Top Automakers on Track to Overshoot US EPA Guidelines

Greenpeace East Asia, Tokyo
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Introduction

On March 20, 2024, the United States (US) Environmental Protection Agency (EPA) announced new national pollution standards that are intended to significantly reduce greenhouse gas emissions and other pollutants from road transport.[i] The implications for vehicle manufacturers are profound. Automakers need to drastically reduce average tailpipe greenhouse gas emissions each year. The aim is to decrease fleetwide average carbon dioxide (CO_2) emissions from 320 grams per mile (gpm) in 2023 to 85 gpm for new passenger cars and light trucks[1] by 2032.

However, Greenpeace East Asia analysis finds that current sales trajectories by the top seven automakers in the US are not compatible with the new EPA standard. If the seven carmakers do not change course, by 2032 their projected fleetwide CO_2 emissions are on track to dramatically exceed the EPA emissions standard. However, the outlook is different if automakers do not default on their US sales targets. If they achieve their targets, Ford, GM and Honda would exceed EPA standards by an estimated 8-12%. By contrast, even if Toyota and Nissan were able to meet their own sales targets, they would still overshoot the EPA limit in 2032 by 154% and 76%, respectively – the highest margin among the automakers whose targets were analyzed.

Moreover, Toyota stands out as the sole automaker in the analysis whose projected sales distribution of internal combustion engine (ICE) vehicles, hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), and battery electric vehicles (BEV) in 2032, based on the automaker's own targets, is incompatible with the EPA pathways. Out of the seven automakers, Toyota's targets overshoot the EPA limit by the highest margin. The consequences of such an overshoot are potentially severe.

In addition, the findings of this study suggest that the seven automakers will not be able to meet the EPA limit by relying on advancements in fuel efficiency technology alone or by dramatically increasing the sale of hybrids. Instead, carmakers need to phase out fossil fuel vehicles, including hybrid vehicles.

The climate impact of the greenhouse gas emissions overshoot would be significant. The top seven automakers accounted for 85% of all newly sold passenger cars and light trucks in the

[1] Together, passenger cars and light trucks constitute "light-duty vehicles" in the federal definition, as opposed to medium- and heavy-duty vehicles.[ii]

US in 2023.[2] At a time when the world is experiencing the impacts of extreme weather events such as droughts, wildfires and storms, Greenpeace calls on all automakers to phase out fossil fuel vehicles by 2030 globally and by 2028 in Europe. It is crucial that the total number of vehicles on the road is reduced to limit the global annual temperature rise within 1.5 degrees Celsius.

Background

The United States (US) Environmental Protection Agency's (EPA's) new regulation mandates substantial reductions in fleetwide average greenhouse gas emissions. The anticipated benefits include significant reductions in pollutants, with the EPA projecting a nearly 50% reduction in tailpipe greenhouse gas emissions for light-duty vehicles by 2032 and a reduction of 7.2 billion tonnes of CO_2 through 2055 compared to 2026 levels.[iii]

To achieve the reductions, automakers must lower average fleetwide emissions to 85 grams per mile (gpm) for passenger cars and light trucks by 2032, down from the current level of 320 gpm in 2023. The standards will be phased in gradually, starting at 170 gpm in 2027 and decreasing annually. Automakers can meet these targets through a mix of powertrains, including internal combustion engines (ICE), hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), and battery electric vehicles (BEV). Companies that meet the standards earn credits, which can be traded. Failure to meet the standards may result in EPA-imposed penalties.

Achieving the 85 gpm target requires a significant acceleration in the adoption of BEVs, which emit zero tailpipe CO_2. Improvements in fuel efficiency alone are unlikely to suffice, as meeting the new standards requires a 16% annual reduction in CO_2 emissions, whereas the average annual fuel efficiency improvement rate has averaged approximately 1% over the past five years.

The transition to a low-emission fleet demands a substantial shift in manufacturing and sales processes by automakers. To aid the transition, the EPA has outlined three potential compliance pathways for automakers, detailing changes in powertrain composition over six years from 2027 to 2032 (Fig. 1):

1. **Pathway A**: Focuses on a rapid increase in BEVs, aiming for them to become the dominant vehicle type by 2032. This pathway requires a significant reduction in ICE vehicles.
2. **Pathway B**: Adopts a balanced approach by increasing the number of HEVs and PHEVs alongside BEVs. This pathway reduces ICE vehicles more moderately and spreads the adoption of various low-emission technologies.
3. **Pathway C**: Relies heavily on HEVs and PHEVs, with a slower increase in BEV adoption. It presents a gradual transition away from ICE vehicles, emphasizing hybrids more than the other pathways.

[2] Greenpeace compilation based on data from Marklines.

These three compliance pathways serve as benchmarks to assess whether an automaker's fleet is on track to meet the 85 gpm standard by 2032, allowing annual progress evaluations. Detailed powertrain distribution proportions can be found in Appendix A.

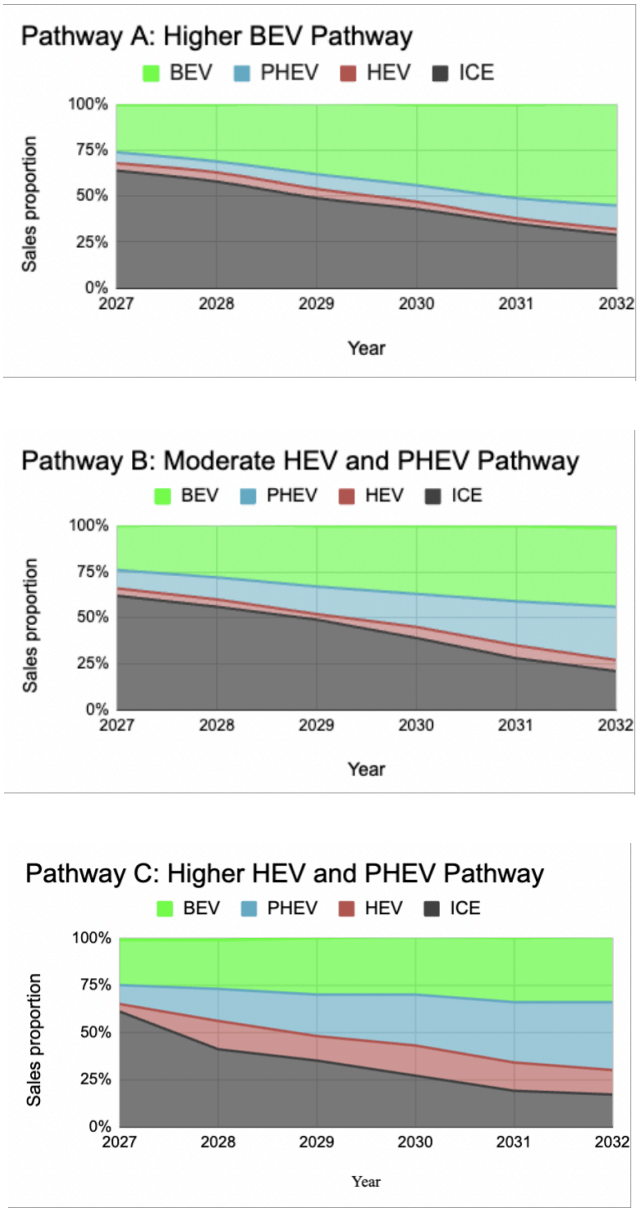


Fig. 1. The graphs show powertrain distributions of three potential compliance pathways for the March 2024 EPA emissions standards from the period 2027–-2032. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).

Methodology

This Greenpeace East Asia research evaluates whether Toyota, Honda, Nissan, Ford, General Motors, Stellantis, and Hyundai-Kia are projected to comply with the EPA emissions standard of 85 grams per mile (gpm) CO_2 emissions for light-duty vehicles by 2032. The evaluation consists of two main components: (1) assessing powertrain mix compliance and (2) estimating average fleetwide CO_2 emissions.

