Ricardo
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Survey of Tier 1 automotive suppliers with respect to the US greenhouse gas emission standards for light-duty vehicles

Final report for CALSTART

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Survey of Tier 1 automotive suppliers with respect to the US greenhouse gas emission standards for light-duty vehicles

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Executive summary

The US National Program for greenhouse gas (GHG) emissions and fuel economy standards for light-duty vehicles (LDVs) was developed jointly by the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA), with the first phase of the Program running for model years (MYs) 2012 – 2016. In April 2020, the EPA and NHTSA released the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule to amend the previous Corporate Average Fuel Economy (CAFE) and GHG emission standards for LDVs, finalizing the current federal administration's revisions to the standards for MYs 2021 – 2026.

The SAFE Vehicles Rule weakens the previous CAFE and GHG emission standards, to increase annual fuel economy by 1.5% each year to 2026, compared with the previous CAFE standards issued in 2012, which would have increased annual fuel economy by 5% per year to 2025 (NHTSA, 2020). Conversely, international policymaking is displaying a shift towards incentivizing the uptake of zero- and low-emission vehicles. Therefore, it has become important to consider the level of ambition of the US LDV GHG emission standards, in the context of international policymaking.

In light of the evolving legislative framework, Ricardo was commissioned by CALSTART to carry out a survey to examine the views of Tier 1 suppliers on the current US LDV GHG emission standards, and post-2026 ambition. This survey built upon two surveys conducted by Ricardo on behalf of CALSTART in 2018 and 2016, which assessed suppliers' views on the previous CAFE and GHG emission standards. The 2020 survey aimed to gather suppliers' views on the existing standards and future ambition, as well as the role of the standards in investment decision-making, innovation and job growth. The survey also aimed to examine perceptions relating to the key technologies required to achieve GHG emission reductions and fuel economy improvements in line with legislative measures in the LDV segment.

Due to technological advancements and a growing focus on zero-emission vehicles (ZEVs) in the sector, the survey aimed, in particular, to gather responses from suppliers which produce components for electric vehicles (EVs). The survey remained open for seven weeks, and upon closure on September 11, 2020, 21 complete responses and 5 partial responses were received, equating to a response rate of 6% (of 377 total contacts). Of the respondents, 20 out of 26 work for suppliers which produce some components for EVs, such as batteries, motors, thermal management systems and drivetrains.

The survey findings indicate a high level of consensus amongst suppliers in regard to the vast majority of topic areas explored. With regard to existing standards and future ambition, the majority of respondents disagree with the current federal administration's policy decision to adopt the SAFE Vehicles Rule. In addition to this, an overwhelming majority of respondents (23 out of 25) indicated that standards should be made more ambitious post-2026, to further drive innovation in the sector and to help the US industry to remain competitive.

The vast majority of respondents (23 out of 26) also agreed that it is important to start planning and setting targets now for beyond 2026, to account for the long lead time required for technological development, and to speed up the transition towards low-carbon technology uptake to support climate change response. There was also consensus regarding state-level standards, with the majority of respondents (18 out of 21) stating that they would support, or partially support, a state-led process to set more stringent LDV standards. However, a number of respondents indicated that a single federal-level standard would be preferable, from a planning perspective, and to help avoid confusion.

With regard to a 100% ZEV sales target for 2035-40, the responses displayed a more mixed level of support. A small majority of respondents (14 out of 26) indicated that they would support the implementation of the target, to allow the US to align with global requirements, and to remain competitive. In addition, the majority of respondents (16 out of 26) stated that achieving 100% ZEV

sales by 2035-40 for the LDV market is viable, indicating the existing technical feasibility. However, of those that did not consider the target to be viable, the lack of political feasibility was referenced.

The majority of respondents (17 out of 21) indicated that more ambitious US LDV vehicle efficiency standards tend to encourage more innovation and investment in the US. Therefore, there seems to be a general consensus that more ambitious standards, and an increased shift towards the uptake of vehicle efficiency technologies, will benefit the sector in terms of competitiveness, and in terms of enhancing innovation and investment.

There is also a general consensus that policies which encourage the uptake of ZEVs, and hence increase innovation in the automotive sector, would encourage job growth in the US. However, the consensus amongst respondents is that this is more likely to happen at the industry (15 out of 21) or company level (13 out of 21), rather than across the US economy as a whole.

For prior, existing and future standards, battery electric vehicles (BEVs) were viewed as the most important technology required to meet these legislative targets. Alongside BEVs, other EV types, including plug-in hybrid electric vehicles (PHEVs) and fuel cell electric vehicles (FCEVs), were also perceived as key, particularly in a post-2026 world. This indicates an increasing recognition of the importance of electrification in achieving the targets set out in LDV GHG emission standards, relative to the 2018 and 2016 survey results.

This report captures the key findings from the 2020 survey, as well as providing a comparison to the 2018 and 2016 survey findings, which will be used by CALSTART to inform their strategy for encouraging the adoption of clean LDVs.

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1 Introduction

Ricardo was commissioned by CALSTART to carry out a survey to examine the views of Tier 1 suppliers on the current US light-duty vehicle (LDV) greenhouse gas (GHG) emission standards, and post-2026 ambition. CALSTART is a national non-profit consortium, dedicated to supporting and accelerating the growth of the clean transportation technologies industry in the US[1].

The survey aimed to gather suppliers' views on the existing standards and future ambition, as well as the role of the standards in investment decision-making, innovation and job growth. The survey also aimed to examine perceptions relating to the key technologies required to achieve GHG emission reductions and fuel economy improvements in line with legislative measures in the LDV segment.

The 2020 survey built upon two surveys conducted by Ricardo on behalf of CALSTART in 2018 and 2016, which assessed suppliers' views on the previous Corporate Average Fuel Economy (CAFE) and GHG emission standards. This report captures the key findings from the 2020 survey, as well as providing a comparison to the 2018 and 2016 survey findings, which will be used by CALSTART to inform their strategy for encouraging the adoption of clean LDVs.

2 Policy context

The US National Program for GHG emissions and fuel economy standards for LDVs was developed jointly by the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA), with the first phase of the Program running for model years (MYs) 2012 – 2016.

Following the inception of the Program, between MYs 2013 and 2018, eleven of the fourteen largest manufacturers selling vehicles in the US improved the estimated real-world CO_2 emissions and fuel economy of their new vehicle fleets[2]. By MY 2018, the average estimated real-world CO_2 emission rate for all new vehicles fell to 353 grams per mile, and fuel economy increased by 0.2 miles per gallon to 25.1 miles per gallon (EPA, 2019).

However, in April 2020, the EPA and NHTSA released the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule to amend the previous CAFE and GHG emission standards for LDVs, finalizing the current administration's revisions to the standards for MYs 2021 – 2026. The SAFE Vehicles Rule weakens the previous CAFE and GHG emission standards, to increase annual fuel economy by 1.5% each year to 2026, compared with the previous CAFE standards issued in 2012, which would have increased annual fuel economy by 5% per year to 2025 (NHTSA, 2020).

Internationally, ambition is shifting towards net-zero emissions, and this is being reflected in legislation. For example, the European Commission (2020) has revised its post-2020 CO_2 emission performance standards for LDVs, enhancing ambition and incentivizing a pathway to zero-emission mobility. By 2030, the standards aim to reduce average CO_2 emissions by 37.5% for passenger cars and by 31% for light-commercial vehicles, relative to 2021 levels (European Commission, 2020). Analysis is currently taking place with the aim of possibly further enhancing the ambition of these standards for 2030 and beyond, to align with the European Commission's proposed climate neutrality target for 2050.

At the state level in the US, California is also displaying efforts to enhance ambition. California's zero-emission vehicle (ZEV) mandate requires 'large-volume manufacturers' and 'intermediate-volume manufacturers' to fulfil certain ZEV percentage credit requirements, which increase from 4.5% in 2018 to 22% in 2025 (ICCT, 2020). Overall, the ZEV mandate aims to contribute towards California's

[1] CALSTART has more than 250 member companies engaged in developing and producing cleaner, lower-carbon cars, trucks, buses, and fuels.
[2] Tesla improved fuel economy but not tailpipe CO_2 emissions, due to their fleet being all-electric. The remaining two manufacturers increased CO_2 emissions and decreased fuel economy of their new vehicle fleets.

economy-wide emission reduction target, which requires an average emission reduction of 2% per year between 2030 and 2050, relative to 1990 levels. More recently, California's Governor, Gavin Newsom, has announced intentions to phase out gasoline-powered cars, through issuing an Executive Order, requiring the sale of all new passenger vehicles to be zero-emission by 2035 (State of California, 2020).

On the East Coast, New Jersey Department of Environmental Protection (NJDEP) issued a report in October 2020, recommending that by 2035, 100% of new car, sport utility vehicle (SUV) and light truck sales in the state should be zero-emission vehicles (NJDEP, 2020). The proposed recommendation by Governor Phil Murphy's administration will significantly expand the state's existing targets, with the goal to increase total EV registrations in New Jersey to 330,000 by 2025, and 2 million by 2035, in order to reduce GHG emissions by 80% by 2050, on 2006 levels.

Despite the federal-level rollback of the previous CAFE and GHG emission standards, the broader policy landscape is displaying a shift towards incentivizing the uptake of zero- and low-emission vehicles. Therefore, it is important to consider the level of ambition of the US LDV GHG standards post-2026, the associated impacts, and the potential to align with international policymaking, as well as recognizing state-level measures.

3 Methodology

The primary aim of the survey was to reengage with Tier 1 suppliers, to understand how their views of the US LDV GHG emission standards have developed since 2018. Due to technological advancements and a growing focus on ZEVs, the survey aimed, in particular, to gather responses from suppliers which produce components for electric vehicles (EVs). Therefore, the selection of survey respondents formed a key element of the methodology. This was followed by the design of the survey, developed in close collaboration with CALSTART, and the subsequent analysis of the findings, which is presented in Chapter 4.

3.1 Selection of survey respondents

Building upon the list of stakeholders contacted as part of the 2018 survey, Ricardo developed a comprehensive stakeholder database. The database included supplier organizations provided by CALSTART, as well as those sourced through desk research. Of note, the Automotive News (2019) Top Suppliers List was a key reference document for sourcing additional US-based Tier 1 suppliers. Due to an increasing focus on electrification, a review of the supplier organizations was then undertaken, to understand the proportion of suppliers that produced components for EVs. From a review of their component offerings listed online, 55% of the 135 supplier organizations were found to produce components for EVs.

An initial review of the 2018 stakeholder list allowed us to determine which contacts remained with their respective organizations, and helped to identify gaps in the list. The gaps were supplemented by CALSTART and internet searches, to source replacement contacts. In total, the survey was shared with 377 potential respondents, who were considered to have the necessary expertise, knowledge and seniority to provide insightful and detailed responses to the survey questions. Section 3.3 details the process of engaging with stakeholders and outlines the final response rate.

3.2 Survey design

The survey was designed by Ricardo in collaboration with CALSTART. The survey explored similar themes to the 2018 and 2016 surveys, accounting for policy and technological developments which have occurred since 2018. Due to this, the survey focused more greatly on electrification and ZEV technologies than the previous surveys.

The survey was comprised of a total of 32 questions (see Appendix 1), covering the following themes:

- Existing standards and future ambition;
- Innovation and investments;
- Future policies and employment implications;
- Key technologies for meeting vehicle efficiency standards.

The survey included both closed response questions and open response questions, to allow respondents to elaborate upon their position and provide further detail. Where appropriate, the survey included duplicate, or very similar, questions to the previous surveys, to allow for a comparison of views over time.

Following approval, the survey was designed and distributed via Survey Gizmo[3], an online survey tool which allows for the creation of accessible surveys, and acts as a more efficient means of data collection. Survey Gizmo include smart features, such as survey logic, which limits the chance of overburdening respondents, through only presenting questions of relevance depending on their responses to particular questions.

3.3 Survey release and reminders

Following approval of the list of suppliers and survey questions, the survey was released on July 23, 2020. As indicated in Table 3-1, the initial deadline was set for August 14, 2020, offering approximately three weeks for suppliers to complete the survey. The survey was initially shared with 126 stakeholders in July, and the database was elaborated upon over time to maximize the potential response rate. By August 7, 2020, the survey had been shared with 281 potential respondents.

Between July 23 and August 14, weekly email reminders were sent to the list of stakeholders, and telephone reminders took place in the week commencing August 10, 2020. By August 14, 11 complete responses and five partial responses had been received. To increase the potential number of responses, the survey deadline was extended to September 11, 2020. A further 96 contacts were sourced, and the survey was also shared with these potential respondents. All contacts continued to receive weekly email reminders until the deadline. Six supplier organizations explicitly indicated their inability to complete the survey via email, due to a lack of capacity.

Upon survey closure on September 11, 21 complete responses and 5 partial responses were received, equating to a response rate of 6% (of 377 total contacts). Of the respondents, 20 out of 26 work for suppliers which produce some components for EVs, such as batteries, motors, thermal management systems and drivetrains. This is an important factor to consider when analyzing the survey results.

Table 3-1: Schedule of survey process

Milestone	Date
Circulate survey link with potential participants	July 23, 2020
Initial deadline for completion of the survey	August 14, 2020
Extended deadline for completion of the survey	September 11, 2020

3.4 Survey analysis

Following survey closure, the raw data was exported from Survey Gizmo, into a Microsoft Excel file. The raw data was then cleaned and analyzed using Ricardo's in-house survey analysis tool. The tool allows for more efficient data cleaning, as well as enabling a series of chart formats to be developed.

[3] https://www.surveygizmo.co.uk/

For each of the closed response questions, either pie charts or frequency charts were developed to provide a visual representation of the survey responses. In addition to this, stacked bar charts were developed, to allow for cross-year comparisons to be made between the 2020, 2018 and 2016 surveys (see Appendix 2). The responses to the open questions were also analyzed and have been incorporated into the presentation of results in Chapter 4, to complement the charts by providing additional detail.

4 Survey results

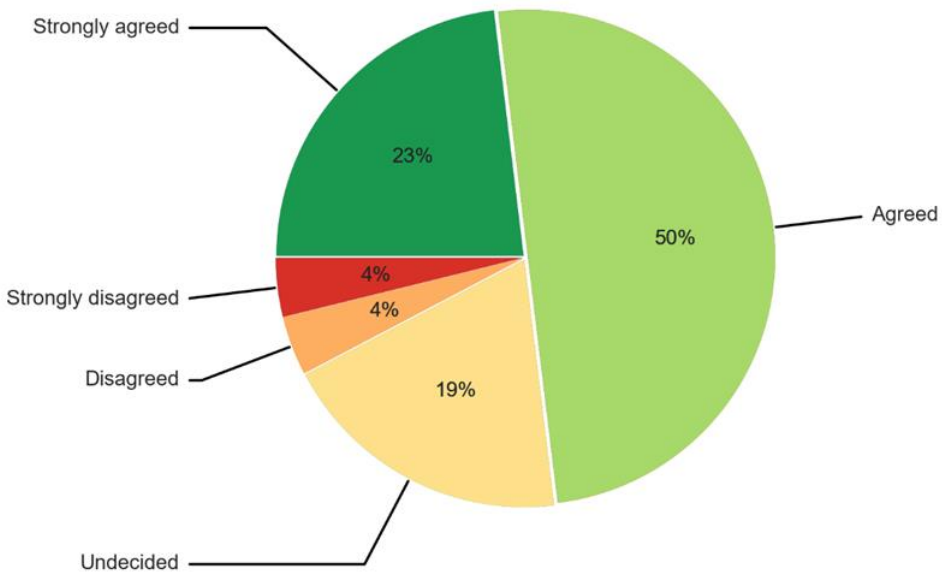
This chapter presents the key findings from the 2020 survey, outlining views on existing standards and future ambition, the impact on innovation and investments, the impact on job growth and perceptions relating to the key technologies required to meet existing and possible future standards. The analysis also indicates where clear consensus can be seen across suppliers, and where more mixed views emerged.

4.1 Existing standards and future ambition

The majority of survey respondents either "strongly agreed" or "agreed" that the previous, more ambitious CAFE and GHG emission standards, were appropriate.

The prior CAFE and GHG emission standards would have increased annual fuel economy by 5% per year for MYs 2022 – 2025. As displayed in Figure 4-1, the majority of respondents (19 out of 26) indicated their agreement with the policy decision in 2016, to reaffirm the CAFE and GHG emission standards in the Mid-term Evaluation (MTE). Only two respondents either strongly disagreed or disagreed with the decision to reaffirm the standards, with the remaining five respondents undecided.

Figure 4-1: Did you agree that the CAFE and GHG emission standards reaffirmed in the MTE in 2016 were appropriate?



The majority of survey respondents either "strongly disagreed" or "disagreed" with the current administration's policy decision to adopt the SAFE Vehicles Rule when it was announced.

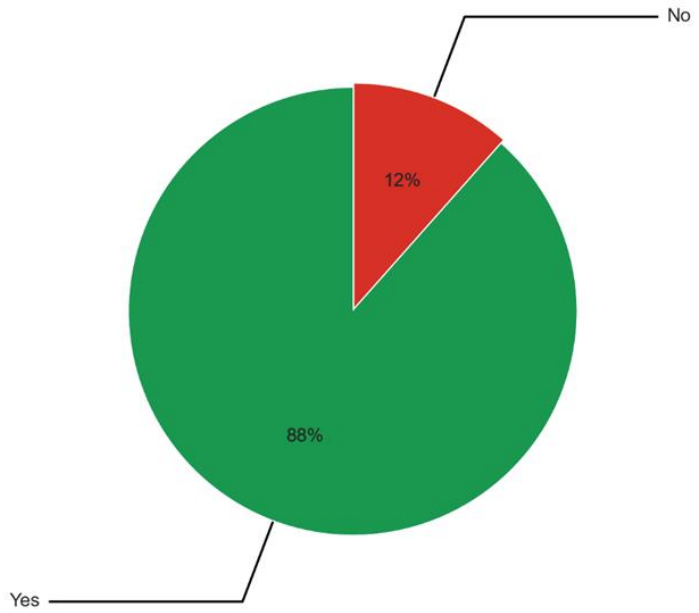
The SAFE Vehicles Rule reduced the magnitude of annual fuel economy improvement requirements from 5% under the CAFE standards, to 1.5%. The majority of respondents (16 out of 26) either strongly disagreed or disagreed with the current administration's policy decision to adopt the SAFE Vehicles

Rule, suggesting a preference for more ambitious standards. The remaining respondents either agreed with the policy decision (4 out of 26), or were undecided (6 out of 26) (See Figure 8-2 in Appendix 2).

The majority of survey respondents stated that it is important to start planning and setting standards now, for beyond 2026.

As displayed in Figure 4-2, the vast majority of respondents (23 out of 26) indicated that it is important to start setting standards now for post-2026. Of the respondents advocating for planning and setting standards now, 19 out of 23 noted long lead times for technological development as a key reason to set standards early, to allow suppliers to prepare for the potential need to invest and diversify product portfolios now, to meet future standards.

Figure 4-2: In your view, is it important to start planning and setting standards now for beyond 2026?



