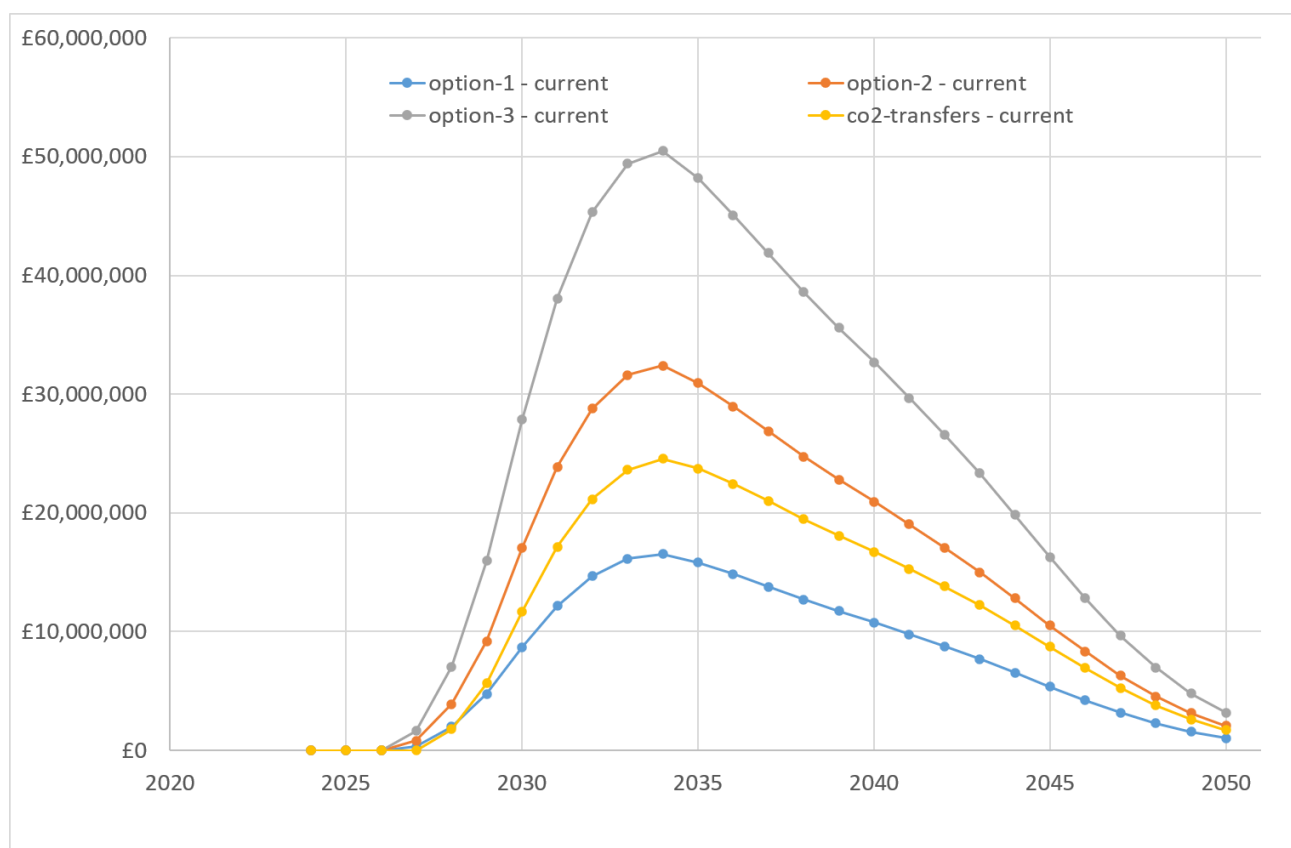
Table 6 Central, low and high damage costs for emissions from cars and LGVs relative to current scenario 2024-2050 (£ million 2025)

		Central	Low	High
NO _x	option-1 - current	£205	£30	£706
PM _{2.5}	option-1 - current	£83	£29	£260
Total	option-1 - current	£288	£59	£965
NO _x	option-2 - current	£402	£59	£1,381

		Central	Low	High
PM _{2.5}	option-2 - current	£159	£56	£500
Total	option-2 - current	£561	£115	£1,881
NO _x	option-3 - current	£631	£93	£2,169
PM _{2.5}	option-3 - current	£251	£87	£787
Total	option-3 - current	£882	£180	£2,956
NO _x	co2-transfers - current	£308	£45	£1,059
PM _{2.5}	co2-transfers - current	£128	£45	£403
Total	co2-transfers - current	£436	£90	£1,461

Figure 6 shows how the cumulative damage costs over the period from 2024 to 2050 relative to the current scenario calculated for each year. As expected, the largest deviations from the current scenario are in the early 2030s. The damage costs are not very different from the current scenario in the earliest years and towards 2050. This follows from the emissions estimates, which deviate most from the current scenario during the early 2030s.

Figure 6 Central annual damage costs for emissions from cars and LGVs relative to the central scenario for each year 2024-2050 (£ 2025)



The maximum increase in central damage costs in an individual year, relative to the current mandate scenario, is in 2034. Table 7 shows the increases in damage costs for 2034 for each scenario and the percentage increases above the current scenario.

Table 7 Central damage costs for emissions from cars and LGVs relative to current scenario for 2034 (£ million 2025)

Metric	Option 1	Option 2	Option 3	CO2 transfers
Total increase in damage costs in 2034	£23	£45	£71	£35
Percentage increase in damage costs in 2034	2.4%	4.7%	7.4%	3.6%

3.3.2 Health metrics

Table shows the key health impacts for the current scenario. Totals are shown for 2024-2050 for Life Year Lost attributable to long-term exposure, Quality Adjusted Life Years lost attributable to long-term exposure and hospital admissions associated with short-term exposure. These impacts are consistent with the central damage costs estimates and have been calculated using the central values for the concentration response functions. As mentioned above, no discounting has been applied to these health impact values. The values calculated are therefore not directly comparable with the damage cost estimates, which are discounted.