1. Powertrain mix compatibility (2027–2032): We evaluate whether the projected powertrain mixes of the three automakers align with the recommended EPA compliance pathways from 2027 to 2032. This serves as a progress check to determine if the automakers are on track to meet the EPA standards during the six-year period.

We use two approaches to project each automaker's US sales during this period:

- The **"target-based projection"** relies on automakers' publicly released sales targets, which include significant but insufficient electrification.
- The **"business as usual projection"** is based on recent sales data.

For each year, we compare these projected powertrain mixes – comprising internal combustion engine (ICE) vehicles, hybrid electric vehicles (HEVs), plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs) – to the powertrain mixes outlined in the three EPA pathways. This comparison assesses how closely each automaker's projected vehicle mix aligns with the EPA's pathways for reducing emissions.

Stellantis and Hyundai-Kia lack US sales targets for hybrid vehicles, therefore it was not possible to calculate target-based projections for these two automakers.

2. Average fleetwide CO_2 emissions estimates (2032): We calculate the average fleetwide CO_2 emissions per mile in 2032 for each automaker to compare with the 85 gpm EPA standard. We base these emissions on the projected powertrain mixes for 2032 from Part 1, using two estimates: one from the target-based projection and one from the business as usual projection. This helps to determine whether automakers will meet the 85 gpm CO_2 emissions target under both scenarios.

We use data from the EPA's 2023 Fuel Economy Guide to find the average CO_2 emissions for each powertrain type for each automaker in 2023.[iv] Combined with the projected powertrain mixes for 2032, this information allows us to calculate the total average fleetwide emissions.

Additionally, to ensure fairness, we provide another set of average fleetwide CO_2 emissions estimates for each automaker. These estimates assume business as usual technological advances, meaning that automakers continue to reduce CO_2 emissions from tailpipe-emitting vehicles at the same rate as they have over the past five years.

This dual-tracked assessment framework examines the alignment of automakers' future sales strategies with EPA emissions targets. It highlights potential areas for policy adjustments and strategic shifts within the automotive industry on the path towards ending tailpipe emissions. For a detailed methodology, see Appendix A.

Key findings

Table 1. Summary of projected average fleetwide CO_2 emissions for the top seven automakers in the US in 2032 for target-based and business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile.

Automaker (Group)	Average fleetwide emissions (gpm) and percentage overshoot in 2032 based on **target-based projections** with 1.15% annual fuel efficiency improvements		Average fleetwide emissions (gpm) and percentage overshoot in 2032 based on **business as usual projections** with 1.15% annual fuel efficiency improvements	
	EPA standards: 85 gpm			
Honda	92.0	+8%	268.0	+215%
General Motors	94.4	+11%	356.7	+320%
Ford	95.1	+12%	344.6	+305%
Nissan	149.3	+76%	288.0	+239%
Toyota	215.5	+154%	260.6	+207%
Stellantis	N/A[3]	N/A	338.9	+299%
Hyundai-Kia	N/A[4]	N/A	203.1	+139%

- None of the seven automakers' current US sales trajectories are compatible with the March 2024 EPA emissions standard. If they do not change course from their current sales practices, by 2032, each of the seven automakers would exceed the EPA limit by more than 130%.
- **Even if Toyota and Nissan were able to meet their own sales targets, which are more ambitious than their sales trajectories, they would still overshoot the EPA limit for 2032 – Toyota by 154% and Nissan by 76%.** By contrast, Honda, General Motors, and Ford's emissions levels come closer to being EPA-compliant at only an 8-12% overshoot in 2032. However, these automakers will need to enhance their US BEV sales goals to remain under the limit.

[3] Stellantis lacks hybrid vehicle sales target data for the US.
[4] Hyundai-Kia lacks hybrid vehicle sales target data for the US.

- Toyota's targets lead to the highest emissions overshoot from the EPA limit by a significant margin. Toyota stands out as the sole automaker in the analysis whose powertrain mix distribution for 2032 would not be compatible with the EPA pathways if the automaker were to meet its own sales targets.
- None of the automakers will be able to meet the EPA emissions limit by relying on advancements in fuel efficiency technology alone. Instead, they must pursue ending tailpipe emissions and phase out fossil fuel vehicles, including hybrid vehicles.
- Breaching EPA regulations may lead to disciplinary action.

Honda

Honda's US sales strategy emphasizes the sales of ICE and hybrid vehicles, which comprised 77.55% and 22.45%, respectively, of the automaker's US sales in 2023, with no recorded sales of BEVs. The sales of hybrid vehicles have accelerated in the past five years to reach almost one-quarter of the automaker's total sales in the US. Honda's high sales proportion of hybrid vehicles aligns most closely with EPA pathway C, the Higher HEV and PHEV Pathway.

Honda has communicated its target for BEV sales to reach 40–50% in the US by 2030, and 100% by 2040. **If Honda followed its own targets, its powertrain proportions would be compatible with the proportions specified in the EPA pathways.** However, because of the automaker's slow transition to BEVs and its heavy reliance on ICE to boost its US sales, **Honda will not be able to comply with any of the EPA pathways if it continues along the same sales trajectory as in the past five years**. Fig. 2 shows Honda's business as usual projections for BEV and ICE vehicles, which are both in the non-compliance zone. If no changes are made, Honda is on track to exceed the allowed proportion of ICE by a large margin.

Honda's US sales targets correspond to an overshoot of the automaker's average fleetwide CO_2 emissions of 20%, compared to the EPA limit of 85 gpm, as shown in Table 2. Factoring in estimates of fuel efficiency improvement reduces the overshoot to 8%. However, considering Honda's slow transition to BEVs in the US market, if the automaker continued along the sales trajectory that it has been on in the past five years, it is projected to exceed the EPA limit by 250%, or 215% if assuming a fuel efficiency improvement of 1.15% annually. The average fleetwide CO_2 emissions estimates for Honda's US sales targets come close to complying with the EPA limit. The stark difference in average fleetwide CO_2 emissions levels between the target-based and business as usual projections highlights the importance of Honda to change course from its current sales practices in the US.

Fig. 2. Recent (2007-2023) and projected (2024-2040) sales trajectories of Honda vehicles in the US market, compared to the March 2024 EPA standard pathways with estimates of compliance. The EPA pathways assume a PHEV:HEV ratio of minimum 2.7:1. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).

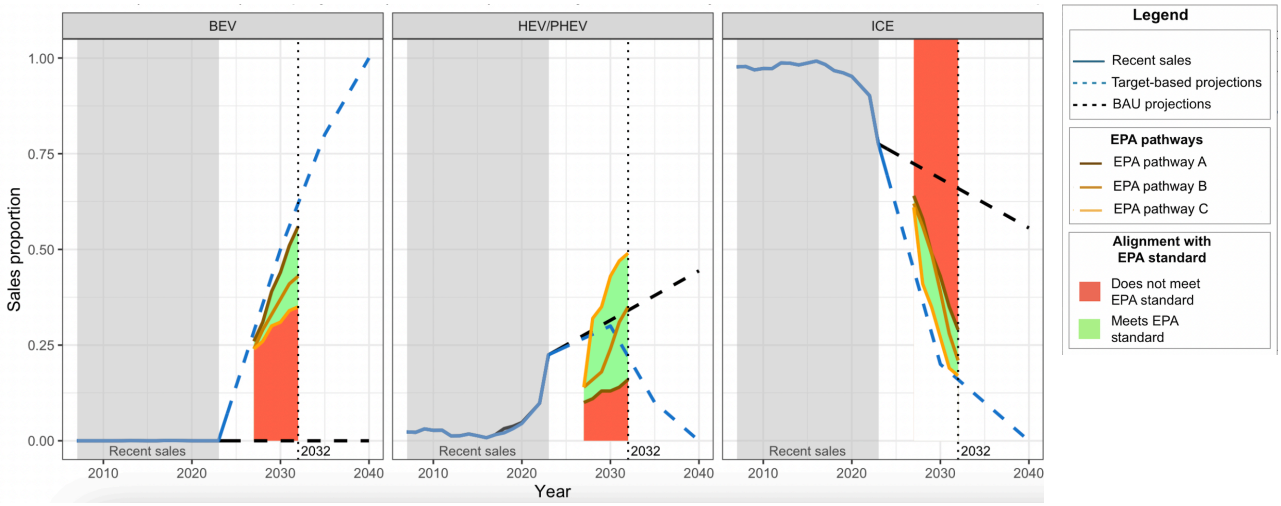


Table 2. Projected fleetwide average CO_2 emission for Honda in the US in 2032 for target-based and business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile.