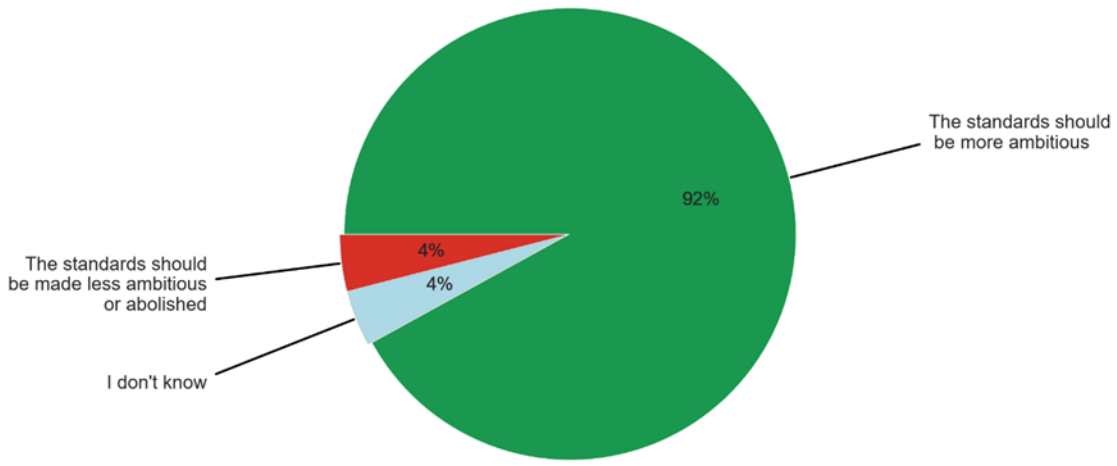
An overwhelming majority of respondents stated that the current LDV GHG emission standards should be made more ambitious post-2026.

As displayed in Figure 4-3, the vast majority of respondents (23 out of 25) indicated that current standards should be made more ambitious post-2026. Only one respondent indicated that the standards should be made less ambitious or abolished. The primary justification expressed by respondents was the belief that more ambitious standards could further drive innovation in the sector and help the US industry to remain competitive. This was followed closely by the opinion that US standards should continue to evolve in line with other major Organization for Economic Co-operation and Development (OECD) nations, and that more ambitious standards will allow US suppliers to develop and sell products which differentiate them from their competitors.

Bringing these arguments around maintaining competitiveness and alignment with other OECD nations together, one respondent stated that '*weakening US standards demonstrates a lack of leadership on the world stage and severely hinders economic growth opportunities for US-based technologies at home and abroad*'. Another respondent explicitly noted the climate emergency as their justification for demanding more ambitious targets, focusing on the broader environmental agenda.

The one respondent that indicated that the standards should be made less ambitious or abolished stated that enhancing ambition would increase the cost of vehicles, which would reduce sales and harm the sector, as well as suggesting that more ambitious standards would harm the position of the US industry relative to international competitors.

Figure 4-3: How do you think that the current LDV GHG standards should be adjusted post-2026?



Responses are more mixed as to whether suppliers would support a regulation which would target 100% ZEV sales by 2035-40.

A small majority of respondents (14 out of 26) indicated that they would support the implementation of a regulation which would target 100% ZEV sales by 2035-40, for the LDV market in the US. Of these respondents, support was associated with the need for the US to converge with global requirements to remain competitive. For example, one respondent suggested that '*US technology companies will have no choice but to seek foreign investment and markets, weakening long-term security in both technology and manufacturing',* should the US not keep pace with other countries.

One respondent stated that a 2035-40 timeframe for 100% ZEV sales is essential to stabilize global temperature increase, in line with the 1.5°C target set out in the Paris Agreement. Another respondent noted that a 2035-40 timeframe offers sufficient time to allow industry to adapt, providing the incentive that some original equipment manufacturers (OEMs) require, relative to manufacturers that solely produce EVs.

However, a significant minority of respondents (10 out of 26) indicated that they would not support such a target. Of those that did not display support, the practicality of the target and the need to decarbonize the grid were noted as justifications.

The majority of respondents stated that achieving 100% ZEV sales by 2035-40 for the LDV market is viable but only a minority of respondents thought this target would be enacted.

The majority of respondents (16 out of 26) stated that achieving 100% ZEV sales by 2035-40 for the LDV market is viable. Of those that stated it was viable, one respondent stated that it is currently technologically feasible, and one respondent indicated that the cost parity between electric vehicles and conventional vehicles is already very close. Of those that disagreed, three respondents indicated that it would not be feasible from a political perspective, and one respondent indicated that there is not sufficient market pull.

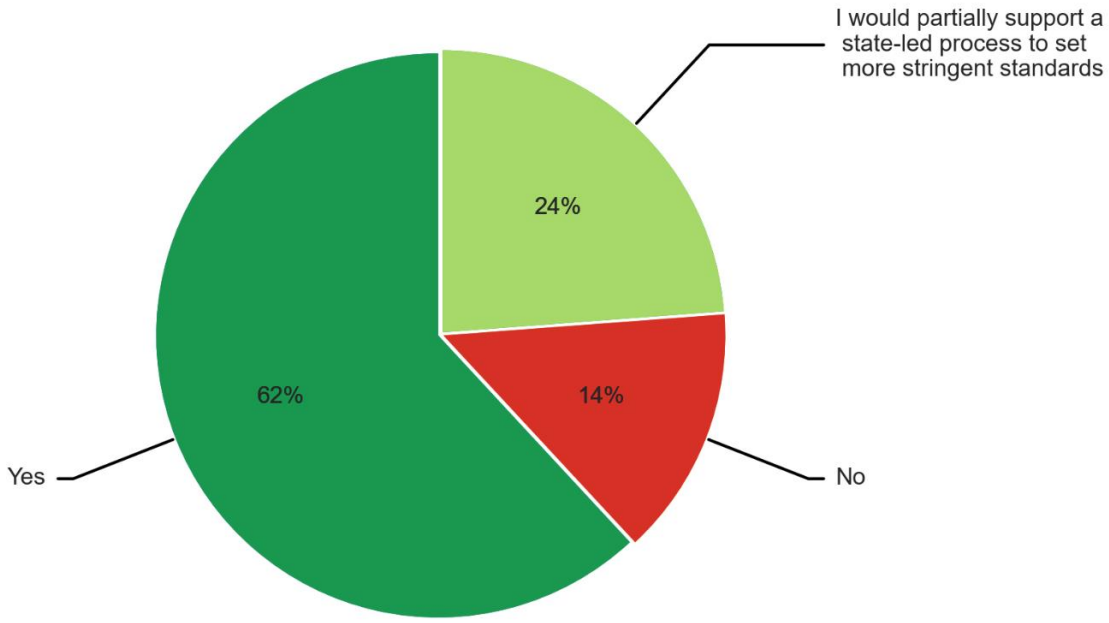
Despite the consensus over viability, a large proportion of respondents (11 out of 26) stated that they did not believe a 100% ZEV sales target for 2035-40 would be enacted. The remaining respondents either believed it would be enacted (6 out of 26) or stated that they did not know (9 out of 26). In support of the target, one respondent suggested that '*the US should aim to be in the vanguard of the zero emission technologies that will be required worldwide to enable countries and regions to move towards net zero emissions. California is leading the way with its Executive Order driving to net zero in 2045, and the European Union is committed to reaching net zero by 2050'*.

The survey closed prior to the announcement from California Governor, Gavin Newsom, that the State of California intends to phase out gasoline-powered cars, through issuing an Executive Order, requiring the sale of all new passenger vehicles to be zero-emission by 2035 (State of California, 2020). This provides the potential for California to steer the way on ZEV sales and adoption, offering a state-level example for federal policy. Although the survey had closed prior to this announcement, it is clear that the majority of respondents support the viability of such a target.

The majority of respondents were in favor of allowing states to maintain the authority to set state-led standards, where these are more stringent than federal standards.

A large majority of respondents (18 out of 21) either support or partially support the continued ability of states to set more stringent standards, with only three respondents stating that they do not support the state-led process. Of those in favor of the state-led process, one respondent noted that *'California is seen as a global leader in driving the uptake of new technologies, so their ability to set more stringent standards should continue',* for the benefit of the US and other regions. Four respondents expressed concern over the need to harmonize standards across states, whilst one respondent stated that a unified national standard was necessary to reduce complexity, and to help avoid confusion.

Figure 4-4: Do you think that California and other states should continue to have the authority to set state-level standards, as long as the standards are more stringent than federal LDV standards?



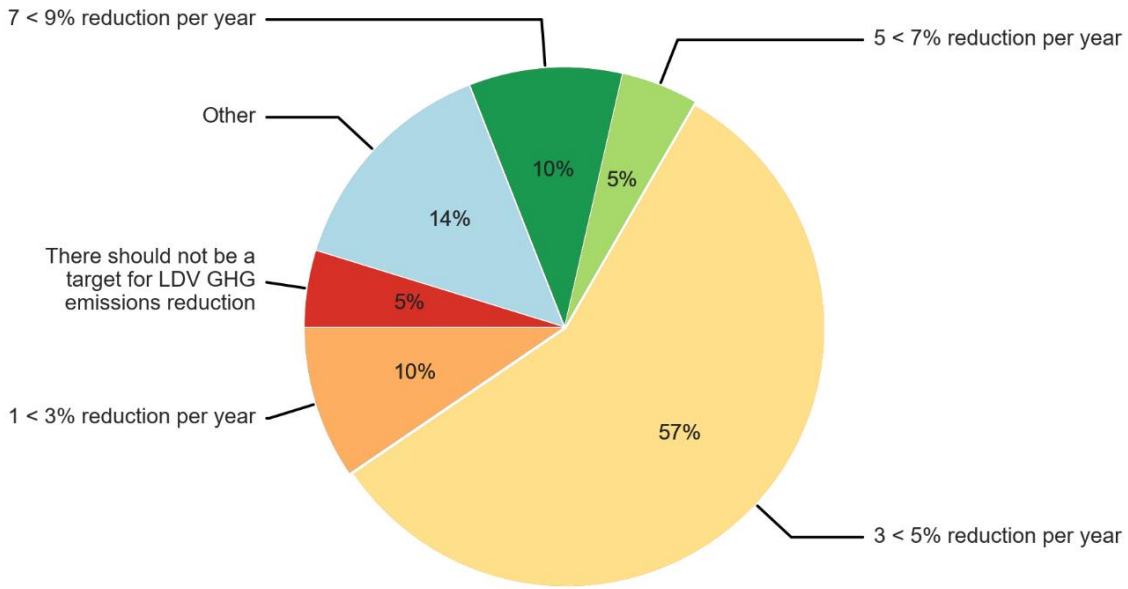
Responses were mixed in regard to the recommended annual GHG emission reduction, though the majority of respondents recommended an annual reduction of 3% or greater.

As displayed by Figure 4-5, the majority of respondents (15 out of 21) indicated a preference for an annual GHG emission reduction target of at least 3%, with the largest group of stakeholders (12 out of 21) indicating a preference for 3 < 5% reduction per year. This seems to align with the ambition of Europe's post-2020 CO_2 emission performance standards, which aim to reduce average CO_2 emissions by an average of 4.5% per year between 2025 and 2030 for passenger cars, and 3.2% for light-commercial vehicles.

Two respondents stated that an annual reduction of 1 < 3 % was preferable, with one respondent indicating that they do not believe that there should be a GHG emission reduction target for LDVs. However, one respondent suggested that the target should be monitored over the coming years as ZEV technologies mature and costs fall, ensuring that the target aligns with the trajectory for net-zero GHG

emissions by 2050. In addition to this, two respondents noted that it will be important for future standards to consider a lifecycle analysis approach, rather than solely focusing on tailpipe emissions.

Figure 4-5: Which of the following targets for LDVs do you think is the best in terms of annual reductions of GHG emissions in the US?



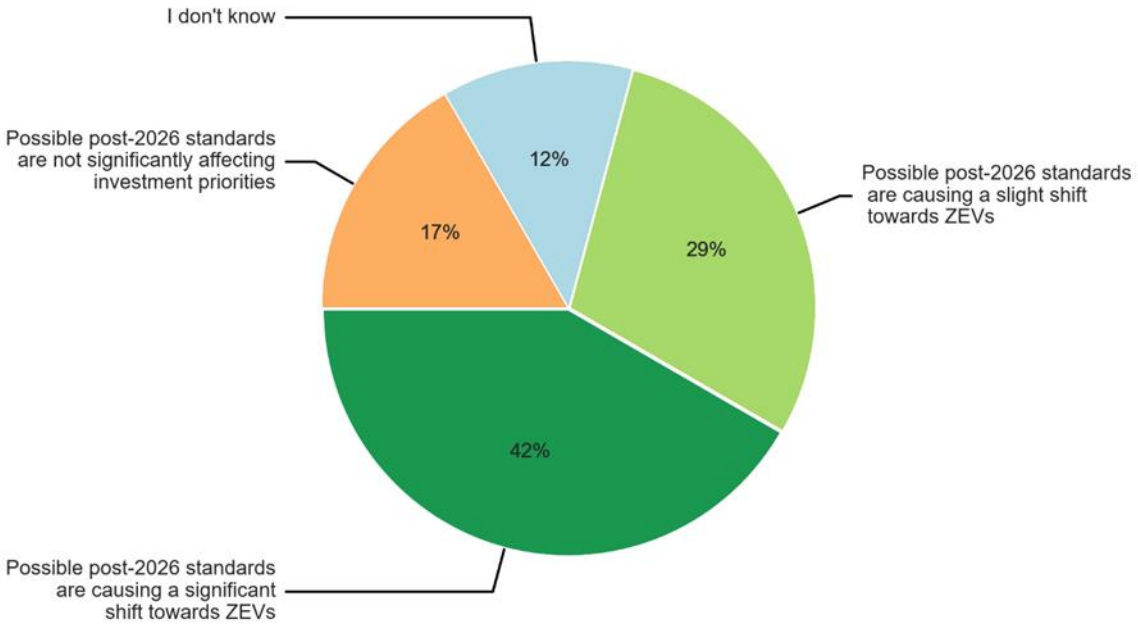
4.2 Innovation and investments

A large majority of respondents stated standards that may come into force beyond 2026 are already causing either a slight or significant shift towards investment in ZEV technologies.

As displayed in Figure 4-6, the majority of respondents (17 out of 24) indicated that possible post-2026 standards are causing either a slight (7 out of 24) or significant (10 out of 24) shift towards investment in ZEV technologies at their companies. Four respondents stated that possible standards which could come into force beyond 2026 are not significantly affecting investment priorities. Of note, fuel economy standards in global markets were considered the most important factor for determining investments in ZEV technologies (16 responses), followed closely by fuel economy standards in the US (13 responses) (see Figure 8-14 in Appendix 2).

In regard to the impact of standards on investment and innovation, one respondent stated that *'standards lead innovation by forcing the industry towards a better future. Standards need to keep forcing innovation, otherwise we will end up less competitive. If the standards are dismissed, we will lose our leadership and weaken our position in a global market*'. This indicates the perceived role of the standards in driving innovation in the US, and maintaining competitiveness. In addition, another respondent noted the importance of maintaining alignment with global standards from a commercial perspective, stating that *'the regulatory environment in the US is important, but any business that wants to be successful needs to design/develop to the toughest standards around the globe'*.

Figure 4-6: Are you making or planning investments in ZEV technologies based on any possible GHG and fuel economy standards, which could come into force beyond 2026 (both production and R&D)?



The majority of respondents perceived vehicle efficiency technologies, and associated standards, as being beneficial from a commercial perspective.

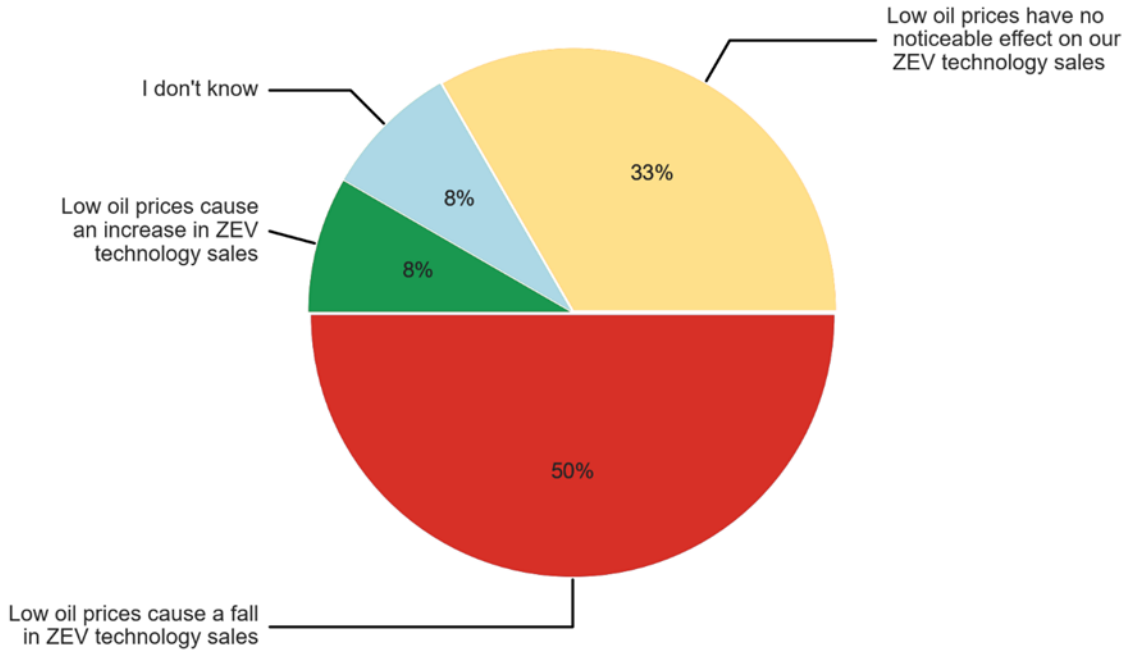
The vast majority of respondents strongly agreed or agreed (17 out of 21) that companies that are leaders in vehicle efficiency technologies will be more successful over the next 10 – 15 years. Similarly, the majority of respondents strongly agreed or agreed (17 out of 21) that more ambitious US LDV vehicle efficiency standards tend to encourage more innovation and investment in the US. Therefore, there seems to be a general consensus that more ambitious standards, and an increased shift towards vehicle efficiency technologies, will benefit the sector both in terms of financial success and competitiveness, and in terms of enhancing innovation and investment.

There was a more mixed level of agreement with the statement 'the current Safe Vehicles Rule includes a requirement for an annual 1.5% improvement in fuel economy to 2026. If standards were implemented beyond 2026, which included a lower level of ambition, the US market would fail to benefit from investments already made in fuel efficiency technologies'. A small majority of respondents (11 out of 20) either strongly agreed or agreed with this statement. A further 2 out of 20 respondents neither agreed nor disagreed, with the remaining 7 out of 20 respondents disagreeing with the statement. This suggests that, from a supplier perspective, there is potential for the market to lose out on the potential benefits associated with past investments in fuel efficiency technologies, should further rollbacks occur.

Responses were mixed as to the impact of low oil prices on ZEV technology sales, with half of the respondents stating that low oil prices cause a fall in ZEV technology sales.

As displayed in Figure 4-7, half of the respondents (12 out of 24) indicated that low oil prices tend to result in a decrease in the sale of ZEV technologies. The next largest group of respondents (8 out of 24) stated that low oil prices do not have a notable effect on ZEV sales. Although this indicates a mixed level of agreement, the largest proportion of stakeholders display their belief that ZEV technology sales are likely to fall in the event of low oil prices.

Figure 4-7: What effect do low oil prices have on the sales of ZEV technologies that your company produces?