Table 8 Health impacts for emissions from cars and LGVs 2024-2050

Metric	Scenario	Units	NO _x	PM _{2.5}	Total
Mortality attributable to long-term exposure	current	LYL	146,751	219,959	366,710
Morbidity attributable to long-term exposure	current	QALY lost	90,987	95,273	186,260
Hospital admissions	current	Admissions	8,994	4,796	13,790

Table shows the values for the health metrics relative to the central scenario. As expected, the differences from current are greater for NO_x than for PM_{2.5}.

Table 9 Health impacts for emissions from cars and LGVs relative to BAU 2024-2050

Metric	Scenario	Units	NO _x	PM _{2.5}	Total
Mortality attributable to long-term exposure	option-1 - current	LYL	2,738	1,211	3,949
Morbidity attributable to long-term exposure	option-1 - current	QALY lost	1,698	525	2,222
Hospital admissions	option-1 - current	Admissions	168	26	194
Mortality attributable to long-term exposure	option-2 - current	LYL	5,358	2,334	7,693
Morbidity attributable to long-term exposure	option-2 - current	QALY lost	3,322	1,011	4,333
Hospital admissions	option-2 - current	Admissions	328	51	379
Mortality attributable to long-term exposure	option-3 - current	LYL	8,407	3,668	12,075
Morbidity attributable to long-term exposure	option-3 - current	QALY lost	5,213	1,589	6,801
Hospital admissions	option-3 - current	Admissions	515	80	595
Mortality attributable to long-term exposure	co2-transfers - current	LYL	4,127	1,886	6,013
Morbidity attributable to long-term exposure	co2-transfers - current	QALY lost	2,559	817	3,376
Hospital admissions	co2-transfers - current	Admissions	253	41	294

4. Conclusions

4.1 Introduction

The Department for Transport (DfT) has issued a consultation document on a review of the current Zero Emission Vehicle (ZEV) Mandate. This review sets out four potential alternative options to the current mandate which has an 80% headline sales target by 2030 for cars and 70% for vans.

We have carried out an analysis to assess what the air quality impacts of the different options might be compared to the current mandate. We have used of the National Atmospheric Emissions Inventory (NAEI) road transport model to provide the total national car and van emissions (for NO_x and PM_{2.5}) for each of the alternative options out to 2050. We have then calculated the differences in health metrics for each option covering:

- Mortality – Life Years Lost (LYL)
- Morbidity – Quality Adjusted Life Years (QALY) lost
- Morbidity – Number of hospital admissions
- The monetisation of these health metrics

The emission scenarios were modelled using the NAEI road transport model for cars and vans, covering NO_x and PM_{2.5} emissions from 2024 to 2050. The vehicle sales trajectories for the current mandate and Options 1 to 3 were taken directly from the corresponding tables in the DfT consultation. Option 4 was assessed assuming the ZEV sales shares follow the current-mandate trajectory up to 2027 and then increase linearly from the 2027 value to 100% in 2035, to reflect the use of the extended-flexibilities in a way that is comparable to the other options. These trajectories were applied consistently to both cars and vans (LGVs), while the remaining NAEI assumptions, including vehicle survival, mileage by age and emission factors, were retained. The current-mandate scenario was selected as the main comparator because it represents the policy currently being assessed and assumes that zero-emission vehicles account for all new car and van sales from 2035. Note that this current mandate scenario differs from the published NAEI baseline, which incorporates the mandate target only to 2030 and does not assume 100% zero-emission sales from 2035.

4.2 Emissions results

The different scenarios begin at the same level because they share a common starting fleet, and they converge again towards 2050 as all scenarios transition towards fully zero-emission new vehicle sales. The main differences therefore occur during the intervening years, when the alternative ZEV sales trajectories affect the rate at which petrol and diesel vehicles are replaced.

Between 2024 and 2050 the options would result in increases in total NO_x emissions summed over the entire period relative to the current mandate scenario of 1.9%, 3.7%, 5.7% and 2.8% for the options 1, 2, 3 and CO₂ transfers scenarios. The percentage increases for PM_{2.5} and smaller at 0.6%, 1.1%, 1.7% and 0.9%. This is because electrification only removes the exhaust emissions for PM_{2.5}, making little difference to the non-exhaust emissions. The increases in emissions relative to the current mandate are largest in 2034. The increases in emissions from cars and LGVs in this specific year for option 3 are 13.6% for NO_x and 3.4% for PM_{2.5}.

4.3 Health impact and damage cost results

The increases in NO_x and PM_{2.5} emissions between 2024 and 2050 resulting from a change from the current mandate would lead to an increase in the damage caused by air pollution. The total increases in central damage costs relative to the current mandate range from £288m for option 1, £561m for option 2, £882m for option 3 and £436m for the CO₂ transfers option, for which we have assumed an intermediate flexibility within the allowed envelope between 2028 and 2035. These increases range from 1% up to 3.2% of the total damage costs for NO_x and PM_{2.5} emissions from cars and LGVs over the period from 2024 to 2050.

The additional emissions associated with option 1 are estimated to result in increases of about 4,000 in Life Years Lost due to Mortality, about 2,000 in Quality Adjusted Life Years lost due to morbidity associated with long-term exposure to air pollution between 2024 and 2050. For options 2 and 3 these values increase to about 8,000 and 12,000 LYL and 4,000 and 7,000 QALY lost. For the CO₂ transfers scenario the increases would be about 6,000 LYL and 3,000 QALY lost.

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