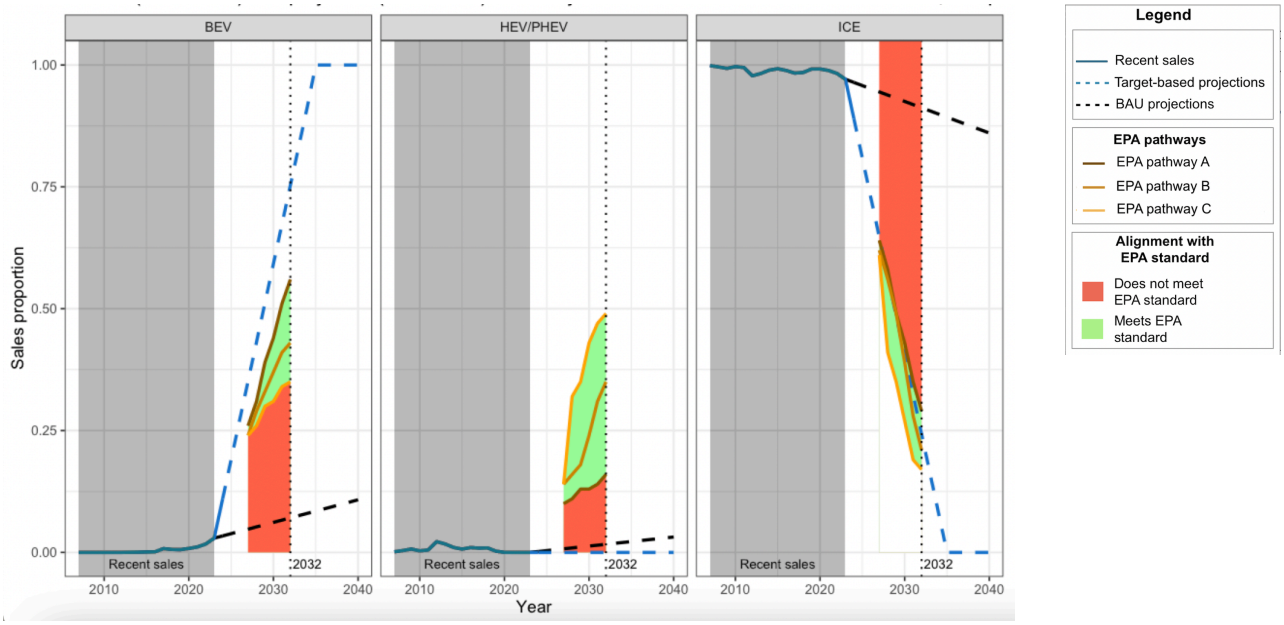
Target-based projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***102.1***
		Overshoot against EPA standards (%)	***20%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***92.0***
		Overshoot against EPA standards (%)	***8%***
BAU projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***297.4***
		Overshoot against EPA standards (%)	***250%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***268.0***
		Overshoot against EPA standards (%)	***215%***
EPA's 2032 average fleetwide CO_2 emissions limit (gpm)			***85***

General Motors

General Motors is a signatory to the 26th United Nations Climate Change conference (COP26) declaration that stipulates a transition to 100% zero emissions cars and vans in the US by 2035.[5] The automaker's ICE vehicles sales comprised 97.08% of its total US sales in 2023. The rest was made up of BEVs (2.92%). The automaker had no recorded sales of hybrid vehicles in the US in 2023, according to Marklines. General Motors' US sales strategy is almost exclusively focused on the sales of ICE vehicles.

The sales trajectory of General Motors over the past five years is not EPA-compatible and the automaker will not meet the EPA CO_2 emissions standard in 2032. General Motors 2032 sales will be dominated by ICE vehicles with an insufficient proportion of BEVs and hybrid vehicles to align with any of the three EPA pathways by 2032, according to the automaker's current sales performance (Fig. 3). General Motors' COP26-aligned target to end tailpipe emissions by 2035 exhibits a higher ambition level than many other automakers in the study. General Motors' projected BEV sales proportion in 2032 is 75.32% if it were to meet the target.

Fig. 3. Recent (2007–2023) and projected (2024–2040) sales trajectories of General Motors vehicles in the US market, compared to the March 2024 EPA standard pathways with estimates of compliance. The EPA pathways assume a PHEV:HEV ratio of minimum 2.7:1. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).



The projected sales proportions for each powertrain are converted to an average CO_2 emissions level for the General Motors 2032 US fleet and compared against the EPA standards, shown in Table 3. Similar to Ford, General Motors' COP26-aligned US sales targets lead to a 24%

[5] The COP26 pledge specifies a 100% adoption rate of zero-emission vehicles in all new car and van sales 2040 globally and by 2035 in leading markets. The US is considered a leading market.

overshoot of the EPA limit of 85 gpm. The overshoot is reduced to 11% when factoring in annual 1.15% fuel efficiency improvements. Although General Motors is not projected to meet the EPA standard in 2032, its relative deficiency level is considerably less than Toyota and Nissan. However, General Motors' average fleetwide emissions are much further away from being EPA-compliant if the company continues to sell ICE vehicles at the same rate as in the past five years. If General Motors fails to change course, the automaker is projected to overshoot the EPA limit of 85 gpm CO_2 emissions by 367% in 2032, or 320% when factoring in fuel efficiency improvements. Accelerating BEV sales is essential for General Motors to meet its own targets.

The similarities between General Motors' and Ford's projected 2032 EPA-compliant performance are as expected because the current sales for both carmakers are ICE-focused and both have adopted COP26-aligned targets.

Table 3. Projected fleetwide average CO_2 emissions for General Motors in the US in 2032 for target-based and business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile.

Target-based projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***105.0***
		Overshoot against EPA standards (%)	***24%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***94.4***
		Overshoot against EPA standards (%)	***11%***
BAU projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***396.6***
		Overshoot against EPA standards (%)	***367%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***356.7***
		Overshoot against EPA standards (%)	***320%***
EPA's 2032 average fleetwide CO_2 emissions limit (gpm)			***85***