4.3 Future policies and employment implications

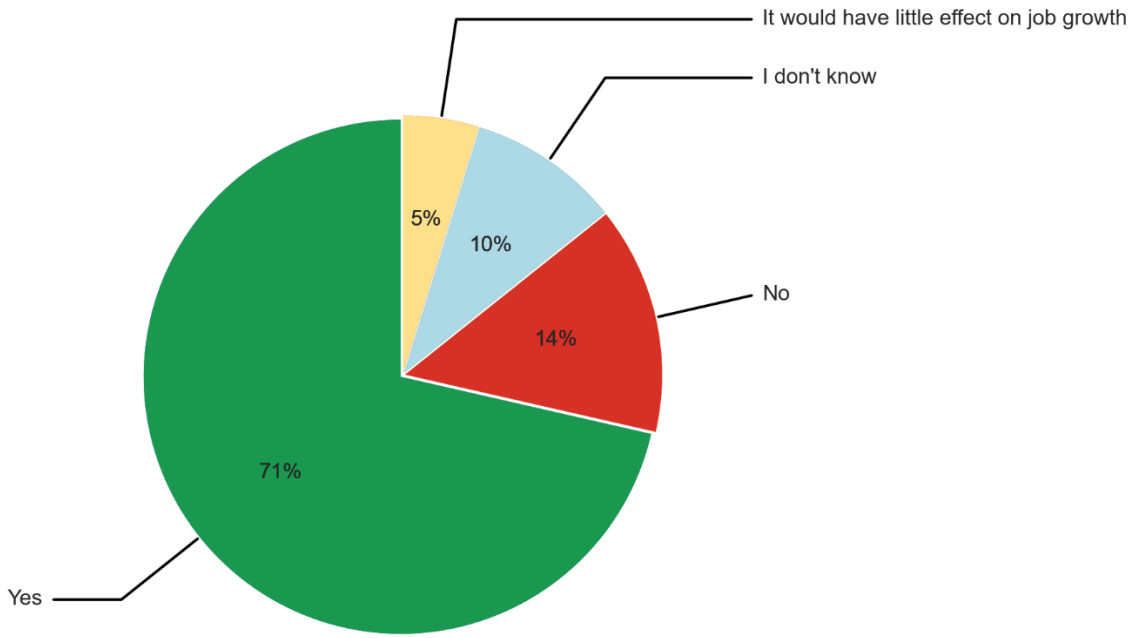
The majority of respondents stated that US policies that encourage or force the uptake of ZEVs also encourage job growth at their companies in the US.

The majority of respondents (13 out of 21) stated that policies which encourage the uptake of ZEVs generally result in job growth at their company. Four respondents indicated that adapting to such policies would not influence job growth at their company, and only two respondents stated that adapting to such policies tends to reduce job growth at their company.

The majority of respondents suggested that a more ambitious ZEV sales target would help encourage job growth in the sector.

As displayed by Figure 4-8, a large majority of respondents (15 out of 21) stated that, if a more ambitious sales target for ZEVs was implemented, it would lead to job growth in the sector. Three respondents suggested that a more ambitious target would reduce job growth in the sector, while only one respondent stated that it would have little effect on job growth.

Figure 4-8: If a more ambitious ZEV sales target was introduced, do you think that it would help encourage job growth in your sector?



Responses were mixed as to whether ambitious post-2026 standards, which drive the uptake of ZEVs, would encourage job growth in the wider US economy.

The largest group of respondents (9 out of 21) indicated that adapting to such policies is likely to encourage job growth in the wider US economy. Only one respondent stated that such policies reduce jobs in the wider US economy, and five respondents suggested that adapting to such policies would have little effect on job growth in the US.

Therefore, there is a general consensus that policies which encourage the uptake of ZEVs, and hence increase innovation in the automotive sector, would encourage job growth in the US. However, the consensus amongst respondents is that this is more likely to happen at the industry or company level, rather than across the US economy as a whole.

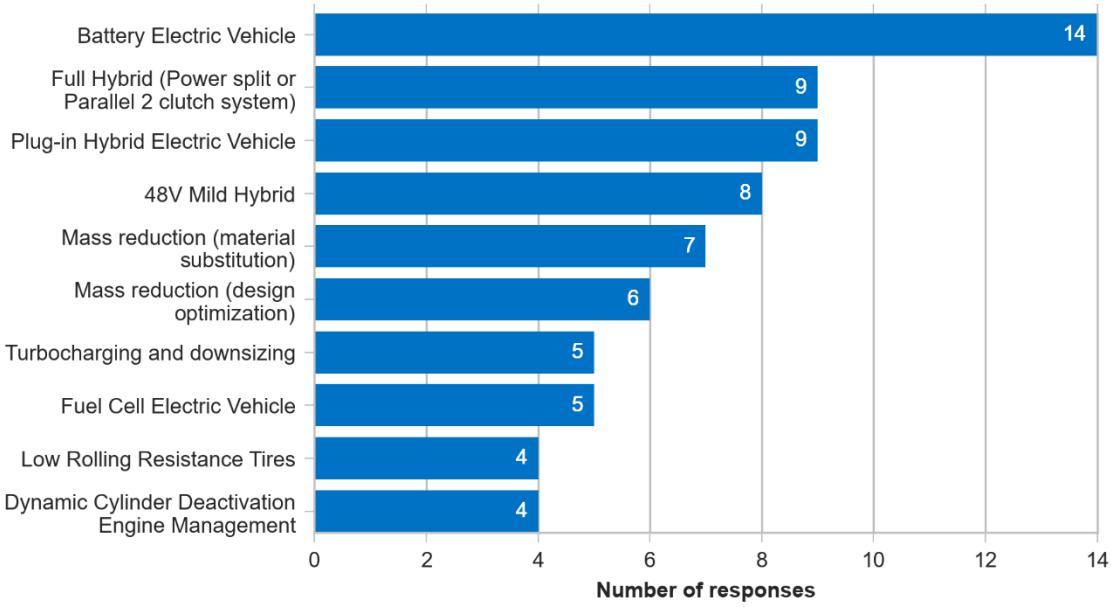
4.4 Key technologies

To gain a view from suppliers on the key technologies required to meet certain regulatory measures, respondents were asked to select up to five key technologies, which they considered most important for achieving prior, existing and future GHG emission standards.

Battery electric vehicles (BEVs) and hybrid technologies were viewed as key to meeting the prior 2025 LDV GHG standards.

As displayed in Figure 4-9, BEVs were viewed as key to achieving the more ambitious 2025 LDV GHG standards by the largest number of respondents (14 out of 21). In order to meet these stricter standards, hybrid vehicle technologies were also viewed as key, with both full hybrid (Power split or parallel 2 clutch system) and plug-in hybrid electric vehicle (PHEVs) receiving support from nine respondents respectively.

Figure 4-9: Which of the following technologies would you view as key for meeting the prior 2025 LDV GHG standards, proposed in the MTE in 2016?



BEVs, turbocharging and downsizing, and stop-start (12V Microhybrid) were viewed as the key technologies required to meet the SAFE Vehicles Rule.

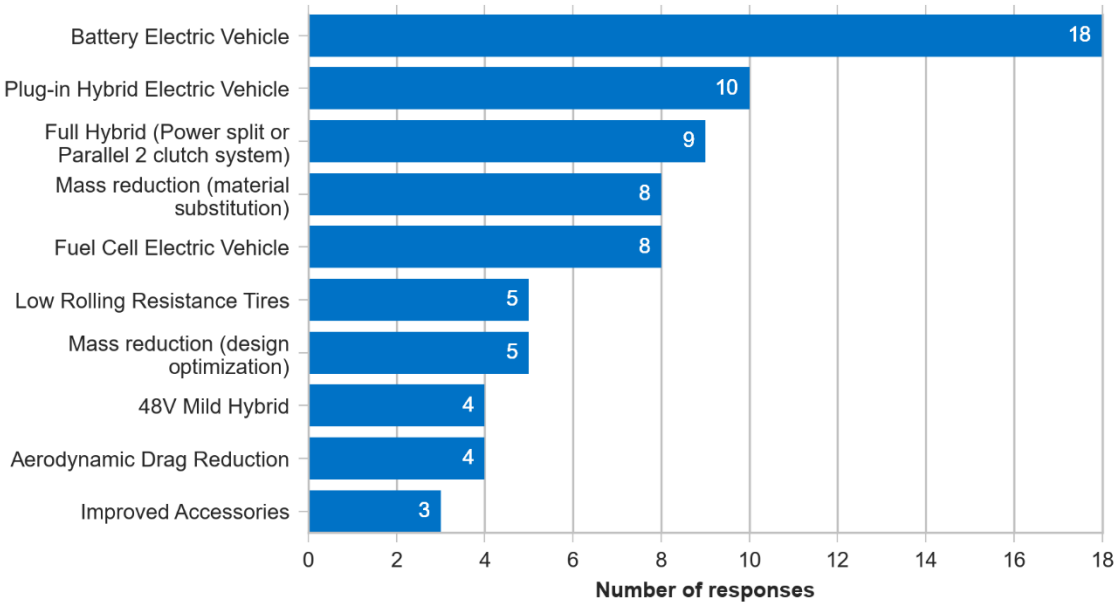
As indicated by Figure 8-24 in Appendix 2, BEVs were perceived as key for meeting the SAFE Vehicles Rule by the highest number of respondents (15 out of 21), followed by turbocharging and downsizing (9 out of 21), and stop-start (12V Microhybrid) (8 out of 21). Mass reduction was also perceived as important. Table 8-24 in Appendix 2 presents the full list of technologies (and associated responses), indicating that a number of technologies were only viewed as important by one or none of the respondents.

In regard to the post-2026 period, the majority of respondents viewed BEVs as the most important technology required for reducing GHG emissions and improving fleet average fuel economy.

As displayed in Figure 4-10, over 80% of respondents (18 out of 21) suggested that BEVs are key for the post-2026 period. PHEVs were also perceived as key by a large proportion of respondents (10 out of 21), as were full hybrid systems (9 out of 21). A moderately high number of respondents (8 out of 21) indicated that fuel cell electric vehicles (FCEVs) were key, under this more future-focused question.

Therefore, for prior, existing and future standards, BEVs were viewed as the most important technology required to meet these legislative targets. Alongside BEVs, other EV types, including PHEVs and FCEVs, were also perceived as key, particularly in a post-2026 world. This indicates an increasing recognition of the importance of electrification in achieving the targets set out in LDV GHG emission standards. However, it is worth noting here that the majority of stakeholders that responded to the survey already produce components for EVs, which could influence their perception of the key technologies required to meet the standards.

Figure 4-10: Beyond 2026, which of the following technologies do you view as key for reducing GHG emissions and improving fleet average fuel economy?

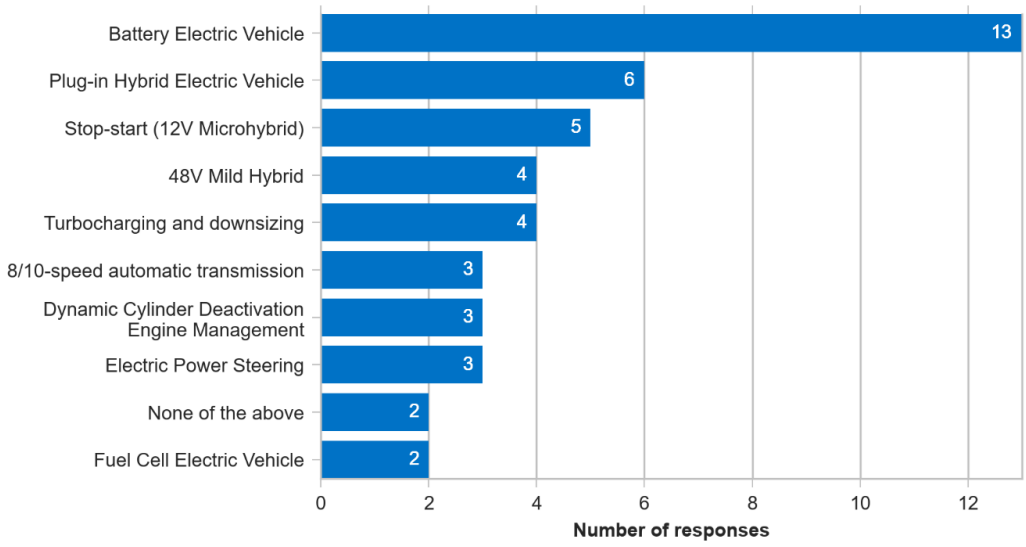


Advances in BEV technology have exceeded expectations more significantly than advances in other technologies, compared to what was anticipated in 2016.

As displayed in Figure 4-11, over half of the respondents (13 out of 21) indicated that BEVs had advanced more quickly than was anticipated in 2016. Despite the support for BEVs, one respondent noted the challenges associated with implementing the necessary charging infrastructure to support BEV uptake, suggesting the potential to shift investment towards other technologies, such as FCEVs.

Although BEVs were viewed as advancing more quickly by the highest number of respondents, PHEVs and stop-start (12V Microhybrid) were also perceived to have advanced more quickly than anticipated by six and five respondents, respectively. Other technologies were also considered to have advanced more quickly than was anticipated, which increases the potential for a more rapid shift towards low-emission transportation, should these technologies be adopted at scale. In addition to this, one respondent suggested that significant investment from Tier 1 suppliers, to bring technologies to market in a cost-effective manner, has improved the value proposition for these leading technologies.

Figure 4-11: Has the development and introduction of any of the technologies listed advanced more quickly than was anticipated in 2016?



5 Comparison with 2018 and 2016 survey results

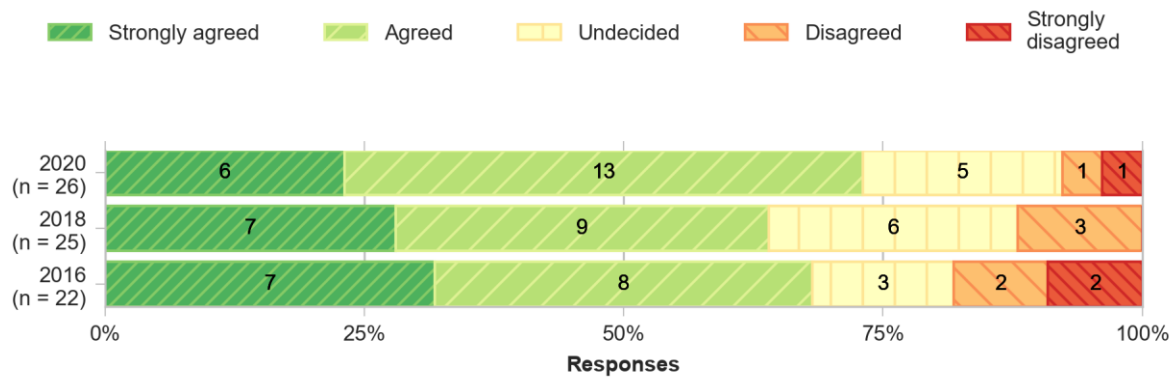
This chapter presents a high-level comparison of the results from the 2020 survey, with the 2018 and 2016 survey results. Although the respondents were not the same, and some of the survey questions have been adjusted over time to reflect technological and policy developments, this comparison provides an indication of how suppliers views have evolved over time.

5.1 Existing standards and future ambition

The responses in all three survey years are similar with respect to 2025 standards: the majority of survey respondents agreed with the 2016 policy decision to reaffirm the CAFE and GHG emission standards.

As displayed in Figure 5-1, in all three years at least 64% of respondents either strongly agreed or agreed with the decision to reaffirm the previous CAFE and GHG emission standards in 2016. Although respondents were not asked to provide justification for their responses in 2020, in the previous years, respondents indicated the need for regulatory certainty and the potential for standards to drive innovation as key reasons for displaying support for the standards in their previous form.

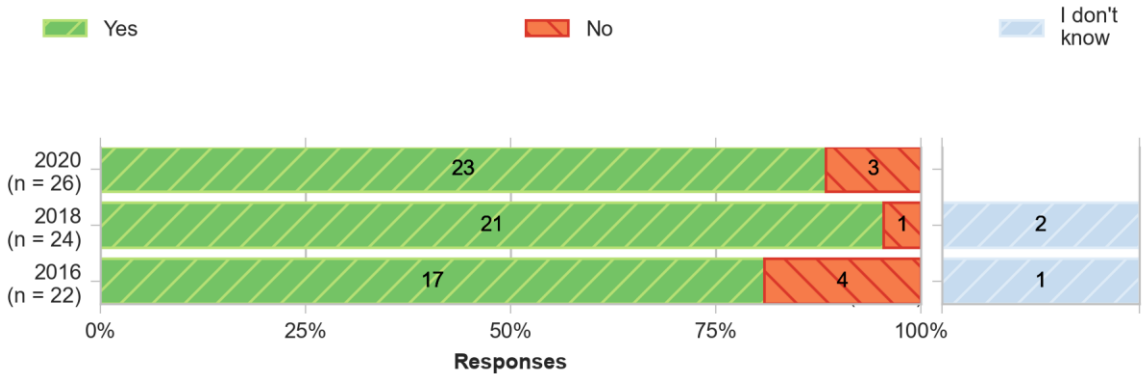
Figure 5-1: Did you agree with the policy decision to set the target for 2025 when it was announced?



Respondents in all three survey years almost unanimously indicated that it is important to start planning ahead for future standards.

As displayed in Figure 5-2, the majority of respondents to all three surveys indicated their preference for planning and setting targets now for beyond 2026 (or beyond 2025 in the case of the 2018 and 2016 surveys). Across all three years, the most common justifications for setting standards early were the long lead times required for technological development, and the need for regulatory certainty to reduce the risk associated with investing in new technologies. In the 2020 and 2018 surveys, respondents echoed the need to set more ambitious standards for environmental purposes, referring to the need to address climate issues. In addition, both 2020 and 2018 respondents noted a desire for the US to align its policymaking with other nations.

Figure 5-2: In your view, is it important to start planning and setting targets now for beyond 2026[4]?

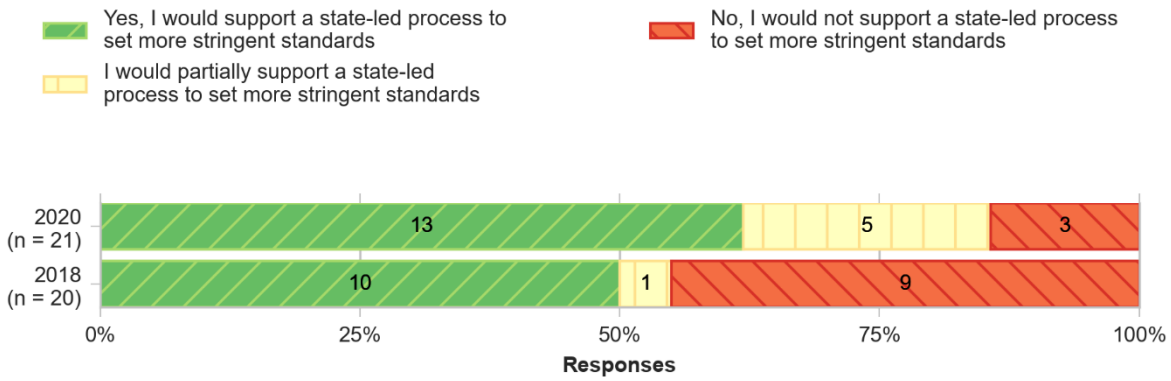


A higher proportion of respondents displayed direct support for a state-led process to set more stringent standards in the 2020 survey than in the 2018 survey.