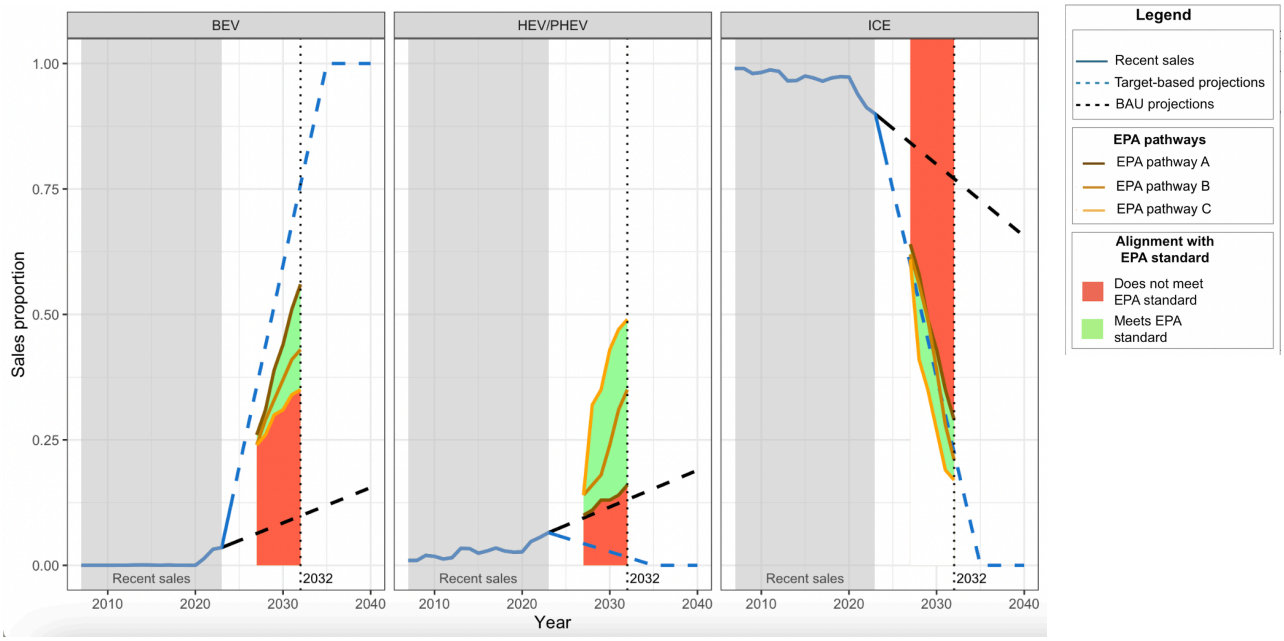
Ford

Ford Motor Company is a signatory to the COP26 declaration that stipulates a transition to 100% zero emissions cars and vans in the US by 2035.[6] In 2023, ICE vehicles comprised 89.95% of Ford's total US sales. The rest consisted of hybrid vehicles (6.52%) and BEVs (3.52%). Ford increased its BEV sales between 2020 and 2023, but there are many improvements the company could make to increase sales of zero emissions vehicles. Ford's ICE-focused sales strategy does not align with any of the three EPA pathways.

[6] The COP26 pledge specifies a 100% adoption rate of zero-emission vehicles in all new car and van sales 2040 globally, and by 2035 in leading markets. The US is considered a leading market.

Ford will not be on track to meet any of the three EPA pathways in 2032 if its sales continue along the same trajectory as the past five years. Fig. 4 shows that Ford is projected to lag behind on its BEV sales and sell a significantly higher proportion of ICE vehicles, which is not compatible with the EPA emissions targets. Ford's targets, however, are among the most ambitious. If Ford were to meet its own targets (as it pledged as a COP26 signatory), its US sales would exhibit a higher ambition level than many other automakers in the study, and the automaker would achieve a BEV sales proportion of 75.88% in 2032.

Fig. 4. Recent (2007–2032) and projected (2024–2040) sales trajectories of Ford vehicles in the US market, compared to the March 2024 EPA standard pathways with estimates of compliance. The EPA pathways assume a PHEV:HEV ratio of minimum 2.7:1. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).



The projected sales proportions for each powertrain are converted to an average CO_2 emissions level for Ford's 2032 US fleet and compared against the EPA standards, shown in Table 4. Ford's COP26-aligned US sales targets lead to an overshoot of the EPA limit of 85 gpm. The overshoot percentage is 24%, and reduced to 12% when factoring in 1.15% annual fuel efficiency improvements. Ford is not projected to meet the EPA standard in 2032, but the shortage is considerably less than Toyota and Nissan, though higher than Honda. Ford's track record in the US market tells a different story. If the automaker does not change course from its current sales patterns, it is on track to exceed the EPA limit of 85 gpm CO_2 emissions by 351%, or 305% if assuming fuel efficiency improvements of 1.15% annually. Ford needs to accelerate its BEV sales in order to comply with its own target and cut down on its average fleetwide CO_2 emissions levels.

Table 4. Projected fleetwide average CO_2 emissions for Ford in the US in 2032 for target-based and business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile.

Target-based projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***105.7***
		Overshoot against EPA standards (%)	***24%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***95.1***
		Overshoot against EPA standards (%)	***12%***
BAU projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***383.1***
		Overshoot against EPA standards (%)	***351%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***344.6***
		Overshoot against EPA standards (%)	***305%***
EPA's 2032 average fleetwide CO_2 emissions limit (gpm)			***85***

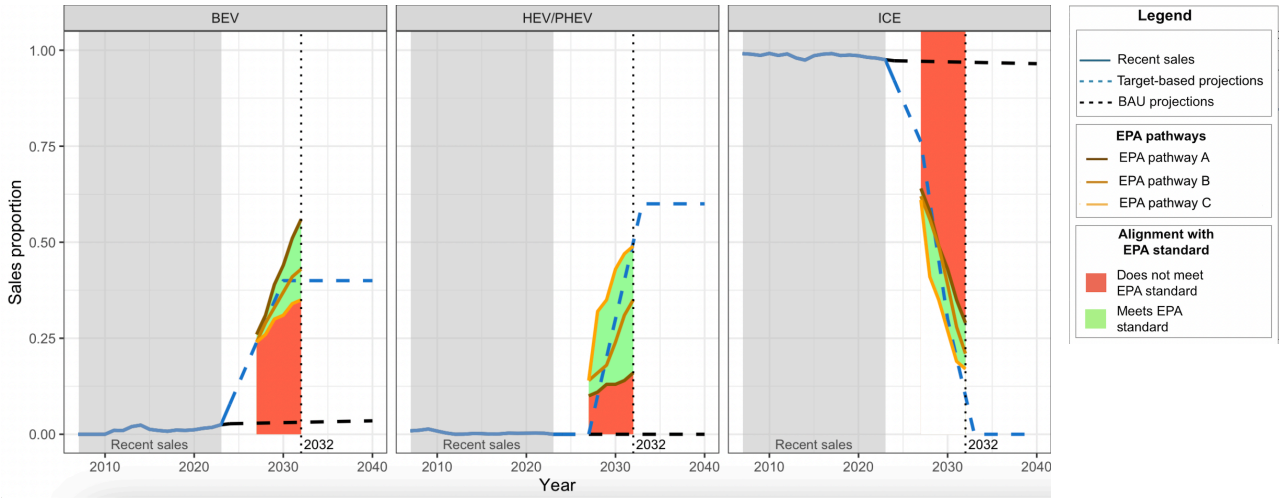
Nissan

In 2023, Nissan's US sales were driven by ICE vehicles, which contributed 97.53% of the automaker's total sales in the US market that year. The same year, Nissan's BEV sales proportion in the US was 2.47%, while no sales of hybrid vehicles were recorded. In the past five years, hybrid vehicles have never contributed more than 1% of the automaker's total US sales. No PHEV vehicles were offered in the US market from 2007 to 2023. Having neither promoted BEVs nor hybrid vehicles, Nissan's current US sales strategy does not align with any of the three EPA pathways.

Nissan's past sales do not show any signs of an ICE phase-out in the US. **By a considerable margin, Nissan is not on track to meet the EPA standard by 2032 if it continues to cruise along the same sales trajectory that it has been on the past five years**. As shown in Fig. 5, the business as usual sales projections for all three powertrains are in the red, non-compliance zone for 2032. Nissan's ICE sales rate will exceed all three EPA pathways without a significant change in direction.

According to sales targets released by Nissan, BEVs and hybrid vehicles will comprise 40% and 60%, respectively, of the automaker's US sales by early 2030s. However, Nissan's sales targets do not specify the ratio of HEV and PHEV within the hybrids category. Promoting hybrid vehicles in its future sales, Nissan's US sales targets would align with EPA pathway B and C, shown in Fig. 5, if its PHEV to HEV ratio reaches 2.7:1.

Fig. 5. Recent (2007–2032) and projected (2024–2040) sales trajectories of Nissan vehicles in the US market, compared to the March 2024 EPA standard pathways with estimates of compliance. The EPA pathways assume a PHEV:HEV ratio of minimum 2.7:1. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).



Based on Nissan's sales targets, the automaker's average fleetwide CO_2 emissions levels are projected to exceed the EPA limit of 85 gpm by 97%, assuming no improvement in fuel efficiency technology, and by 76% if fuel efficiency technology advances by 1.15% yearly between 2024 and 2032. These figures are shown in Table 5. The outlook is worse if the estimations are based on Nissan's current sales figures. If Nissan continues to sell vehicles at the same rate as in the past five years, its average fleetwide CO_2 emissions will exceed the EPA limit of 85 gpm by 276% assuming no improvement in fuel efficiency technology between 2024 and 2032. Even if fuel efficiency technology improves at a rate of 1.15% yearly, the automaker is still projected to exceed the EPA limit by 239%.

The powertrain distribution of Nissan's US sales targets are projected to be compatible with EPA pathways in 2032, but these same targets are not in compliance with the EPA limit of 85 gpm for the same year. This is due to variability in the PHEV to HEV ratio within Nissan's sales segment of HEVs. The three EPA compliance pathways indicate a higher PHEV to HEV ratio (a minimum of 2.7 to 1) than Nissan's current US sales figures suggest, which have been entirely driven by the sales of HEVs in the past 17 years. Nissan has not sold any PHEVs in the US in the past 17 years according to Marklines, and because Nissan does not specify the proportion of PHEVs and HEVs that will meet its own US hybrid sales target[7], our CO_2 emissions projections for Nissan's hybrid fleet are calculated on the basis of fuel economy of the automaker's HEV

[7] According to projections based on Nissan's own sales targets, hybrid vehicles will make up 50% of the automaker's US sales in 2032. Of the 50%, Nissan has not disclosed the proportion of that sales target that will be met by HEV and PHEV sales, respectively. We assume that Nissan's US hybrid sales in 2032 will be entirely driven by HEVs, which has been the case in the past 17 years. Following this assumption, even though Nissan's projected 2032 powertrain distribution aligns with EPA pathway B, because Nissan's HEV and PHEV ratio deviates from the ratio assumed in EPA pathway B (29% PHEVs and 6% HEVs), the automaker's average fleetwide CO_2 emissions level is expected to exceed 85 gpm.

models only. The average emissions levels of PHEV and HEV powertrains are known to differ significantly. Consequently, the hybrid powertrain ratio used in the calculations can have a significant impact on average fleetwide emissions estimates. Nissan's actual 2032 average fleetwide emissions could be lower than our calculations if PHEVs make up a higher proportion of the automaker's hybrid vehicles sales than at present.

Table 5. Projected fleetwide average CO_2 emission for Nissan in the US in 2032 for target-based and business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile

Target-based projections	*Annual fuel efficiency improvement rate: **0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***167.2***
		Overshoot against EPA standards (%)	***97%***
	*Annual fuel efficiency improvement rate: **1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***149.3***
		Overshoot against EPA standards (%)	***76%***
BAU projections	*Annual fuel efficiency improvement rate: **0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***319.6***
		Overshoot against EPA standards (%)	***276%***
	*Annual fuel efficiency improvement rate: **1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***288.0***
		Overshoot against EPA standards (%)	***239%***
EPA's 2032 average fleetwide CO_2 emissions limit (gpm)			***85***

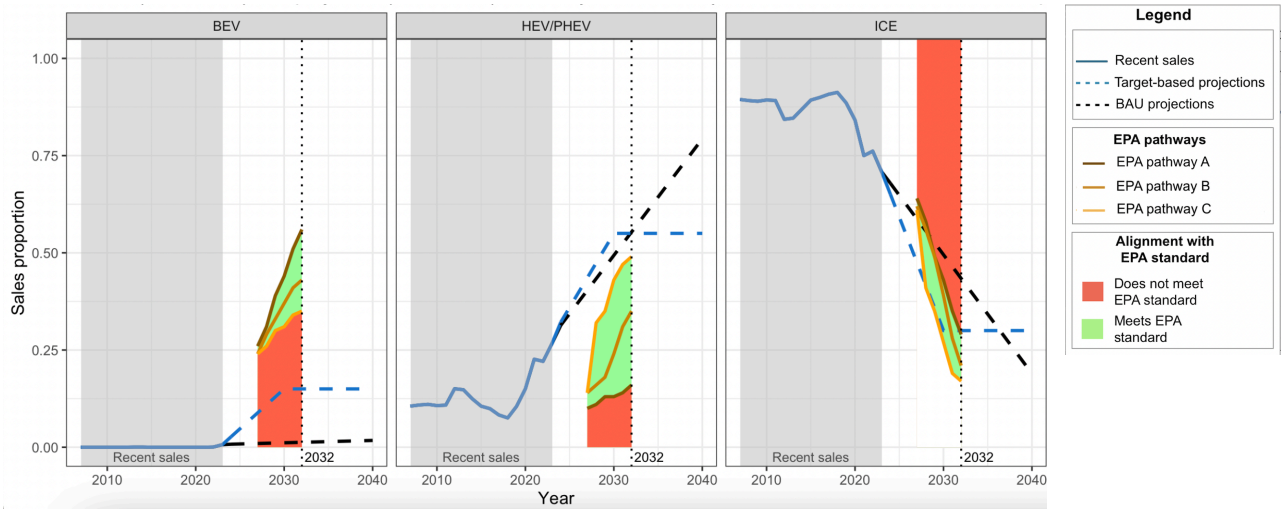
Toyota

In 2023, ICE and hybrid vehicles dominated Toyota's US sales at 70.87% and 28.36%, respectively. The same year, Toyota's BEV sales proportion in the US was 0.65%. Whilst the proportion of hybrid vehicles in Toyota's US sales increased between 2007 and 2023, the changes in the automaker's BEV sales in the same period were minimal (Fig. 6). The company's focus on selling hybrids closely follows the profile of EPA pathway C, which the EPA described as the Higher HEV and PHEV Pathway.

Toyota's slow phase-out of ICE vehicles and lack of progress in increasing its BEV sales in the US means that **if the automaker continues along the same sales trajectory as in the past five years, it is not on track to meet any of the three EPA pathways in 2032**. Fig. 6 shows Toyota's business as usual sales projections for BEV and ICE vehicles for 2032 that are not EPA-compatible. If Toyota does not change course, its ICE sales rate will exceed the suggested proportion for all three pathways, and its BEV sales will fall short of being compatible with any of the three pathways.

Toyota has announced that it targets BEVs and hybrid vehicles to consist of 15% and 55% of its 2030 US sales, respectively. **Even if Toyota delivered on its own targets, its US sales will not be compatible with any of the EPA pathways.** Toyota's BEV sales will lag behind the proportion required by all three EPA pathways by a considerable margin while its proportion of hybrids will be too high.

Fig. 6. Recent (2007–2032) and projected (2024–2040) sales trajectories of Toyota vehicles in the US market, compared to the March 2024 EPA standard pathways with estimates of compliance. The EPA pathways assume a PHEV:HEV ratio of minimum 2.7:1. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).



The projected sales proportions for each powertrain are converted to an average CO_2 emission level for the automaker's US fleet in 2032, shown in Table 6. If Toyota delivered on its own sales targets, its 2032 average fleetwide emissions in the US will exceed the EPA limit by 181%. This figure falls to 154% if fuel efficiency levels improve at an annual rate of 1.15%, which is the average yearly improvement witnessed in the automotive industry between 2018 and 2023. The outlook is worse if they are based on Toyota's current sales figures. If Toyota continued to sell vehicles at the current rate, by 2032, the automaker's average fleetwide CO_2 emissions level will overshoot the EPA limit by 240%, which is reduced to 207% assuming fuel efficiency improvements.