As displayed in Figure 5-3, responses were relatively mixed in regard to support for a state-led process in 2018, with only 10 out of 20 respondents indicating direct support. However, in 2020, a higher proportion of stakeholders (13 out of 21) displayed direct support for maintaining the authority of states to set state-level standards, and a significantly lower proportion of stakeholders displayed a direct lack of support for such a process (3 out of 21). In 2018, similarly to the responses in 2020, justifications for not displaying support for a state-led process were primarily related to a lack of desire for varying fuel economy standards across the nation, so as to avoid complexity.

[4] In the 2018 and 2016 surveys, 2025 was referenced rather than 2026, due to the status of policymaking at the time.

Figure 5-3: Do you think that California and other states should continue to have the authority to set state-level standards[5]?

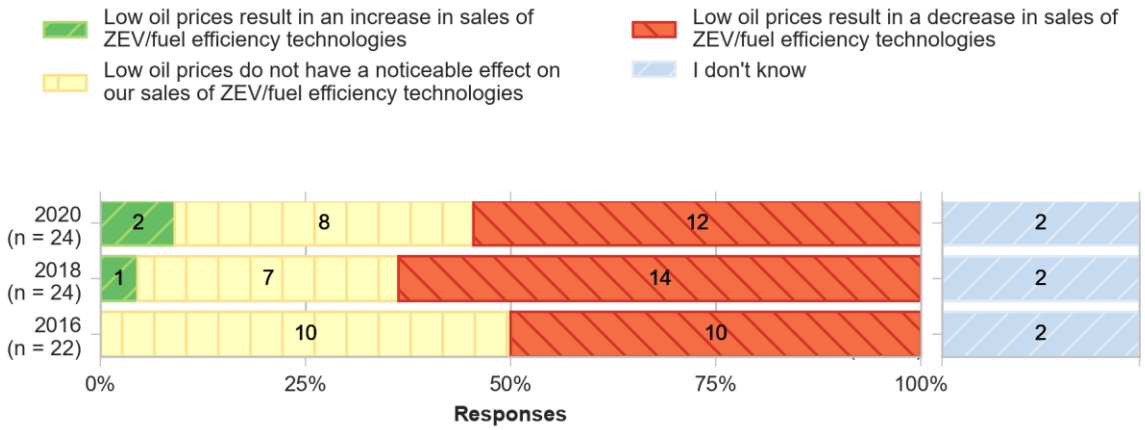


5.2 Innovation and investments

A lack of consensus on the role of low oil prices on the sale of ZEV/fuel efficiency technologies prevails across all three survey years.

As displayed in Figure 5-4, the responses to the surveys in 2016 and 2020 display a lack of consensus on the role of low oil prices, with no majority view (although a large proportion of stakeholders in 2020 indicated that low oil prices result in a decrease in sales of ZEV technologies). Although the responses in 2018 were still mixed, there was a majority view, where 14 out of 24 respondents indicating their agreement with the position that low oil prices result in a decrease in the sale of fuel efficiency technologies.

Figure 5-4: What effect do low oil prices have on the sales of ZEV/fuel efficiency technologies[6] that your company produces?



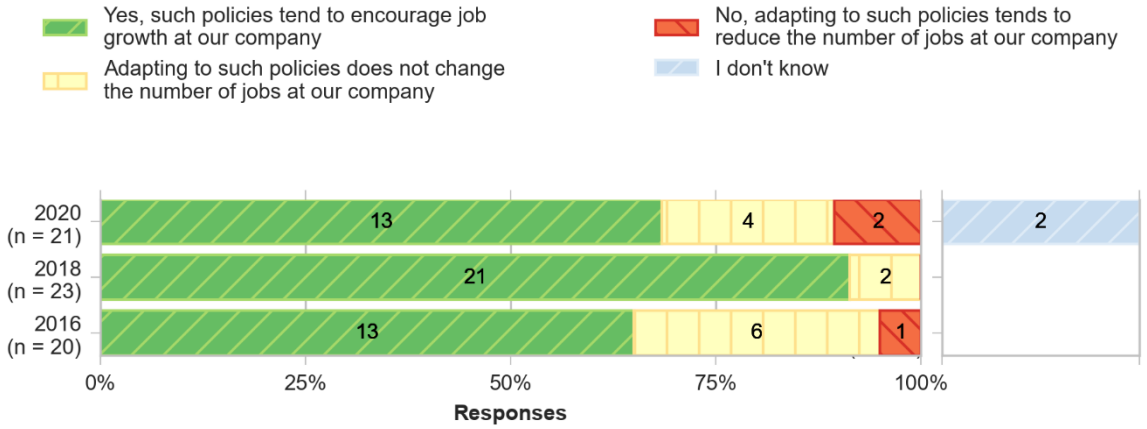
[5] This question was not included in the 2016 survey.
[6] In 2020, the survey question asked about the sales of ZEV technologies. In 2018 and 2016, the survey asked about fuel efficiency technologies.

5.3 Future policies and employment implications

Across all three survey years, the majority of respondents indicated that US policies that encourage the uptake of ZEVs/fuel efficiency technologies also encourage job growth at their companies.

As displayed in Figure 5-5, in 2016 the majority of respondents indicated that policies which force or encourage the uptake of fuel efficiency technologies tend to encourage job growth at their companies. The 2018 survey results displayed an even higher level of agreement, with 21 out of 23 respondents stating that such policies tend to encourage job growth at their company. Despite continued agreement in 2020, the level of agreement fell, with only 13 out of 21 respondents stating that such policies tend to encourage job growth at their company. As respondents were not asked to provide a justification for their response to this question, it is not possible to determine the potential reasons for this relative decline in agreement.

Figure 5-5: In general, do US policies that encourage or force the uptake of ZEVs/fuel efficiency improvements[7] also encourage job growth for your company in the US?

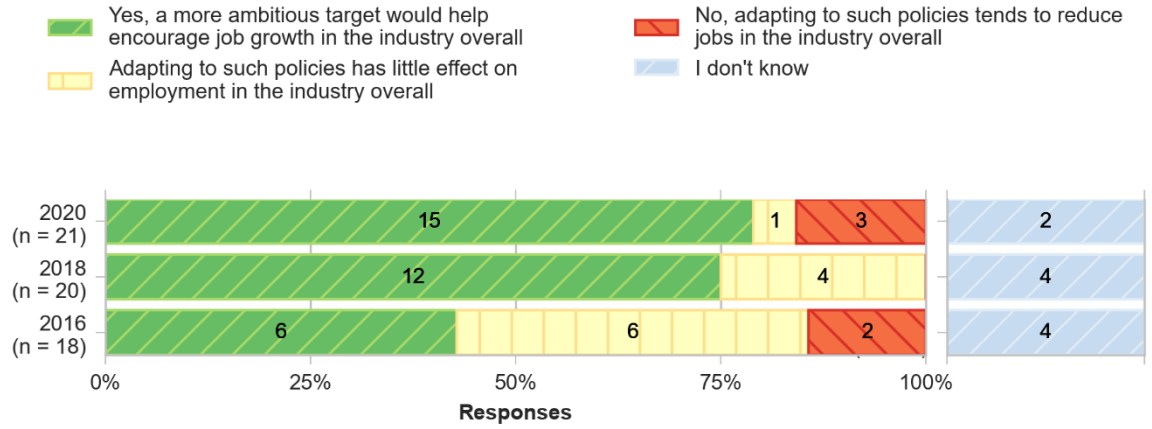


The support for the link between policies which encourage the uptake of ZEVs/fuel efficiency improvements and job growth has continued to grow every survey year.

As displayed in Figure 5-6, in 2016, there was a mixed response in regard to the role of policies which encourage the uptake of ZEVs/fuel efficiency improvements on job growth in the industry. However, in 2018, and even more significantly in 2020, a growing proportion of respondents have found that policies which encourage ZEV uptake/fuel efficiency improvements lead to job growth in the sector.

[7] In 2020, the survey question asked about the uptake of ZEV technologies. In 2018 and 2016, the survey asked about fuel efficiency improvements.

Figure 5-6: In general, do US policies that encourage or force the uptake of ZEVs/fuel efficiency improvements[8] also encourage job growth for your company in your industry overall?



5.4 Key technologies

Perceptions relating to key technologies have shifted since 2018 and 2016, where engine turbocharging and downsizing was perceived the most important technology required to meet the prior CAFE and GHG emission standards. In 2020, BEVs were perceived as the most important technology for achieving emission reductions and fuel economy improvements in line with all policy scenarios.

In 2018, the majority of survey respondents (15 out of 25) indicated that engine turbocharging and downsizing, and 48 Volt mild hybrid systems were key for meeting the prior CAFE and GHG emission standards. Similarly, in 2016, the technology that was most frequently viewed as key to meeting the prior standards was engine turbocharging and downsizing. Although BEVs and PHEVs were also viewed as relatively important technologies in the previous survey years, the 2020 survey has seen a significant shift in the appreciation for electrification as a means of achieving targets outlined in both existing and possible future standards.

6 Conclusions

Through engaging with Tier 1 suppliers, a greater understanding of their views on the US LDV GHG emission standards has been developed, which builds upon the results from the 2018 and 2016 surveys. A high level of consensus can be seen amongst suppliers in regard to the vast majority of topic areas, with the exception of the likelihood of a 100% ZEV sales target for 2035-40 and the role of low oil prices in ZEV technology sales.

With regard to existing standards and future ambition, **the majority of respondents disagreed with the current federal administration's policy decision to adopt the SAFE Vehicles Rule**. In addition to this, an overwhelming majority of respondents (23 out of 25) indicated that **standards should be made more ambitious post-2026**, to further drive innovation in the sector and to help the US industry to remain competitive.

The vast majority of respondents (23 out of 26) also agreed that it is **important to start planning and setting targets now for beyond 2026**, to account for the long lead time required for technological development, and to speed up the transition towards low-carbon technology uptake to support climate change response.

[8] In 2020, the survey question asked about the uptake of ZEV technologies. In 2018 and 2016, the survey asked about fuel efficiency improvements.

The majority of respondents (18 out of 21) stated that **they would support, or partially support, a state-led process to set more stringent LDV standards**. However, a number of respondents indicated that a single federal-level standard would be preferable, from a planning perspective, and to help avoid confusion.

With regard to a 100% ZEV sales target for 2035-40, the responses displayed a more mixed level of support. A small majority of respondents (14 out of 26) indicated that they would support the implementation of the target, to allow the US to align with global requirements, and to remain competitive. In addition, the majority of respondents (16 out of 26) stated that **achieving 100% ZEV sales by 2035-40 for the LDV market is viable**, indicating the existing technical feasibility. However, of those that did not consider the target to be viable, the lack of political feasibility was referenced.

The majority of respondents strongly agreed or agreed (17 out of 21) that **more ambitious US LDV vehicle efficiency standards tend to encourage more innovation and investment in the US**. Therefore, there seems to be a general consensus that more ambitious standards, and an increased shift towards the uptake of vehicle efficiency technologies, will benefit the sector in terms of competitiveness, and in terms of enhancing innovation and investment.

There is a general consensus that **policies which encourage the uptake of ZEVs, and hence increase innovation in the automotive sector, would encourage job growth in the US**. However, the consensus amongst respondents is that this is more likely to happen at the industry (15 out of 21) or company level (13 out of 21), rather than across the US economy as a whole.

For prior, existing and future standards, **BEVs were viewed as the most important technology required to meet these legislative targets**. Alongside BEVs, other EV types, including PHEVs and FCEVs, were also perceived as key, particularly in a post-2026 world. This indicates an increasing recognition of the importance of electrification in achieving the targets set out in LDV GHG emission standards, relative to the 2018 and 2016 survey results.

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8 Appendices

Appendix 1: Online survey questions

Appendix 2: Survey charts and results

Appendix 1: Online survey questions

This Appendix provides a copy of the online survey questions presented to suppliers.

2020 Survey of Tier 1 Automotive Suppliers

Introduction

On behalf of CALSTART, Ricardo is carrying out a survey of Tier 1 automotive suppliers, which aims to gather views in relation to the current US light-duty vehicle (LDV) greenhouse gas (GHG) emissions standards, and post-2026 ambition. The survey aims to gather views on the current and future ambition of the standards, insights into the role of the standards in investment decision-making and job growth, and perceptions relating to the key technologies required to achieve GHG emissions reductions and fuel economy improvements beyond 2026.

Thank you for taking the time to participate in the study, which will provide CALSTART with invaluable insights into the existing LDV GHG standards and ambition beyond 2026. The survey will remain open until Friday 11 September 2020.

In order to analyze the responses to the survey, we will request some personal information. Through completing this survey, you are providing consent to Ricardo to store your data. Your personal data will not be shared with any third party outside of this study and your responses to the survey will be used solely for this project. All responses will be held only by Ricardo, and will be aggregated and anonymized before publication of any reports based on our analysis.

If you have any questions, please do not hesitate to contact us at calstart.survey@ricardo.com.

1) Respondent information

Name*: _____

Email address*: _____

Company name*: _____

Street address: _____

Contact telephone number: _____

US LDV GHG Standards

Background

The US National Program for GHG emissions and fuel economy standards for LDVs was developed jointly by the Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA).

In April 2020, the EPA and NHTSA released the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule to amend the previous Corporate Average Fuel Economy (CAFE) and GHG emissions standards for LDVs, finalizing the current administration's revisions to the standards for model years 2021 through 2026.

The SAFE Vehicles Rule weakens the previous CAFE and GHG emissions standards, to increase the annual fuel economy improvement by 1.5% each year to 2026, compared with the previous CAFE standards issued in 2012, which would have increased the annual fuel economy improvement by 5% per year to 2025.

Internationally, ambition is shifting towards net-zero emissions, and this is being reflected in legislation. For example, the European Commission is considering the revision of its CO_2 emission performance standards for LDVs, to encourage a pathway to zero-emission mobility from 2025 onwards. Therefore,

it is important to consider the level of ambition of the US LDV GHG standards post-2026, the associated impacts, and the potential to align with international policymaking.

Further information is available from the following links:

- LDV GHG Standards Overview
- LDV Trends Report

2) Did you agree that the CAFE and GHG emissions standards reaffirmed in the Mid-term Evaluation in 2016 (to increase the annual fuel economy improvements by 5% per year for model years 2022-2025) were appropriate?

( ) Strongly disagreed ( ) Disagreed ( ) Undecided ( ) Agreed ( ) Strongly agreed

3) Did you agree with the administration's policy decision to adopt the SAFE Vehicles Rule when it was announced?

( ) Strongly disagreed ( ) Disagreed ( ) Undecided ( ) Agreed ( ) Strongly agreed

4) How do you think that the current LDV GHG standards should be adjusted post-2026?

( ) The standards should be made less ambitious or abolished ( ) The standards should be more ambitious ( ) I don't know

5) Why should the standards be made less ambitious or abolished post-2026? Please select all that apply.

[ ] It will increase the cost of vehicles, which will reduce sales and harm the sector

[ ] We will not be able to pass on associated increases in R&D or production costs to Original Equipment Manufacturers (OEMs), which will harm our business

[ ] It will harm the position of the US industry relative to international competitors

[ ] Consumers are less accepting of high efficiency technology, especially given the low oil prices

[ ] Other - please specify: _____

6) Why should the standards be made more ambitious than their current form post-2026? Please select all that apply.

[ ] More ambitious standards could help our company develop a leadership role in future vehicle technologies and help us stay competitive in the long run

[ ] More ambitious standards could further drive innovation in the sector and help the US industry remain competitive

[ ] More ambitious standards will allow us to develop products/sell products which differentiate us from our competitors

[ ] US standards are in line with those in other major OECD nations and should continue to evolve accordingly

[ ] Other - please specify: _____

7) In your view, is it important to start planning and setting standards now for beyond 2026? Please explain your response choice.

( ) Yes: _____

( ) No: _____

( ) I don't know

8) Would you support the implementation of a regulation which would target 100% zero-emission vehicle (ZEV) sales by 2035-40, for the LDV market in the US? Please explain your choice.

( ) Yes: _____

( ) No: _____

( ) I don't know

9) Do you think that it is likely that a regulation implementing a 100% ZEV sales target for 2035-40 for the LDV market would be enacted? Please explain your choice.

( ) Yes: _____

( ) No: _____

( ) I don't know

10) Do you think that achieving 100% ZEV sales by 2035-40 for the LDV market is viable? Please explain your choice.

( ) Yes: _____

( ) No: _____

( ) I don't know

11) Please provide any further comments you have in relation to the existing GHG and fuel economy standards, post-2026 ambition and ZEV sales.

_____

_____

_____

_____

LDV GHG Standards and Investments

12) Are you making or planning investments in ZEV technologies based on any possible GHG and fuel economy standards, which could come into force beyond 2026 (both production and R&D)?

( ) Yes, any possible standards which could come into force beyond 2026 are causing a **significant** shift in investment towards ZEV technologies

( ) Yes, any possible standards which could come into force beyond 2026 are causing a **slight** shift in investment towards ZEV technologies

( ) No, any possible standards which could come into force beyond 2026 are **not** significantly affecting investment priorities

( ) I don't know

13) If the level of ambition of the current standards is maintained/if no new standards are introduced beyond 2026, what effect will this have on your (planned) investments?

( ) Reduce investment in ZEV technologies

( ) No change in investment priorities

( ) Increase investment in ZEV technologies

( ) I don't know

Please explain your response choice:

_____

14) Which factors are more relevant for determining investments into ZEV technologies? Please select all that apply.

[ ] Fuel economy standards in the US

[ ] Fuel economy standards in global markets (e.g. EU, China)

[ ] Competition for better fuel economy within the industry even in the absence of government standards

[ ] Other - please specify: _____

15) If the level of ambition of the current standards is maintained/if no new standards are introduced beyond 2026, what effect would this have on your production of ZEV technologies?

( ) I would expect a reduction in demand for products designed for ZEVs

( ) I would expect no change in demand for products designed for ZEVs

( ) I would expect an increase in demand for products designed for ZEVs

( ) I don't know

Please explain your response choice:

_____

16) Which factors are more relevant for driving demand for ZEV technologies? Please select all that apply.

[ ] Fuel economy standards in the US

[ ] Fuel economy standards in global markets (e.g. EU, China)

[ ] Competition for better fuel economy within the industry even in the absence of government standards

[ ] Other - please specify: _____

17) What effect do low oil prices have on the sales of ZEV technologies that your company produces?

( ) Low oil prices result in an increase in sales of ZEV technologies

( ) Low oil prices result in a decrease in sales of ZEV technologies

( ) Low oil prices do not have a noticeable effect on our sales of ZEV technologies

( ) I don't know

18) Please provide any further comments you have in relation to the effect of the GHG and fuel economy standards on investments in ZEV technologies.

_____

_____

_____

_____

Future policies and employment

19) In general, do US policies that encourage or force the uptake of ZEVs also encourage job growth for your company in the US?

( ) Yes, such policies tend to encourage job growth at our company

( ) Adapting to such policies does not change the number of jobs at our company

( ) No, adapting to such policies tends to reduce the number of jobs at our company

( ) I don't know

( ) Other - please specify: _____

20) Will ambitious post-2026 standards, which drive an increase in the uptake of ZEVs, help encourage job growth in the wider US economy?

( ) Yes, such policies tend to encourage job growth in the wider US economy

( ) Adapting to such policies has little effect on job growth in the wider US economy

( ) No, adapting to such policies tends to reduce jobs in the wider US economy

( ) I don't know

( ) Other - please specify: _____

21) If a more ambitious ZEV sales target was introduced, do you think that it would help encourage job growth in your sector?