Table 6. Projected fleetwide average CO_2 emission for Toyota in the US in 2032 for target-based and business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile.

Target-based projections	*Annual fuel efficiency improvement rate: **0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***239.2***
		Overshoot against EPA standards (%)	***181%***
	*Annual fuel efficiency improvement rate: **1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***215.5***

		Overshoot against EPA standards (%)	***154%***
BAU projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***289.2***
		Overshoot against EPA standards (%)	***240%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***260.6***
		Overshoot against EPA standards (%)	***207%***
EPA's 2032 average fleetwide CO_2 emissions limit (gpm)			***85***

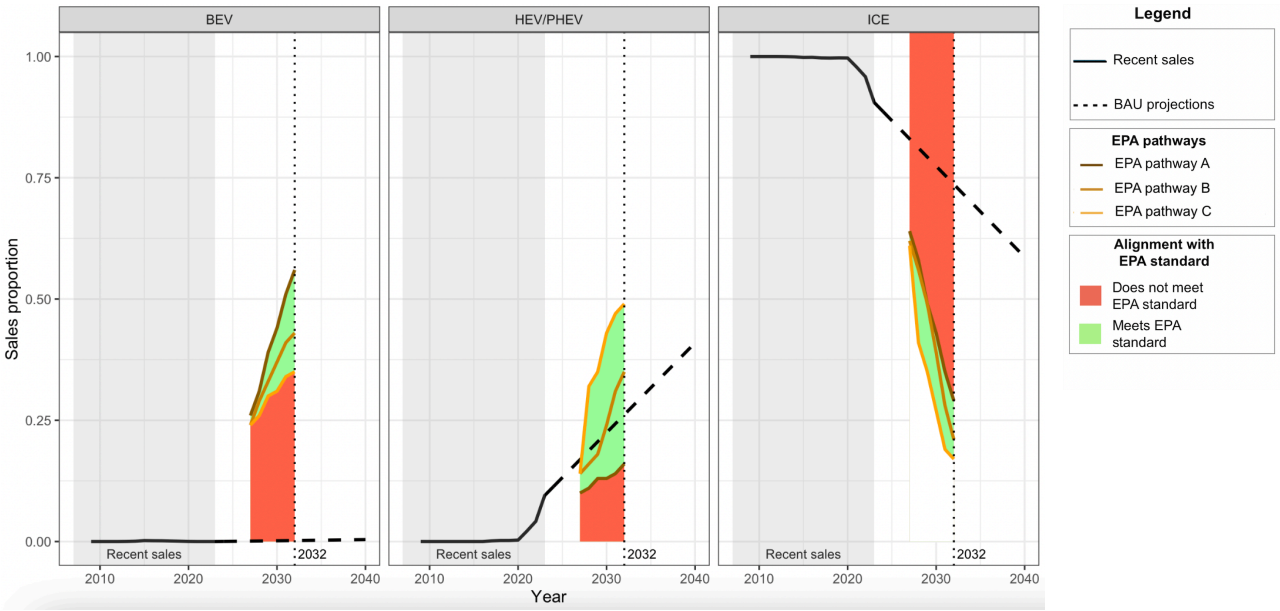
Stellantis

The US sales of Stellantis and the combined US sales of Stellantis' pre-merger predecessors, Fiat Chrysler Automobiles (FCA) and Peugeot S.A. (PSA Group), before 2020 were driven by ICE vehicles. In 2023, 90.52% of Stellantis' US sales comprised ICE vehicles. The rest, at 9.48%, were hybrid vehicles, predominantly plug-in hybrid vehicles (PHEV), which accounted for nearly 97% of all hybrid sales for that year. Stellantis had only recorded sales of one BEV in 2023, according to Marklines. Stellantis' decarbonization efforts rely on the sales of hybrid vehicles, and the automaker has not adopted BEV technology in its US market segment. The automaker's current US sales strategy does not match any of the three EPA pathways.

If Stellantis continues to sell vehicles at the same rate as over the past five years, the automaker is not projected to meet the EPA standards in 2032 (Fig. 7). The lack of presence of Stellantis's BEV vehicles in the US market is an obstacle to the automaker's EPA compatibility, because the EPA standards stipulate that both BEVs and hybrid vehicles comprise a significant portion of an automaker's powertrain mix. Although Stellantis' hybrid vehicles sales trajectory is on track, the automaker needs to replace more than half of its projected ICE vehicles sales in 2032 with BEVs to be in alignment with EPA standards.

Stellantis has not announced US sales targets for ICE, hybrid vehicles, and BEVs separately. The automaker's US targets are not assessed for whether they are EPA-compatible.

Fig. 7. Recent (2007–2032) and projected (2024–2040) sales trajectories of Stellantis vehicles in the US market, compared to the March 2024 EPA standard pathways with estimates of compliance. The EPA pathways assume a PHEV:HEV ratio of minimum 2.7:1. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).



The projected sales proportions for each powertrain are converted to average CO_2 emissions for Stellantis' 2032 US fleet and compared against the EPA standards, shown in Table 7. Stellantis is projected to overshoot the EPA limit of 85 gpm CO_2 emissions by 344% with average fleetwide emissions in the US of 377.1 gpm in 2032, if the automaker fails to change course from vehicle sales in the US over the past five years. Even factoring in the annual improvement in fuel efficiency, Stellantis' overshoot percentage is 299%, or average fleetwide emissions of 338.9 gpm in 2032. Stellantis must accelerate its BEV sales to decrease its average fleetwide emissions.

Table 7. Projected fleetwide average CO_2 emissions for Stellantis the US in 2032 for business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile.

Target-based projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***N/A***
		Overshoot against EPA standards (%)	***N/A***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***N/A***
		Overshoot against EPA standards (%)	***N/A***
BAU projections	*Annual fuel efficiency improvement rate:* ***0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***377.3***
		Overshoot against EPA standards (%)	***344%***
	Annual fuel efficiency improvement rate: ***1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***338.9***
		Overshoot against EPA standards (%)	***299%***
EPA's 2032 average fleetwide CO_2 emissions limit (gpm)			***85***