( ) Yes, a more ambitious target would help encourage job growth in the sector

( ) Adapting to such policies has little effect on job growth in the sector

( ) No, adapting to such policies tends to reduce jobs in the sector

( ) I don't know

( ) Other - please specify: _____

22) Do you think that California and other states should continue to have the authority to set state-level standards, as long as the standards are more stringent than federal LDV standards?

( ) Yes, I would support a state-led process to set more stringent LDV standards

( ) I would partially support a state-led process to set more stringent standards

( ) No, I would not support a state-led process to set more stringent standards

Please explain your response choice:

_____

23) Europe's post-2020 CO_2 emission performance standards for LDVs aim to reduce average CO_2 emissions by an average of 4.5% per year between 2025 and 2030 for passenger cars, and 3.2% for light-commercial vehicles (relative to 2021 levels). Analysis is currently taking place with the aim of possibly enhancing the ambition of

these standards for 2030 and beyond, to align with the European Commission's proposed climate neutrality target for 2050.

California's ZEV mandate requires 'large-volume manufacturers' and 'intermediate-volume manufacturers' to fulfil certain ZEV percentage credit requirements, which increase from 4.5% in 2018 to 22% in 2025. Overall, the ZEV mandate aims to contribute towards California's economy-wide emission reduction target, which requires an average emission reduction of 2% per year between 2030 and 2050, relative to 1990 levels.

Based on these two examples, which of the following targets for LDVs do you think is the best in terms of annual reductions of GHG emissions in the US?

( ) 1 < 3% reduction per year

( ) 3 < 5% reduction per year

( ) 5 < 7% reduction per year

( ) 7 < 9% reduction per year

( ) I do not think there should be a target for reducing GHG emissions for LDVs

( ) Other - please specify: _____

Your views

24) Please indicate your level of agreement or disagreement with the following statement: I believe that the companies that are leaders in vehicle efficiency technologies will be more successful over the next 10 - 15 years.

( ) Strongly disagree ( ) Disagree ( ) Neither agree nor disagree ( ) Agree ( ) Strongly agree

25) Please indicate your level of agreement or disagreement with the following statement: More ambitious US LDV vehicle efficiency standards tend to encourage more innovation and investment in the US.

( ) Strongly disagree ( ) Disagree ( ) Neither agree nor disagree ( ) Agree ( ) Strongly agree

26) Please indicate your level of agreement or disagreement with the following statement: The current Safe Vehicles Rule includes a requirement for an annual 1.5% improvement in fuel economy to 2026. If standards were implemented beyond 2026, which included a lower level of ambition, the US market would fail to benefit from investments already made in fuel efficiency technologies.

( ) Strongly disagree ( ) Disagree ( ) Neither agree nor disagree ( ) Agree ( ) Strongly agree

27) Please provide any further comments you have in relation to these statements.

_____

_____

_____

_____

Key technologies

28) Which of the following technologies do you view as key for meeting the SAFE Vehicles Rule? Please select the five most important technologies.

[ ] Stop-start (12V Microhybrid)

[ ] Integrated Starter Generator

[ ] 48V Mild Hybrid

[ ] Full Hybrid (Power split or Parallel 2 clutch system)

[ ] Plug-in Hybrid Electric Vehicle (PHEV)

[ ] Battery Electric Vehicle (BEV)

[ ] Fuel Cell Electric Vehicle (FCEV)

[ ] Flex-fuel vehicle

[ ] Natural gas/biomethane powertrain

[ ] Low friction lubricants

[ ] Engine friction reduction

[ ] Variable valve timing and lift

[ ] Dynamic Cylinder Deactivation Engine Management

[ ] Stoichiometric Gasoline Direct Injection (GDI)

[ ] Compression Ratio Increase

[ ] Atkinson Cycle plus Compression Ratio Increase (e.g. Mazda SkyActiv-G)

[ ] Turbocharging and downsizing

[ ] Miller cycle for turbocharged engines

[ ] Cooled EGR

[ ] Electrically Assisted Variable Speed Supercharger

[ ] Variable Compression Ratio

[ ] Lean Burn

[ ] Gasoline compression ignition (e.g. Mazda SPCCI for 2019)

[ ] 8/10-speed automatic transmission

[ ] Dual Clutch Transmissions (DCT) (6/8/10 speed)

[ ] Continuously Variable Transmissions (CVT)

[ ] Improved CVT system (e.g. Dana Variglide)

[ ] Electric Power Steering

[ ] Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)

[ ] Mass reduction (design optimization)

[ ] Mass reduction (material substitution)

[ ] Low Rolling Resistance Tires

[ ] Aerodynamic Drag Reduction

[ ] None of the above

[ ] Other - please specify: _____

29) Which of the following technologies would you view as key for meeting the prior 2025 LDV GHG standards, proposed in the Mid-term Evaluation in 2016? Please select the five most important technologies.

[ ] Stop-start (12V Microhybrid)

[ ] Integrated Starter Generator

[ ] 48V Mild Hybrid

[ ] Full Hybrid (Power split or Parallel 2 clutch system)

[ ] Plug-in Hybrid Electric Vehicle (PHEV)

[ ] Battery Electric Vehicle (BEV)

[ ] Fuel Cell Electric Vehicle (FCEV)

[ ] Flex-fuel vehicle

[ ] Natural gas/biomethane powertrain

[ ] Low friction lubricants

[ ] Engine friction reduction

[ ] Variable valve timing and lift

[ ] Dynamic Cylinder Deactivation Engine Management

[ ] Stoichiometric Gasoline Direct Injection (GDI)

[ ] Compression Ratio Increase

[ ] Atkinson Cycle plus Compression Ratio Increase (e.g. Mazda SkyActiv-G)

[ ] Turbocharging and downsizing

[ ] Miller cycle for turbocharged engines

[ ] Cooled EGR

[ ] Electrically Assisted Variable Speed Supercharger

[ ] Variable Compression Ratio

[ ] Lean Burn

[ ] Gasoline compression ignition (e.g. Mazda SPCCI for 2019)

[ ] 8/10-speed automatic transmission

[ ] Dual Clutch Transmissions (DCT) (6/8/10 speed)

[ ] Continuously Variable Transmissions (CVT)

[ ] Improved CVT system (e.g. Dana Variglide)

[ ] Electric Power Steering

[ ] Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)

[ ] Mass reduction (design optimization)

[ ] Mass reduction (material substitution)

[ ] Low Rolling Resistance Tires

[ ] Aerodynamic Drag Reduction

[ ] None of the above

[ ] Other - please specify: _____

30) Beyond 2026, which of the following technologies do you view as key for reducing GHG emissions and improving fleet average fuel economy? Please select the five most important technologies.

[ ] Stop-start (12V Microhybrid)

[ ] Integrated Starter Generator

[ ] 48V Mild Hybrid

[ ] Full Hybrid (Power split or Parallel 2 clutch system)

[ ] Plug-in Hybrid Electric Vehicle (PHEV)

[ ] Battery Electric Vehicle (BEV)

[ ] Fuel Cell Electric Vehicle (FCEV)

[ ] Flex-fuel vehicle

[ ] Natural gas/biomethane powertrain

[ ] Low friction lubricants

[ ] Engine friction reduction

[ ] Variable valve timing and lift

[ ] Dynamic Cylinder Deactivation Engine Management

[ ] Stoichiometric Gasoline Direct Injection (GDI)

[ ] Compression Ratio Increase

[ ] Atkinson Cycle plus Compression Ratio Increase (e.g. Mazda SkyActiv-G)

[ ] Turbocharging and downsizing

[ ] Miller cycle for turbocharged engines

[ ] Cooled EGR

[ ] Electrically Assisted Variable Speed Supercharger

[ ] Variable Compression Ratio

[ ] Lean Burn

[ ] Gasoline compression ignition (e.g. Mazda SPCCI for 2019)

[ ] 8/10-speed automatic transmission

[ ] Dual Clutch Transmissions (DCT) (6/8/10 speed)

[ ] Continuously Variable Transmissions (CVT)

[ ] Improved CVT system (e.g. Dana Variglide)

[ ] Electric Power Steering

[ ] Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)

[ ] Mass reduction (design optimization)

[ ] Mass reduction (material substitution)

[ ] Low Rolling Resistance Tires

[ ] Aerodynamic Drag Reduction

[ ] None of the above

[ ] Other - please specify: _____

31) Has the development and introduction of any of the technologies listed advanced more quickly than was anticipated in 2016? Please select up to five technologies that have advanced more quickly.

[ ] Stop-start (12V Microhybrid)

[ ] Integrated Starter Generator

[ ] 48V Mild Hybrid

[ ] Full Hybrid (Power split or Parallel 2 clutch system)

[ ] Plug-in Hybrid Electric Vehicle (PHEV)

[ ] Battery Electric Vehicle (BEV)

[ ] Fuel Cell Electric Vehicle (FCEV)

[ ] Flex-fuel vehicle

[ ] Natural gas/biomethane powertrain

[ ] Low friction lubricants

[ ] Engine friction reduction

[ ] Variable valve timing and lift

[ ] Dynamic Cylinder Deactivation Engine Management

[ ] Stoichiometric Gasoline Direct Injection (GDI)

[ ] Compression Ratio Increase

[ ] Atkinson Cycle plus Compression Ratio Increase (e.g. Mazda SkyActiv-G)

[ ] Turbocharging and downsizing

[ ] Miller cycle for turbocharged engines

[ ] Cooled EGR

[ ] Electrically Assisted Variable Speed Supercharger

[ ] Variable Compression Ratio

[ ] Lean Burn

[ ] Gasoline compression ignition (e.g. Mazda SPCCI for 2019)

[ ] 8/10-speed automatic transmission

[ ] Dual Clutch Transmissions (DCT) (6/8/10 speed)

[ ] Continuously Variable Transmissions (CVT)

[ ] Improved CVT system (e.g. Dana Variglide)

[ ] Electric Power Steering

[ ] Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)

[ ] Mass reduction (design optimization)

[ ] Mass reduction (material substitution)

[ ] Low Rolling Resistance Tires

[ ] Aerodynamic Drag Reduction

[ ] None of the above

[ ] Other - please specify: _____

Please explain your response choice(s):

_____

32) Do you have any additional comments on the topics covered in this survey?

_____

_____

_____

_____

Appendix 2: Survey charts and results

This Appendix includes all of the charts and summary tables produced for the closed response survey questions. This includes comparative bar charts, which display how supplier views have evolved since the 2018 and 2016 surveys.

US LDV GHG Standards

Figure 8-1: Did you agree that the CAFE and GHG emission standards reaffirmed in the MTE in 2016 (to increase the annual fuel economy improvements by 5% per year for model years 2022-2025) were appropriate?

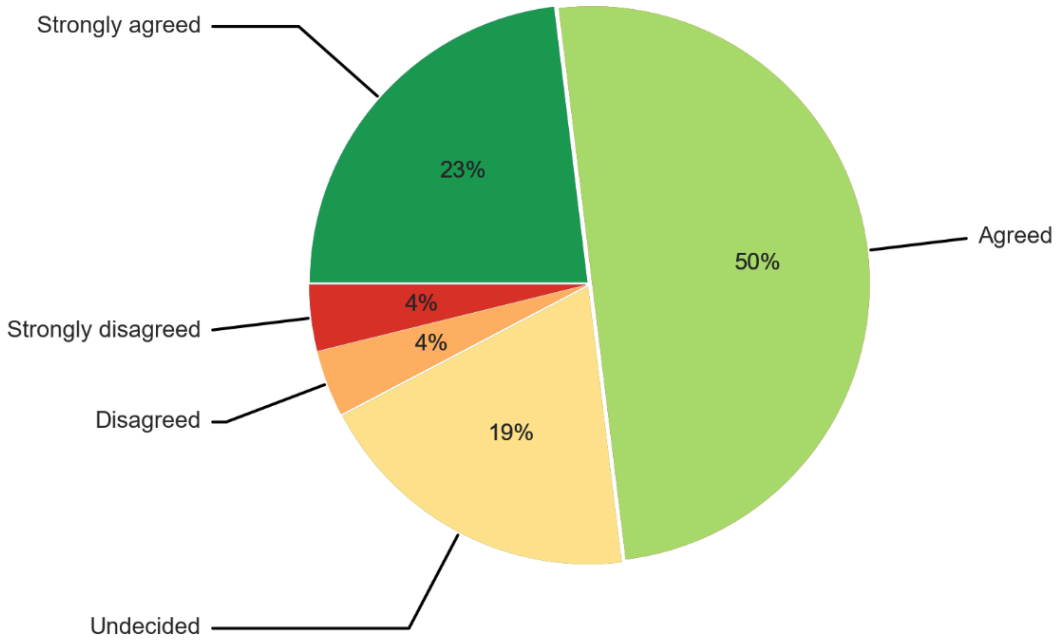

Table 8-1: Summary of responses

Response	Percentage	Count
Strongly disagreed	3.8%	1
Disagreed	3.8%	1
Undecided	19.2%	5
Agreed	50.0%	13
Strongly agreed	23.1%	6
Total	**100%**	**26**

Figure 8-2: Did you agree with the administration's policy decision to adopt the SAFE Vehicles Rule when it was announced?

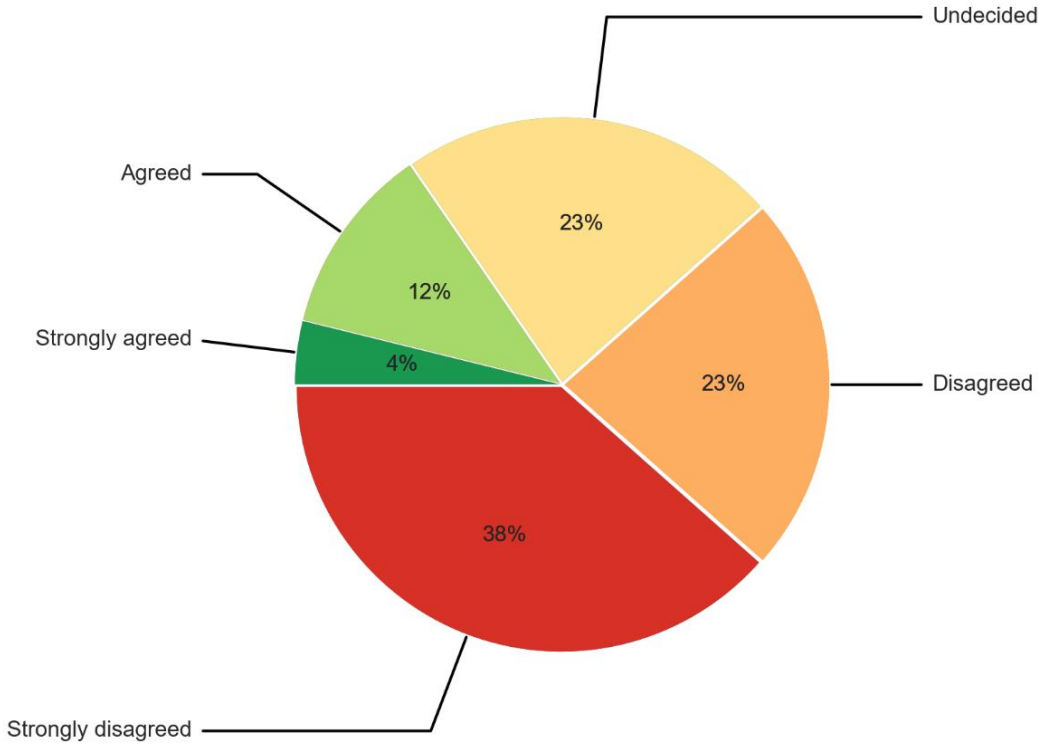

Table 8-2: Summary of responses

Response	Percentage	Count
Strongly disagreed	38.5%	10
Disagreed	23.1%	6
Undecided	23.1%	6
Agreed	11.5%	3
Strongly agreed	3.8%	1
Total	**100%**	**26**

Figure 8-3: How do you think that the current LDV GHG standards should be adjusted post-2026?

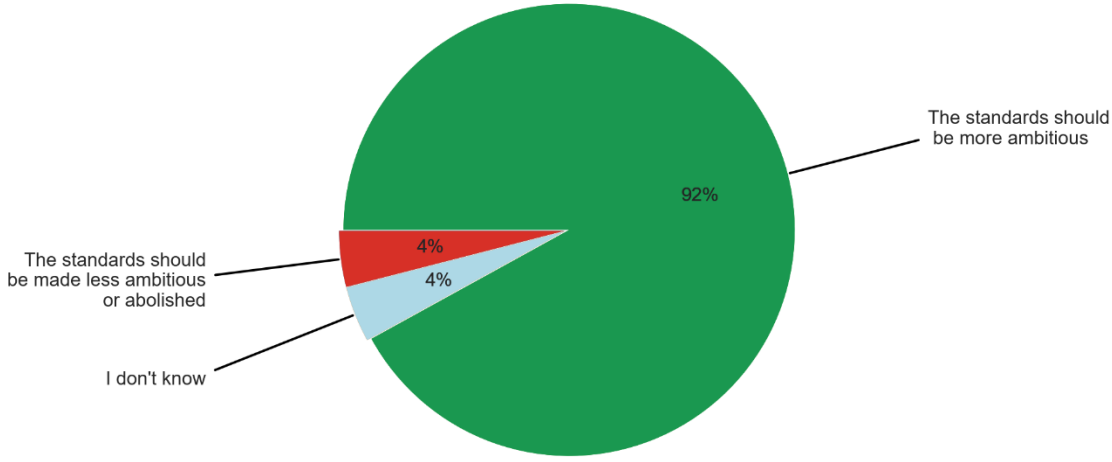

Table 8-3: Summary of responses

Response	Percentage	Count
The standards should be made less ambitious or abolished	4.0%	1
The standards should be more ambitious	92.0%	23
I don't know	4.0%	1
Total	**100%**	**25**

Figure 8-4: Why should the standards be made less ambitious or abolished post-2026[9]?

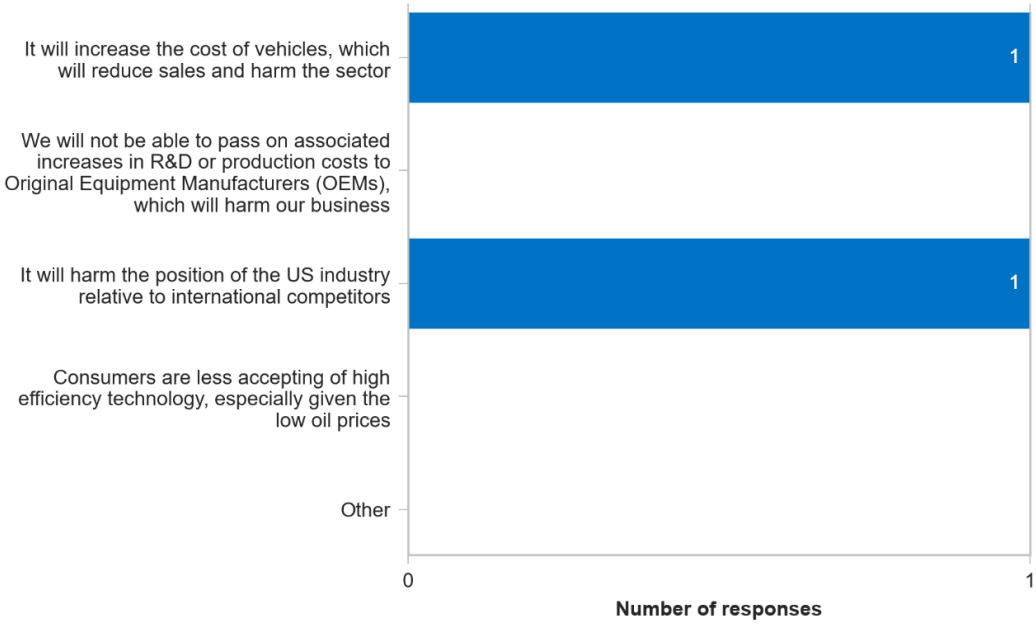

Table 8-4: Summary of responses[10]

Response	Count
It will increase the cost of vehicles, which will reduce sales and harm the sector	1
It will harm the position of the US industry relative to international competitors	1
Total	**2**

[9] This question was only displayed to the respondent that suggested LDV GHG standards should be made less ambitious or abolished.
[10] Percentages are not presented for frequency charts, as the percentages would indicate the proportion of total responses, rather than the proportion of total respondents.

Figure 8-5: Why should the standards be made more ambitious than their current form post-2026[11]?

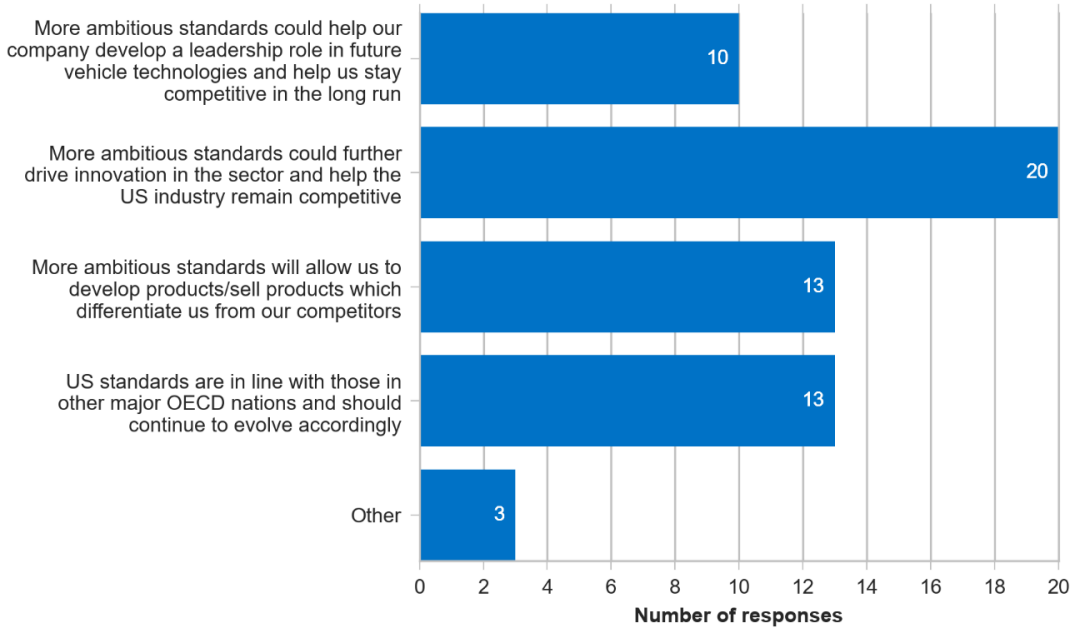

Table 8-5: Summary of responses

Response	Count
More ambitious standards could help our company develop a leadership role in future vehicle technologies and help us stay competitive in the long run	10
More ambitious standards could further drive innovation in the sector and help the US industry remain competitive	20
More ambitious standards will allow us to develop products/sell products which differentiate us from our competitors	13
US standards are in line with those in other major OECD nations and should continue to evolve accordingly	13
Other	3
Total	**59**

[11] This question was only displayed to the respondent that suggested LDV GHG standards should be made more ambitious and participants were able to select multiple responses.

Figure 8-6: In your view, is it important to start planning and setting standards now for beyond 2026?

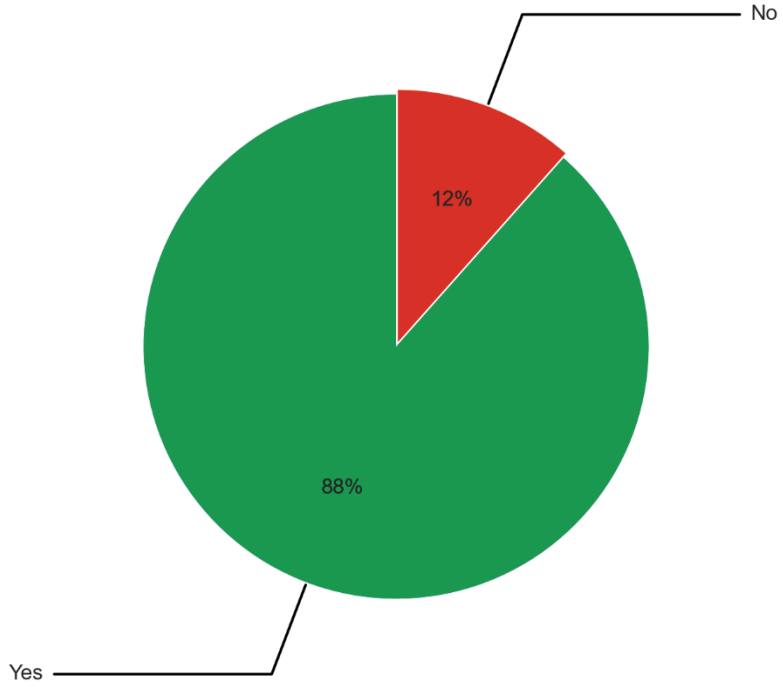

Table 8-6: Summary of responses

Response	Percentage	Count
Yes	88.5%	23
No	11.5%	3
Total	**100%**	**26**

Figure 8-7: Would you support the implementation of a regulation which would target 100% ZEV sales by 2035-40, for the LDV market in the US?

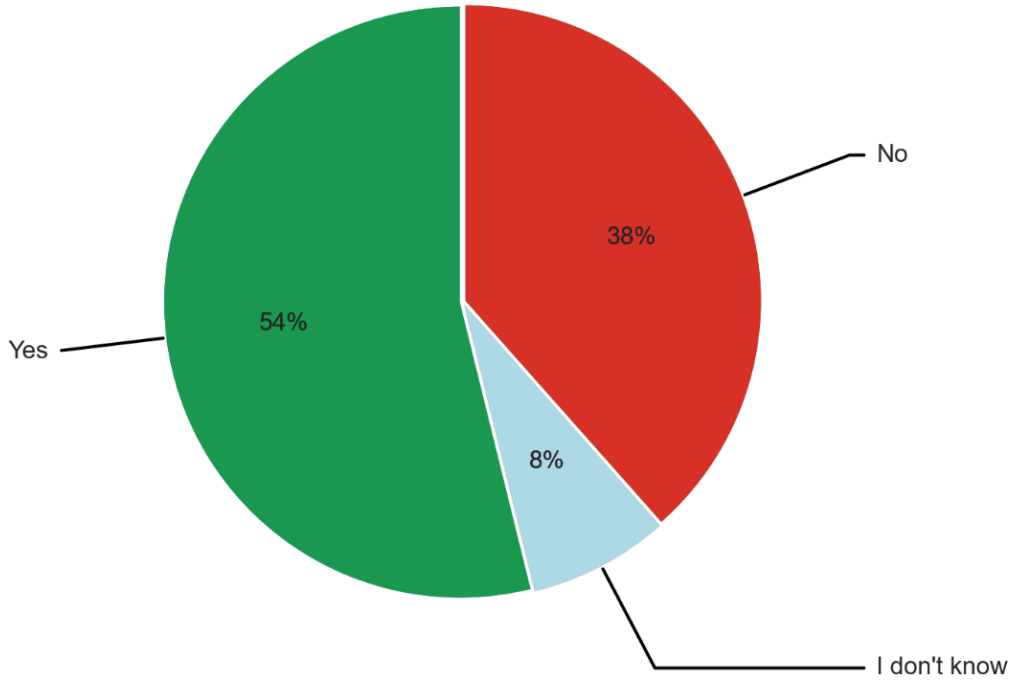

Table 8-7: Summary of responses

Response	Percentage	Count
Yes	53.8%	14
No	38.5%	10
I don't know	7.7%	2
Total	**100%**	**26**

Figure 8-8: Do you think that it is likely that a regulation implementing a 100% ZEV sales target for 2035-40 for the LDV market would be enacted?

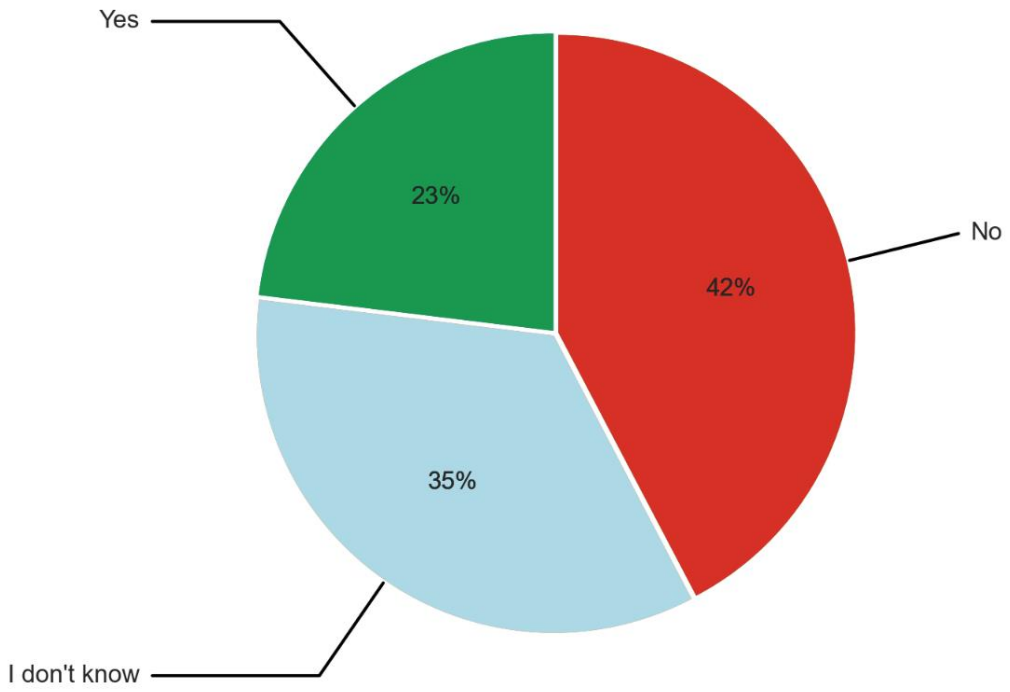

Table 8-8: Summary of responses

Response	Percentage	Count
Yes	23.1%	6
No	42.3%	11
I don't know	34.6%	9
Total	**100%**	**26**

Figure 8-9: Do you think that achieving 100% ZEV sales by 2035-40 for the LDV market is viable?

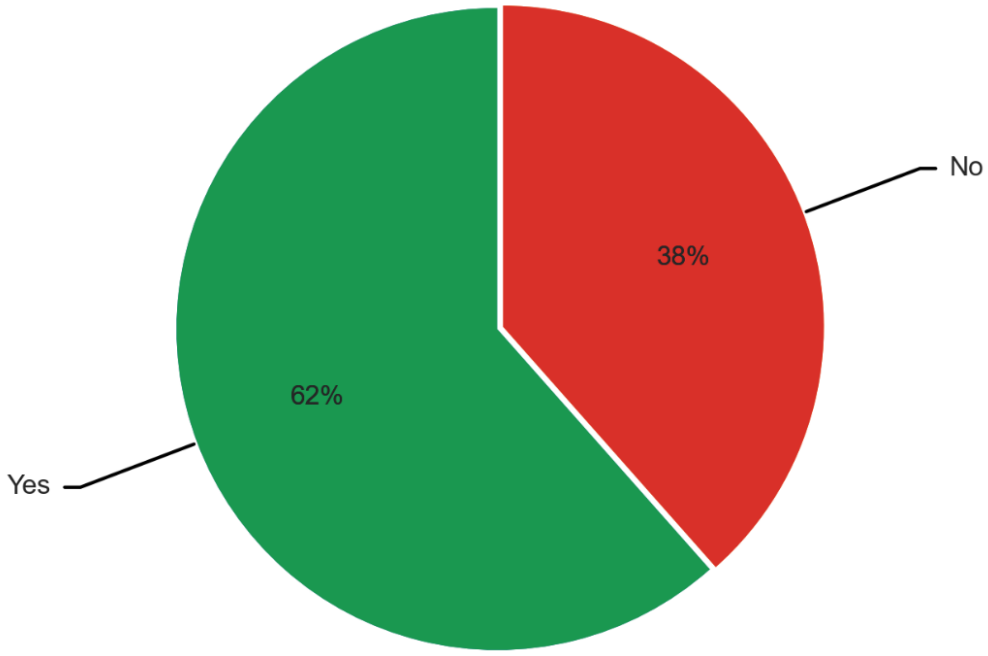

Table 8-9: Summary of responses

Response	Percentage	Count
Yes	61.5%	16
No	38.5%	10
Total	**100%**	**26**

LDV GHG Standards and Investments

Figure 8-10: Are you making or planning investments in ZEV technologies based on any possible GHG and fuel economy standards, which could come into force beyond 2026 (both production and R&D)?

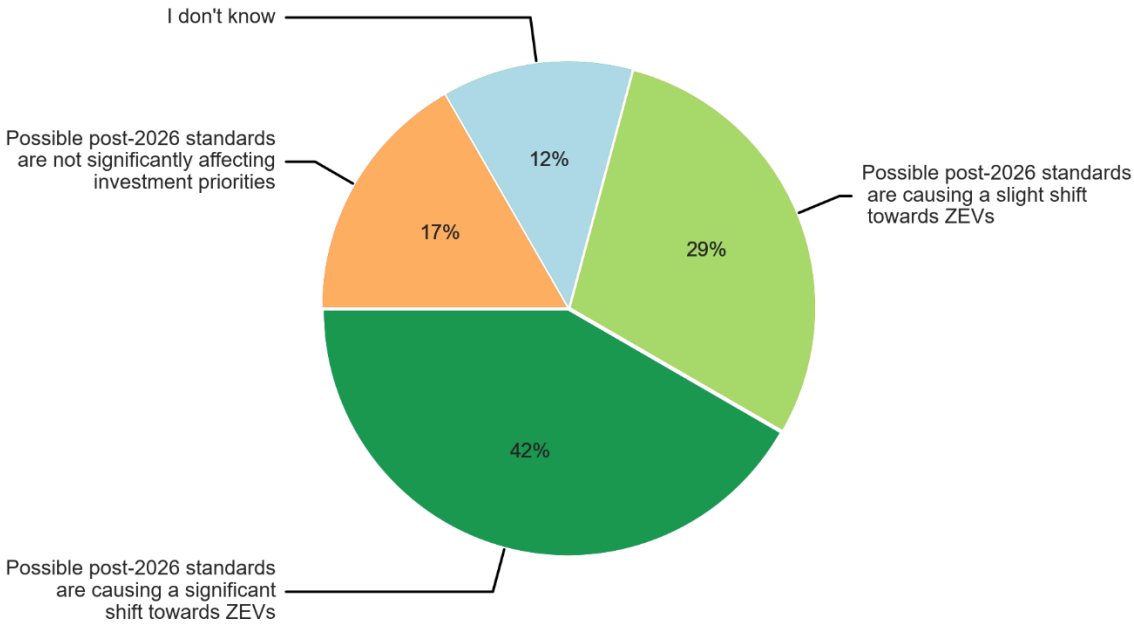

Table 8-10: Summary of responses

Response	Percentage	Count
Yes, any possible standards which could come into force beyond 2026 are causing a significant shift in investment towards ZEV technologies	41.7%	10
Yes, any possible standards which could come into force beyond 2026 are causing a slight shift in investment towards ZEV technologies	29.2%	7
No, any possible standards which could come into force beyond 2026 are not significantly affecting investment priorities	16.7%	4
I don't know	12.5%	3
Total	**100%**	**24**

Figure 8-11: If the level of ambition of the current standards is maintained/if no new standards are introduced beyond 2026, what effect will this have on your (planned) investments?

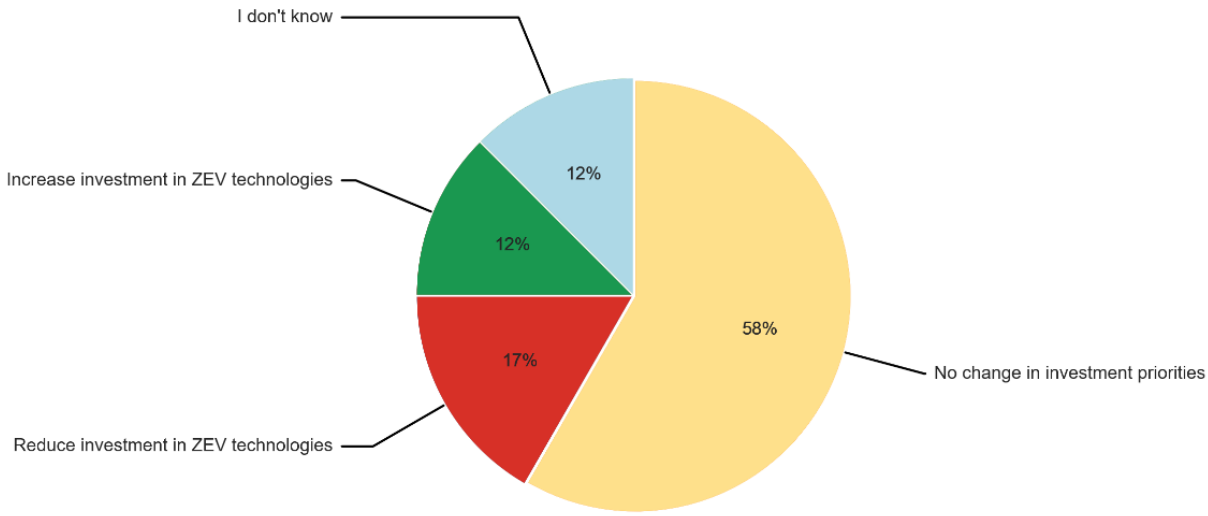

Table 8-11: Summary of responses

Response	Percentage	Count
Reduce investment in ZEV technologies	16.7%	4
No change in investment priorities	58.3%	14
Increase investment in ZEV technologies	12.5%	3
I don't know	12.5%	3
Total	**100%**	**24**

Figure 8-12: Which factors are more relevant for determining investments into ZEV technologies?