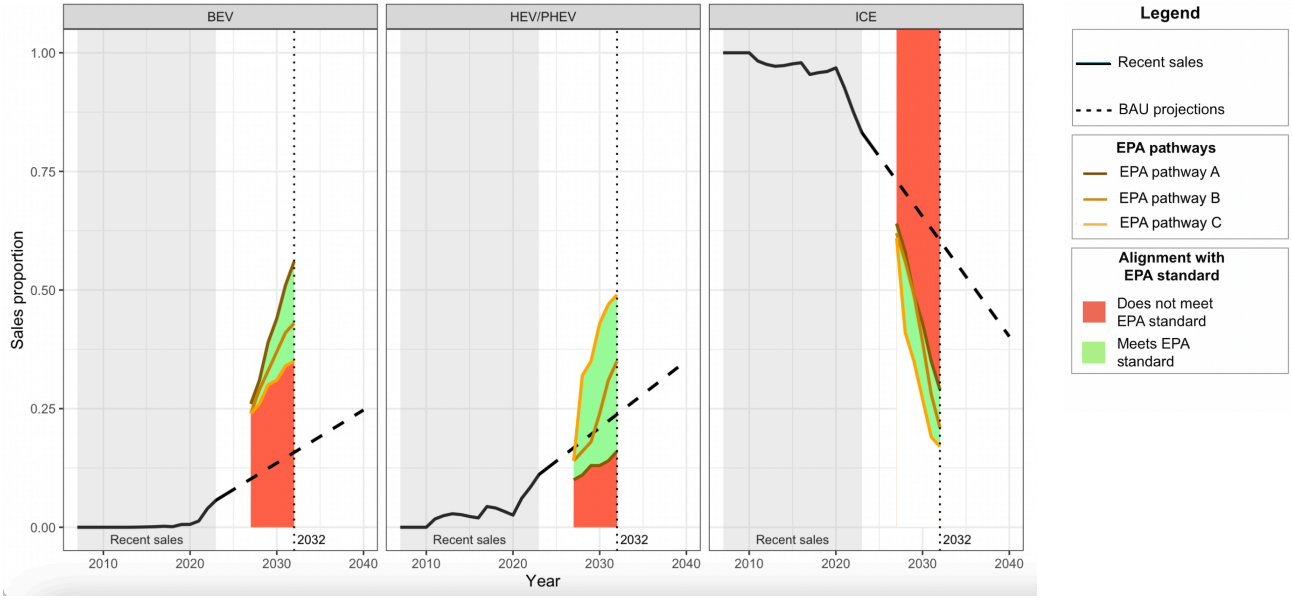
Hyundai-Kia

Hyundai-Kia had a sales proportion of 83.17% for ICE vehicles in the US in 2023, against 5.71% BEVs and 11.11% hybrid vehicles. Approximately nine in ten hybrid vehicles sold by Hyundai-Kia in the US in 2023 were HEVs. The high volume of HEVs is concerning and casts doubt on the emissions-reducing efficacy of Hyundai-Kia's moves to transition away from ICE vehicles.

Hyundai-Kia will fail to meet any of the three EPA pathways in 2032 if its sales continue along the same trajectory as in the past five years. While the hybrid vehicles sales will be compatible with EPA pathway A, Hyundai-Kia is projected to overshoot ICE vehicle sales proportions and fail to sell an adequate proportion of BEVs (Fig. 8). Hyundai-Kia's low proportion of PHEVs in its hybrid vehicles sales mix is likely to make it more difficult for the automaker to meet the EPA limit of 85 gpm CO_2 emissions because PHEVs are more fuel efficient that their HEV counterpart. Hyundai-Kia needs to replace at least half of its projected ICE vehicles sales in 2032 with BEVs to be aligned with EPA standards.

Hyundai-Kia has not announced US sales targets for ICE, hybrid vehicles, and BEVs separately. The automaker's US targets are not assessed for whether they are EPA-compatible.

Fig. 8. Recent (2007–2032) and projected (2024–2040) sales trajectories of Hyundai-Kia vehicles in the US market, compared to the March 2024 EPA standard pathways with estimates of compliance. The EPA pathways assume a PHEV:HEV ratio of minimum 2.7:1. Internal combustion engines (ICE); hybrid electric vehicles (HEV); plug-in hybrid electric vehicles (PHEV); battery electric vehicles (BEV).



The projected sales proportions for each powertrain are converted to average CO_2 emissions for Hyundai-Kia's 2032 US fleet and compared against the EPA standards, shown in Table 8. Hyundai-Kia's US sales trajectory over the past five years is not compatible with the EPA limit of 85 gpm CO_2 emissions by 2032. If the automaker continues to sell vehicles in the US at the same rate, its average fleetwide emissions level in 2032 is on track to exceed the EPA limit by 201%, or 139% when factoring in improvements in fuel efficiency technology. It is imperative that Hyundai-Kia replaces ICE vehicles in its US fleetwide with zero emissions alternatives.

Table 8. Projected fleetwide average CO_2 emissions for Hyundai-Kia the US in 2032 for business as usual projection scenarios, compared against EPA standards. Gpm, grams per mile.

Target-based projections	*Annual fuel efficiency improvement rate: **0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***N/A***
		Overshoot against EPA standards (%)	***N/A***
	*Annual fuel efficiency improvement rate: **1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***N/A***
		Overshoot against EPA standards (%)	***N/A***
BAU projections	*Annual fuel efficiency improvement rate: **0%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***256.2***
		Overshoot against EPA standards (%)	***201%***
	*Annual fuel efficiency improvement rate: **1.15%***	*Average 2032 fleetwide CO_2 emissions (gpm)*	***203.1***
		Overshoot against EPA standards (%)	***139%***
EPA's 2032 average fleetwide CO_2 emissions limit (gpm)			***85***

Recommendations to automakers

1. **Automakers must commit to phase out internal combustion engine vehicles by 2030 globally and by 2028 in Europe.** This Greenpeace East Asia report finds that the current sales trajectories of Honda, Nissan and Toyota are on track to exceed the 2032 US emissions limit. Automakers' sales targets are also not in line with capping the global annual temperature increase within 1.5˚C.

2. **Automakers must not rely on hybrid electric vehicles to cut CO_2 emissions.** Lifecycle emissions from hybrids are only 20.5% less than traditional combustion vehicles.[v] For this reason, carmakers may fail to meet the standards even with a higher ratio of hybrid sales.

   In addition, the hybrid electric vehicle (HEV) to plug-in hybrid electric vehicle (PHEV) ratio among hybrid sales is important for compliance. Although the EPA suggests a high ratio of PHEVs compared to HEVs, most automakers have not specified HEV to PHEV

ratios in their electrification plans. This creates a risk that automakers may fail to achieve the 85 grams per mile (gpm) fleetwide CO_2 emissions target, although their electrification rates may appear in compliance, as in the case of Nissan.

EPA estimates of PHEV emissions have been criticized for being 42–67% lower than real-world usage.[vi] Even if automakers meet PHEV targets on paper, actual CO_2 emissions could significantly exceed the 85 gpm target. Thus, PHEVs should not be relied upon to achieve real-world fleetwide emissions reductions.

3. **To keep the global average temperature increase under 1.5˚C, it is essential to aim for net zero emissions over efficiency.** Even after considering advancements in fuel efficiency technology, under a business as usual scenario, all seven automakers' average fleetwide CO_2 emissions will exceed the EPA limit in 2032. Toyota in particular must set more ambitious BEV targets.

Appendix A: Powertrain distributions of three EPA pathways

Table 9: 2027-2032 powertrain distributions of three potential compliance pathways for the March 2024 EPA emissions standards

Pathway	Technology	2027	2028	2029	2030	2031	2032
Pathway A - Higher BEV Pathway (control analysis case)	ICE	64%	58%	49%	43%	35%	29%
	HEV	4%	5%	5%	4%	3%	3%
	PHEV	6%	6%	8%	9%	11%	13%
	BEV	26%	31%	39%	44%	51%	56%
Pathway B - Moderate HEV and PHEV Pathway	ICE	62%	56%	49%	39%	28%	21%
	HEV	4%	4%	3%	6%	7%	6%
	PHEV	10%	12%	15%	18%	24%	29%
	BEV	24%	29%	33%	37%	41%	43%
Pathway C - Higher HEV and PHEV Pathway	ICE	61%	41%	35%	27%	19%	17%
	HEV	4%	15%	13%	16%	15%	13%
	PHEV	10%	17%	22%	27%	32%	36%
	BEV	24%	26%	30%	31%	34%	35%

Source: US Environmental Protection Agency.[i]

Appendix B: Methodology

The methodology of this research aims to evaluate whether Toyota, Honda, Nissan, Ford, General Motors, Stellantis, and Hyundai-Kia are projected to comply with the EPA emissions standards of 85 gpm by 2032 for light-duty vehicles, which the agency announced in March 2024. The evaluation is divided into two key components: (1) sales projections; and (2) fleetwide CO_2 emission estimations.

1. Sales projections

Sales projections were conducted for each automaker with the aim of estimating the proportions of powertrains in future sales between 2024 and 2032. Three types of powertrain are considered: (i) battery electric vehicles (BEV); (ii) hybrids to include both HEVs and PHEVs; and (iii) internal combustion engine vehicles (ICE). Two sets of sales projections were calculated from (a) company-released targets and (b) historic sales data. The two types of hybrid vehicles are combined into one single category; the hybrid sales targets that the three automakers have communicated do not distinguish between HEVs and PHEVs and it is therefore not possible to assess the two types of hybrid vehicles separately.

Target-based projections

The first approach, hereafter referred to as 'target-based projections', assesses the powertrain composition of each company's yearly sales between 2024 and 2032 based on the most recent sales targets that each company has released. Sales targets for the US market are used whenever possible. In the case where sales targets for the US market are not available, sales targets for the US and Canadian markets are used as a substitution. Global sales targets are not taken into account.

Each powertrain's sales trajectory was assumed to increase or decrease linearly between 2023 and the year of the sales target. For automakers with multi-stage sales targets, e.g., for both 2030 and 2035, the sales proportion was assumed to progress linearly within each stage. The starting point of the sales projections was 2023 and the powertrain proportions were extracted from MarkLines, a web-based automotive industry portal that publishes historical sales data of vehicle models by year and country of sales.

Business as usual projections

The second approach was an assessment of the powertrain composition of each company's yearly sales between 2024 and 2032, but it uses past US sales data from the period 2018 to 2023 as the basis for the projections and assumes that the mean sales trajectory witnessed in the past will continue into the future. This second approach is called the 'business as usual projections', or BAU projections.

The business as usual projections rely on past sales to predict future sales. The powertrain proportions of each automaker's past sales were extracted from MarkLines. For each powertrain, the 5 years average growth rate between 2018 to 2023 was computed and the growth rate used to extrapolate the future sales proportion from 2024 to 2032. The 5 year time

frame allows the projections to reflect the recent decarbonization efforts that the automakers have exhibited through their sales and is in recognition of the relatively recent penetration of electrified technologies in the general automotive marketplace in the US. Moreover, the 5 year time frame reflects that although BEV technology has been available to automakers for a number of years now, it is only recently that the technology has begun to be adopted on a larger scale and be accessible to US car buyers. The key assumption in the projections is that the growth rate within each powertrain remains constant, i.e., that follows a linear growth pattern. Adoption of new technologies such as BEVs, HEVs, and PHEVs can follow a linear or a S-shaped growth pattern. No clear preference for either growth pattern is shown in the literature, and the decision was taken to assume a linear growth rate in this study.[vii,viii]

The two projections are complementary. Company-released sales targets and target-based projections can reflect company goals or ambitions at a specific point in time but are non-binding and (sometimes heavily) subject to revision or retraction. In the business as usual projections, automakers were only assessed on their past, demonstrable performance. Therefore, the two types of projections are an assessment of the information that a company has communicated versus what a company has demonstrated. The target-based projections measure what would happen in the future if an automaker delivers on its promises.

The business as usual projections suggest what could happen if these automakers fail to escalate decarbonisation efforts beyond current levels. In summary, the projections aim to answer the following questions:

- *By 2032, will the automakers comply with the EPA standards according to projections based on their own sales targets?*
- *By 2032, will the automakers comply with the EPA standards according to projections based on historic sales?*

Comparison to EPA pathways
The target-based and business as usual projections were compared against the three scenarios of compliance presented in the EPA standards to assess whether each company is on track to comply with the regulations. The three scenarios are referred to by the EPA as pathway A, pathway B, and pathway C. See Table 9 and Fig. 1.

2. Fleetwide CO_2 Emission Estimations (2032)
This section outlines whether the three automakers will comply with the EPA's 85 grams per mile fleetwide CO_2 target for 2032. To calculate the fleet-wide emissions for each manufacturer in 2032, we need the following information: 1) the number of cars and light trucks each manufacturer will sell in 2032 and the proportion each powertrain will occupy, and 2) the average CO_2 emissions per powertrain for each manufacturer. Data for the powertrain proportions came from projections calculated in this research, while the average CO_2 emissions per powertrain were derived from a combination of MarkLines sales data (for weighting) and fuel economy guide CO_2 emission data by model. The emissions from vehicles of a particular

powertrain were calculated using a sales-weighted average of all models belonging to that powertrain. Summing up the emissions from all powertrains and dividing by the total number of vehicles provided the per-vehicle emissions, to compare against the 85 g/mile target.

We provide two estimates for each automaker's fleetwide CO_2 emissions in 2032, based on two scenarios from 2023 to 2032: (1) the automaker will not experience any reduction in CO_2 emissions by powertrain, and (2) the automaker will achieve a 1.15% average annual reduction in fleetwide CO_2 emissions, consistent with the reduction rate observed between 2018 and 2023. This 1.15% rate is based on reductions experienced by all automakers in the US during that period, likely due to technological advances that improved fleet fuel efficiency.

Sales projection and powertrain shares

The sales target-based projections and the business as usual scenarios were used to calculate the 2032 sales projection and shares of each powertrain. For the total sales estimates, it was assumed that the total number of vehicle sales from 2023 would remain constant until 2032. However, the distribution of sales across different powertrains is expected to change, because manufacturers have indicated plans to increase fleet electrification. The specific number of vehicles expected to be sold each year and the shares of three powertrains (BEV, HEV/PHEV, ICE) was calculated using the preceding section's five sales projections.

CO_2 emissions data collection

Average CO_2 emission data for each powertrain was collected from the US EPA's Fuel Economy Guide, which is published annually. The guide provides fuel economy and tailpipe CO_2 emissions of all car and light truck models sold each year in the US market by automakers. The CO_2 estimates are provided in the EPA testing sites, using an established protocol of five tests that simulate various real-world driving conditions. The CO_2 emissions data for the model was then multiplied by the 2023 sales data of the model, aggregated among the same powertrain, and divided by all sales of that powertrain to produce that powertrain's average, sales-weighted emission. BEV tailpipe emissions were set to zero. Nissan did not sell any HEV models in Model Year 2023. Therefore, Nissan's sole HEV model in 2022 (Rogue) provided the emission data for that powertrain.

This dual-tracked assessment framework examines the alignment of automakers' future sales strategies with EPA emissions targets. It highlights potential areas for policy adjustments and strategic shifts within the automotive industry on the path toward ending tailpipe emissions.

Endnotes

i "Final Rule: Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles," U.S. Environmental Protection Agency, accessed June 1, 2024, https://www.epa.gov/regulations-emissions-vehicles-and-engines/final-rule-multi-pollutant-emissions-standards-model

ii U.S. Department of Transportation, "Title 49: Transportation; Subtitle B: Other Regulations Relating to Transportation; Chapter V: National Highway Traffic Safety Administration, Department of Transportation; Part 523: Vehicle classification," accessed June 7, 2024, https://www.ecfr.gov/current/title-49/subtitle-B/chapter-V/part-523

iii Federal Registry, Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles, (Washington D.C, 2024), https://www.federalregister.gov/documents/2024/04/18/2024-06214/multi-pollutant-emissions-standards-for-model-years-2027-and-later-light-duty-and-medium-duty

iv U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE), "2023 Fuel Economy Guide", accessed June 7, 2024, https://www.fueleconomy.gov/feg/pdfs/guides/FEG2023.pdf

v International Energy Agency (IEA), Comparison of global average lifecycle emissions by powertrain in the Stated Policies and Announced Pledges Scenarios, 2023-2035, (Paris: IEA, 2024), https://www.iea.org/data-and-statistics/charts/comparison-of-global-average-lifecycle-emissions-by-powertrain-in-the-stated-policies-and-announced-pledges-scenarios-2023-2035

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vii Raymond Vernon, "International Investment and International Trade in the Product Cycle," Quarterly Journal of Economics (1966): 190-207.

viii Arthur D. Little International, "Management im Zeitalter der strategischen Führung", Wiesbaden (1986): 52-56.