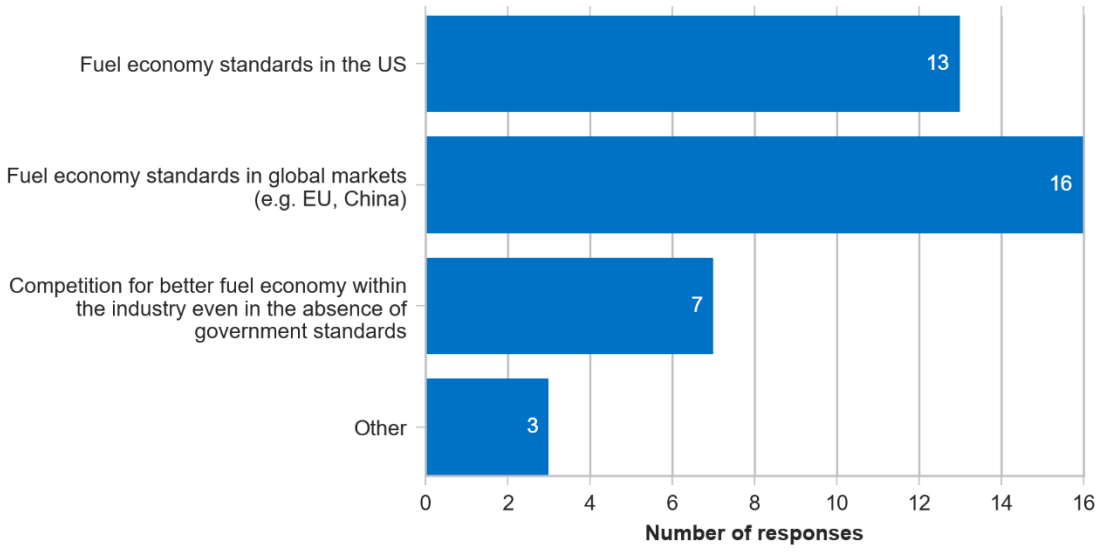

Table 8-12: Summary of responses

Response	Count
Fuel economy standards in the US	13
Fuel economy standards in global markets (e.g. EU, China)	16
Competition for better fuel economy within the industry even in the absence of government standards	7
Other	3
Total	**39**

Figure 8-13: If the level of ambition of the current standards is maintained/if no new standards are introduced beyond 2026, what effect would this have on your production of ZEV technologies?

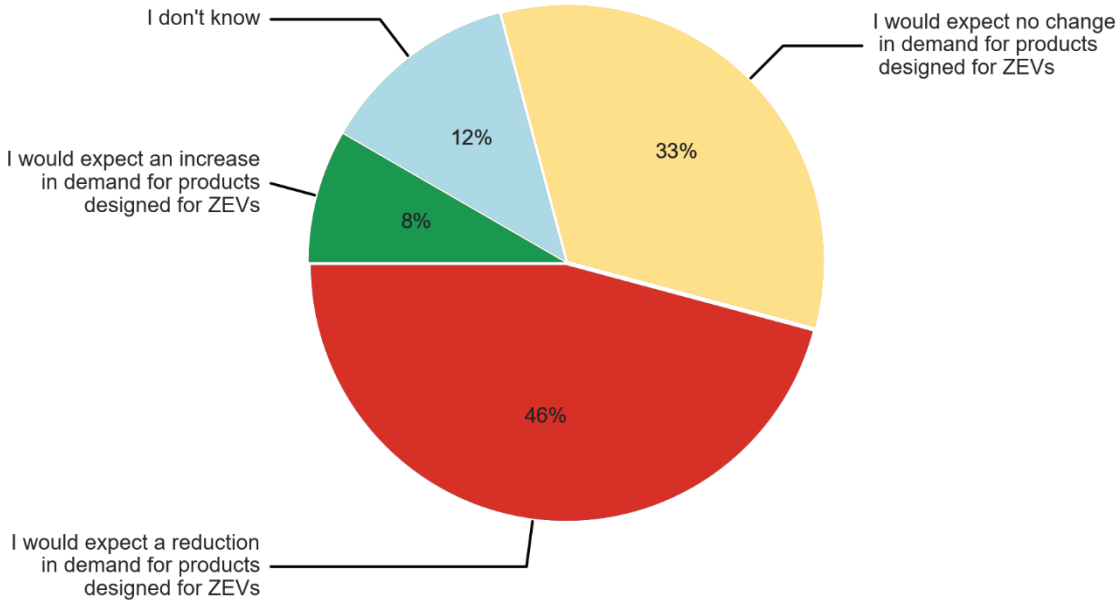

Table 8-13: Summary of responses

Response	Percentage	Count
I would expect a reduction in demand for products designed for ZEVs	45.8%	11
I would expect no change in demand for products designed for ZEVs	33.3%	8
I would expect an increase in demand for products designed for ZEVs	8.3%	2
I don't know	12.5%	3
Total	**100%**	**24**

Figure 8-14: Which factors are more relevant for driving demand for ZEV technologies?

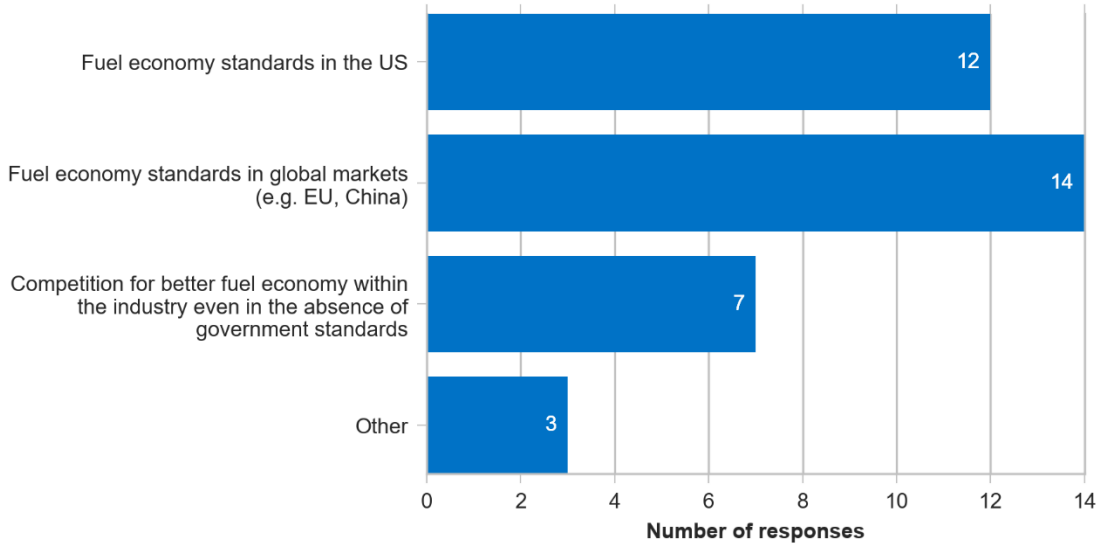

Table 8-14: Summary of responses

Response	Count
Fuel economy standards in the US	12
Fuel economy standards in global markets (e.g. EU, China)	14
Competition for better fuel economy within the industry even in the absence of government standards	7
Other	3
Total	**36**

Figure 8-15: What effect do low oil prices have on the sales of ZEV technologies that your company produces?

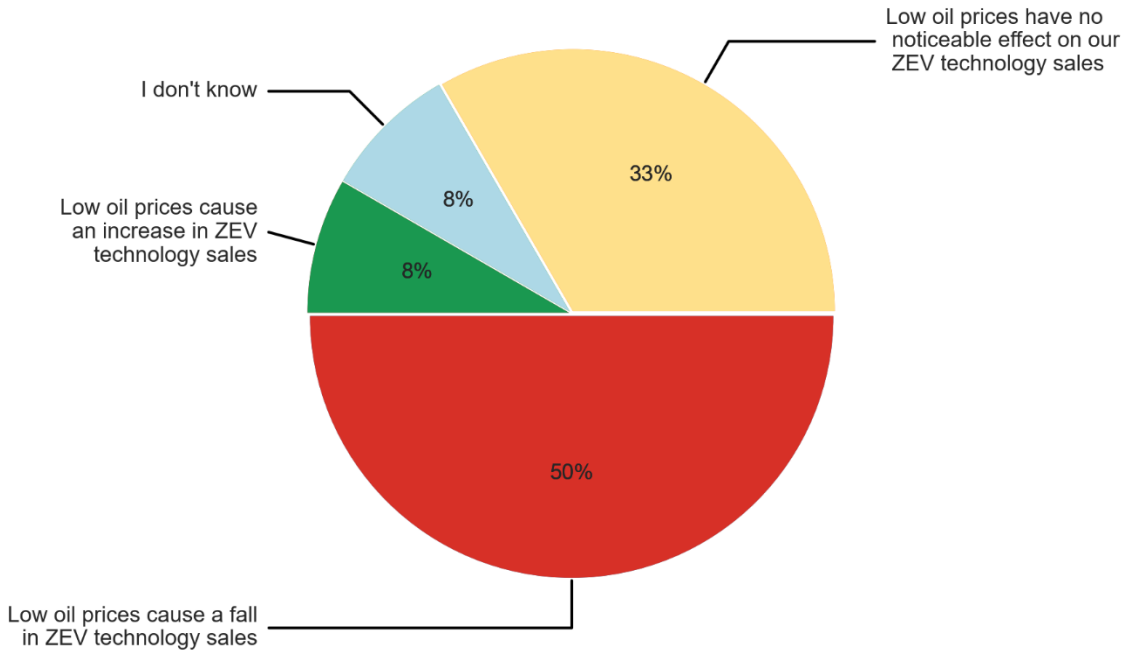

Table 8-15: Summary of responses

Response	Percentage	Count
Low oil prices result in an increase in sales of ZEV technologies	8.3%	2
Low oil prices result in a decrease in sales of ZEV technologies	50.0%	12
Low oil prices do not have a noticeable effect on our sales of ZEV technologies	33.3%	8
I don't know	8.3%	2
Total	**100%**	**24**

Future policies and employment

Figure 8-16: In general, do US policies that encourage or force the uptake of ZEVs also encourage job growth for your company in the US?

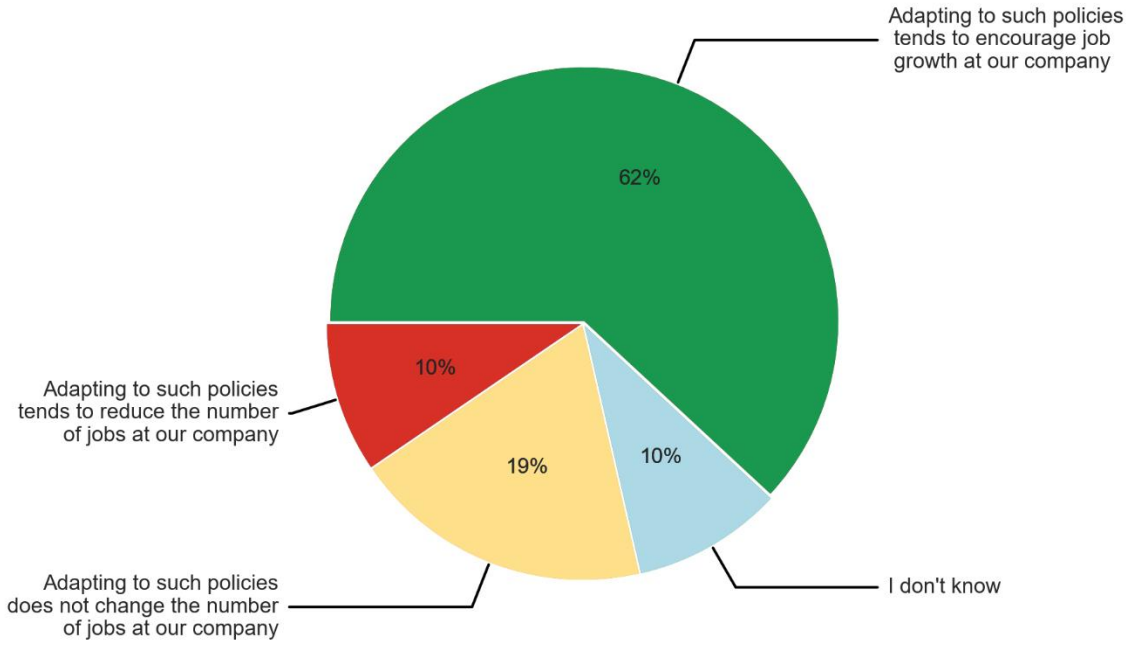

Table 8-16: Summary of responses

Response	Percentage	Count
Yes, such policies tend to encourage job growth at our company	61.9%	13
Adapting to such policies does not change the number of jobs at our company	19.0%	4
No, adapting to such policies tends to reduce the number of jobs at our company	9.5%	2
I don't know	9.5%	2
Total	**100%**	**21**

Figure 8-17: Will ambitious post-2026 standards, which drive an increase in the uptake of ZEVs, help encourage job growth in the wider US economy?

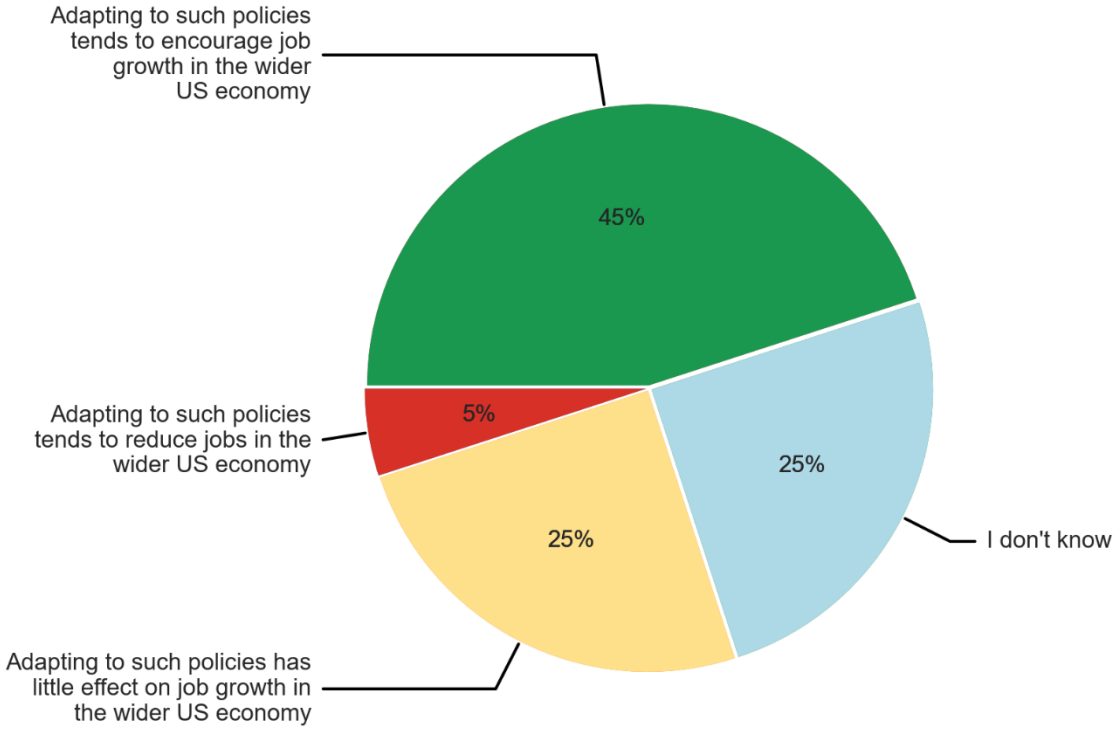

Table 8-17: Summary of responses

Response	Percentage	Count
Yes, such policies tend to encourage job growth in the wider US economy	42.9%	9
Adapting to such policies has little effect on job growth in the wider US economy	23.8%	5
No, adapting to such policies tends to reduce jobs in the wider US economy	4.8%	1
I don't know	23.8%	5
Other	4.8%	1
Total	**100%**	**21**

Figure 8-18: If a more ambitious ZEV sales target was introduced, do you think that it would help encourage job growth in your sector?

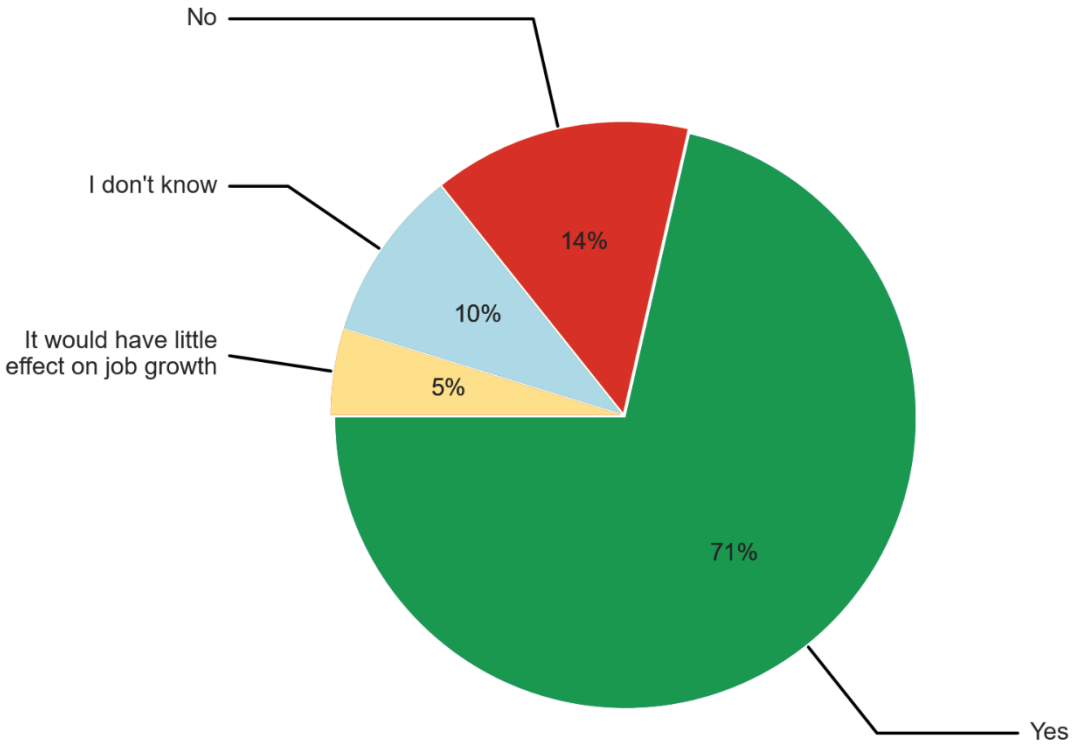

Table 8-18: Summary of responses

Response	Percentage	Count
Yes, a more ambitious target would help encourage job growth in the sector	71.4%	15
Adapting to such policies has little effect on job growth in the sector	4.8%	1
No, adapting to such policies tends to reduce jobs in the sector	14.3%	3
I don't know	9.5%	2
Total	**100%**	**21**

Figure 8-19: Do you think that California and other states should continue to have the authority to set state-level standards, as long as the standards are more stringent than federal LDV standards?

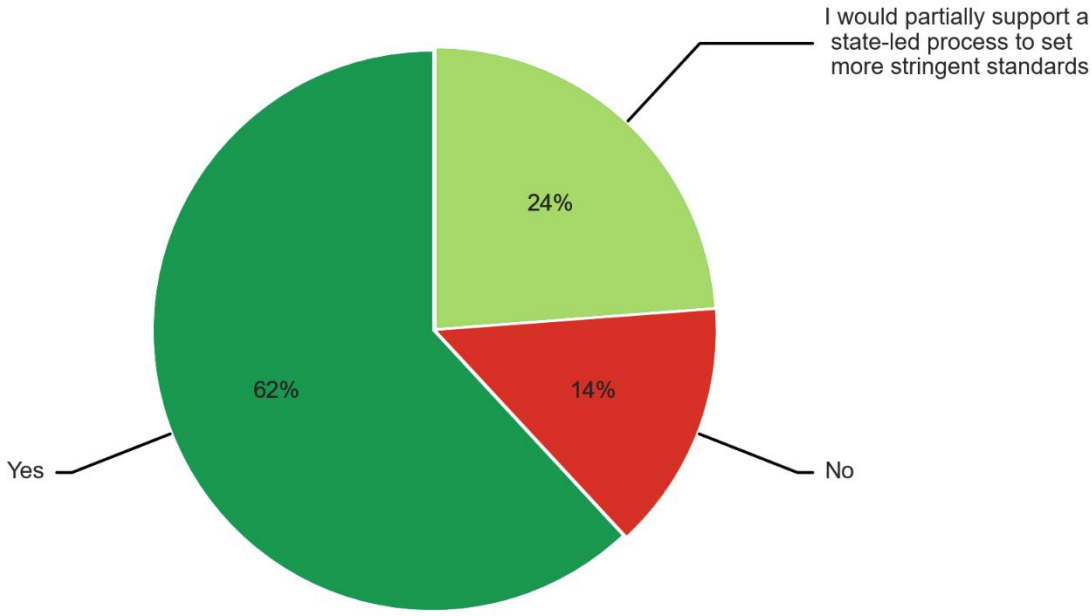

Table 8-19: Summary of responses

Response	Percentage	Count
Yes, I would support a state-led process to set more stringent LDV standards	61.9%	13
I would partially support a state-led process to set more stringent standards	23.8%	5
No, I would not support a state-led process to set more stringent standards	14.3%	3
Total	**100%**	**21**

Figure 8-20: Which of the following targets for LDVs do you think is the best in terms of annual reductions of GHG emissions in the US?

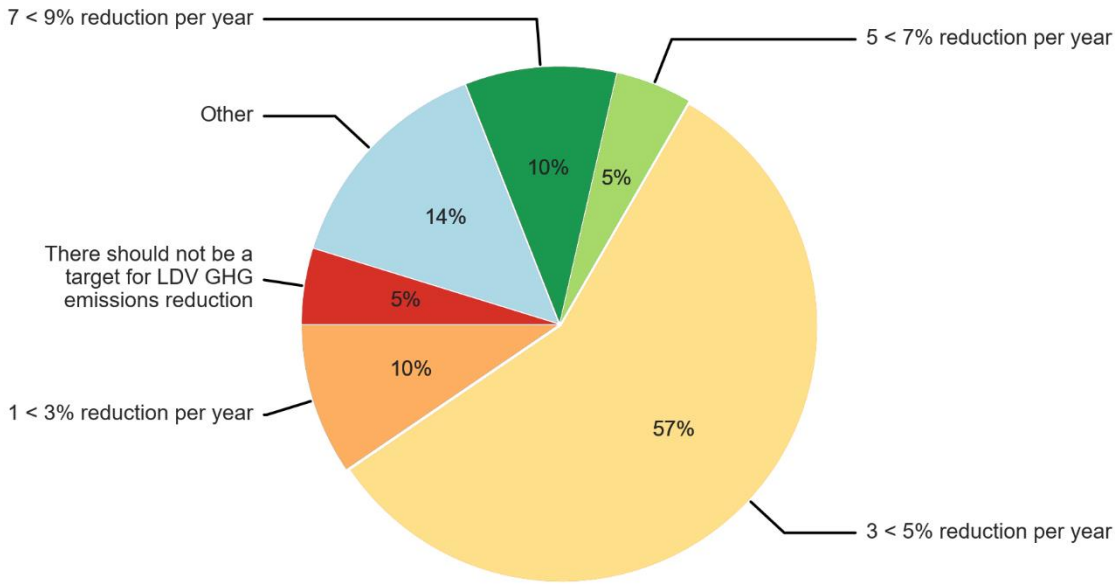

Table 8-20: Summary of responses

Response	Percentage	Count
1 < 3 % reduction per year	9.5%	2
3 < 5 % reduction per year	57.1%	12
5 < 7 % reduction per year	4.8%	1
7 < 9 % reduction per year	9.5%	2
I do not think there should be a target for reducing GHG emissions for LDVs	4.8%	1
Other	14.3%	3
Total	**100%**	**21**

Your views

Figure 8-21: Please indicate your level of agreement or disagreement with the following statement: I believe that the companies that are leaders in vehicle efficiency technologies will be more successful over the next 10 – 15 years.

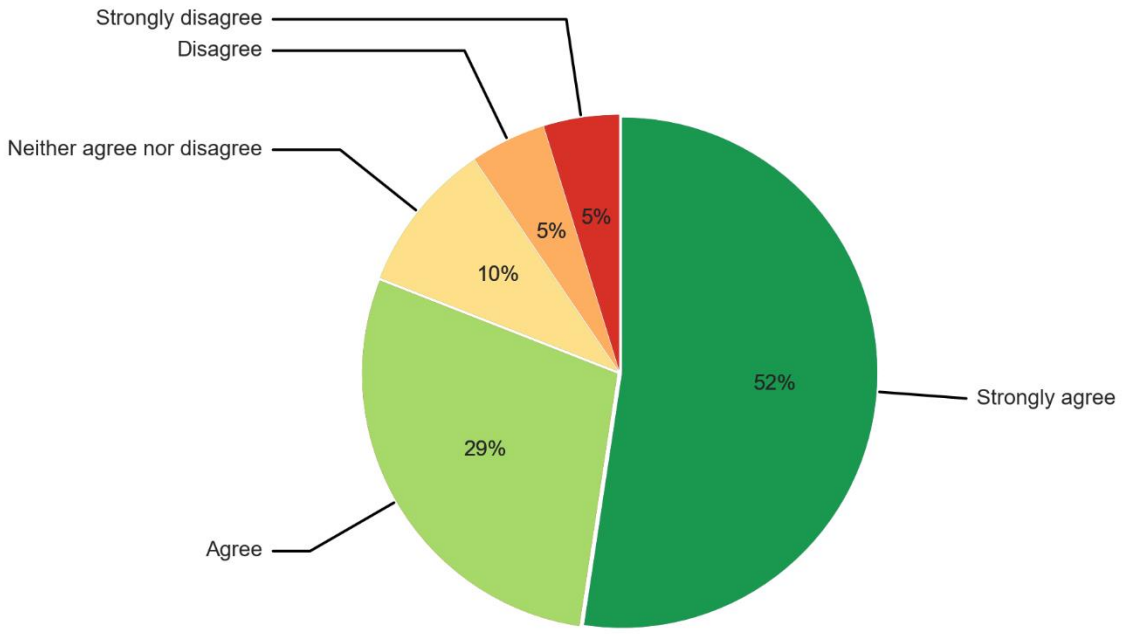

Table 8-21: Summary of responses

Response	Percentage	Count
Strongly disagree	4.8%	1
Disagree	4.8%	1
Neither agree nor disagree	9.5%	2
Agree	28.6%	6
Strongly agree	52.4%	11
Total	**100%**	**21**

Figure 8-22: Please indicate your level of agreement or disagreement with the following statement: More ambitious US LDV vehicle efficiency standards tend to encourage more innovation and investment in the US.

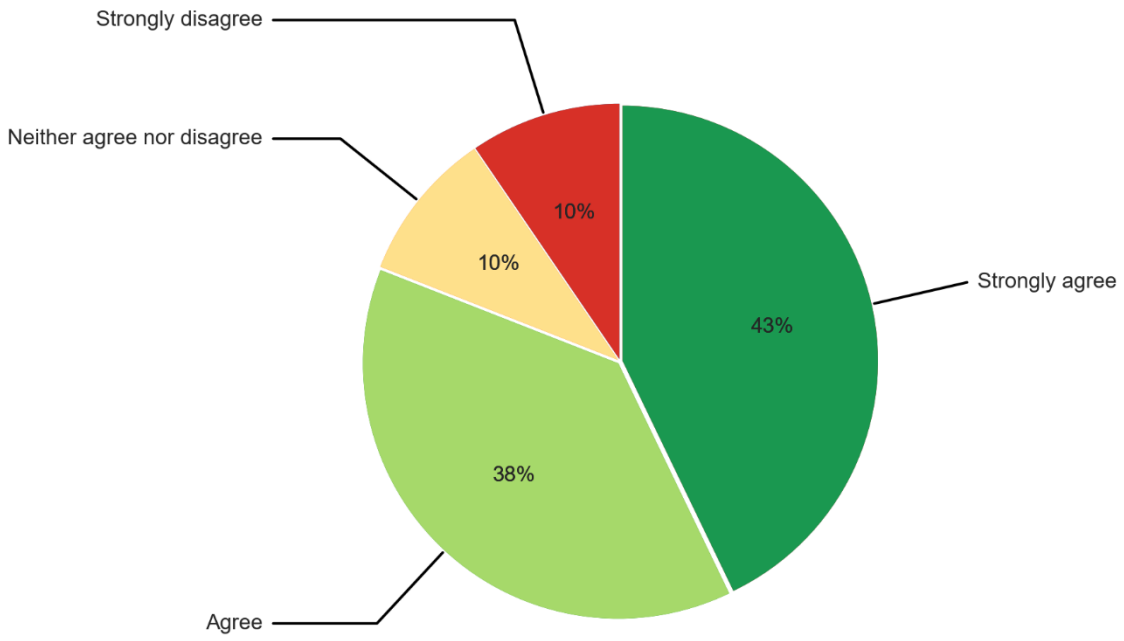

Table 8-22: Summary of responses

Response	Percentage	Count
Strongly disagree	9.5%	2
Neither agree nor disagree	9.5%	2
Agree	38.1%	8
Strongly agree	42.9%	9
Total	**100%**	**21**

Figure 8-23: Please indicate your level of agreement or disagreement with the following statement: The current Safe Vehicles Rule includes a requirement for an annual 1.5% improvement in fuel economy to 2026. If standards were implemented beyond 2026, which included a lower level of ambition, the US market would fail to benefit from investments already made in fuel efficiency technologies.

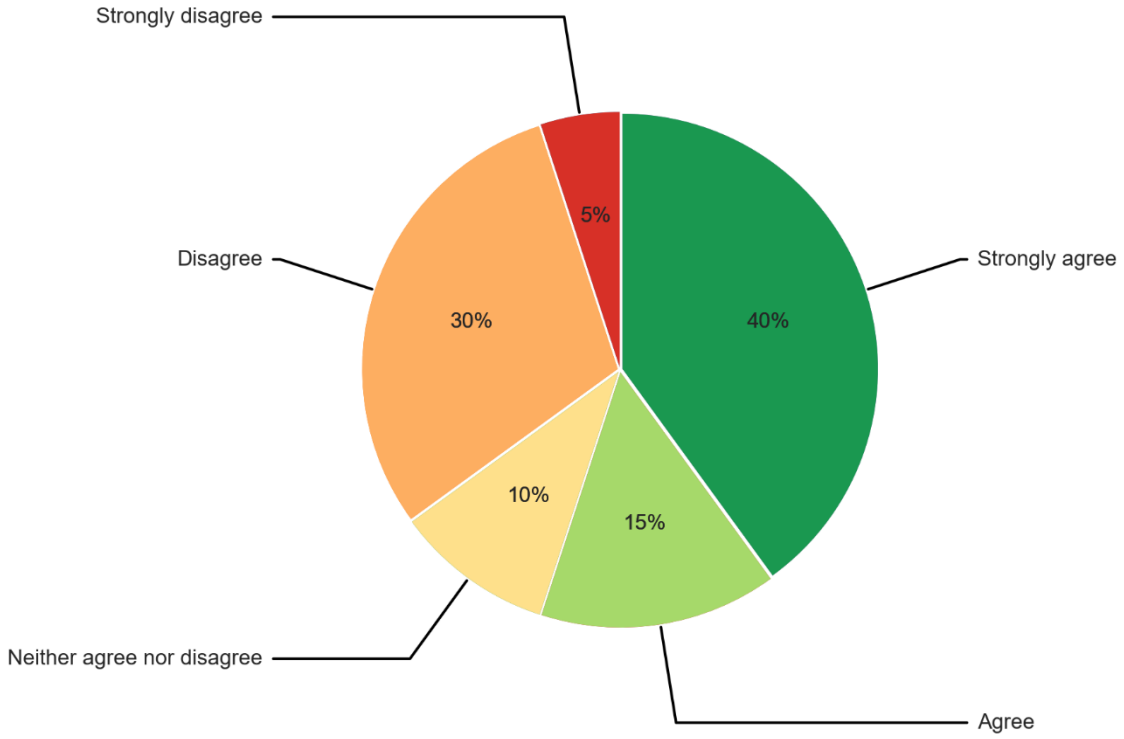

Table 8-23: Summary of responses

Response	Percentage	Count
Strongly disagree	5.0%	1
Disagree	30.0%	6
Neither agree nor disagree	10.0%	2
Agree	15.0%	3
Strongly agree	40.0%	8
Total	**100%**	**20**

Key technologies

Under this subsection, the ten technologies which received the highest number of responses are presented in the figures. The remaining technologies are presented in the accompanying tables.

Figure 8-24: Which of the following technologies do you view as key for meeting the SAFE Vehicles Rule?

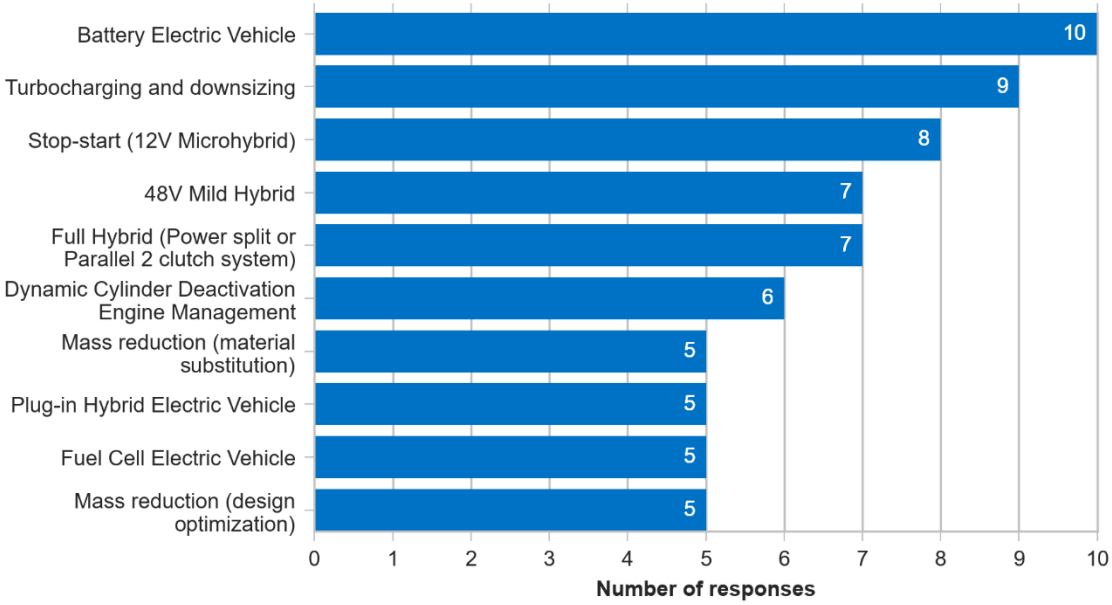

Table 8-24: Summary of responses

Response	Count
Battery Electric Vehicle	10
Turbocharging and downsizing	9
Stop-start (12V Microhybrid)	8
48V Mild Hybrid	7
Full Hybrid (Power split or Parallel 2 clutch system)	7
Dynamic Cylinder Deactivation Engine Management	6
Plug-in Hybrid Electric Vehicle	5
Fuel Cell Electric Vehicle	5
Mass reduction (design optimization)	5
Mass reduction (material substitution)	5
Stoichiometric Gasoline Direct Injection	4
Aerodynamic Drag Reduction	4
8/10-speed automatic transmission	3
Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)	3
Low Rolling Resistance Tires	3
Engine friction reduction	2
Variable valve timing and lift	2
Integrated Starter Generator	1
Compression Ratio Increase	1
Miller cycle for turbocharged engines	1
Cooled EGR	1
Variable Compression Ratio	1
Continuously Variable Transmissions	1
Electric Power Steering	1
None of the above	1

Figure 8-25: Which of the following technologies would you view as key for meeting the prior 2025 LDV GHG standards, proposed in the MTE in 2016?

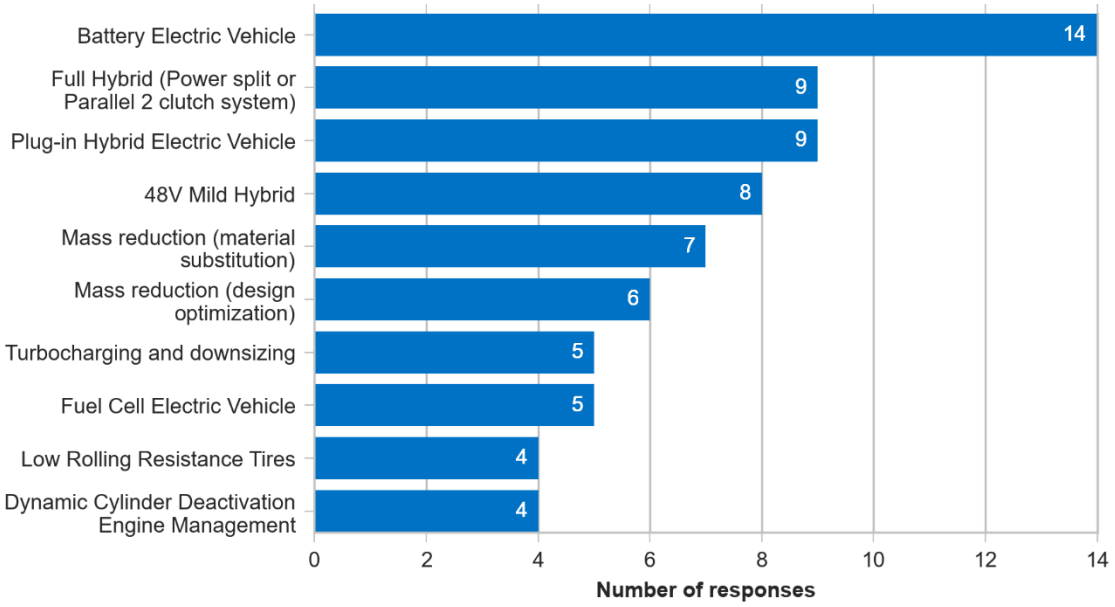

Table 8-25: Summary of responses

Response	Count
Battery Electric Vehicle	14
Full Hybrid (Power split or Parallel 2 clutch system)	9
Plug-in Hybrid Electric Vehicle	9
48V Mild Hybrid	8
Mass reduction (material substitution)	7
Mass reduction (design optimization)	6
Fuel Cell Electric Vehicle	5
Turbocharging and downsizing	5
Dynamic Cylinder Deactivation Engine Management	4
Low Rolling Resistance Tires	4
Engine friction reduction	3
Stoichiometric Gasoline Direct Injection	3
Aerodynamic Drag Reduction	3
Stop-start (12V Microhybrid)	2
Variable valve timing and lift	2
Variable Compression Ratio	2
Compression Ratio Increase	1
Atkinson Cycle plus Compression Ratio Increase (e.g. Mazda SkyActiv-G)	1
Miller cycle for turbocharged engines	1
Cooled EGR	1
Electrically Assisted Variable Speed Supercharger	1
Lean Burn	1
8/10-speed automatic transmission	1
Continuously Variable Transmissions	1
Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)	1

Figure 8-26: Beyond 2026, which of the following technologies do you view as key for reducing GHG emissions and improving fleet average fuel economy?

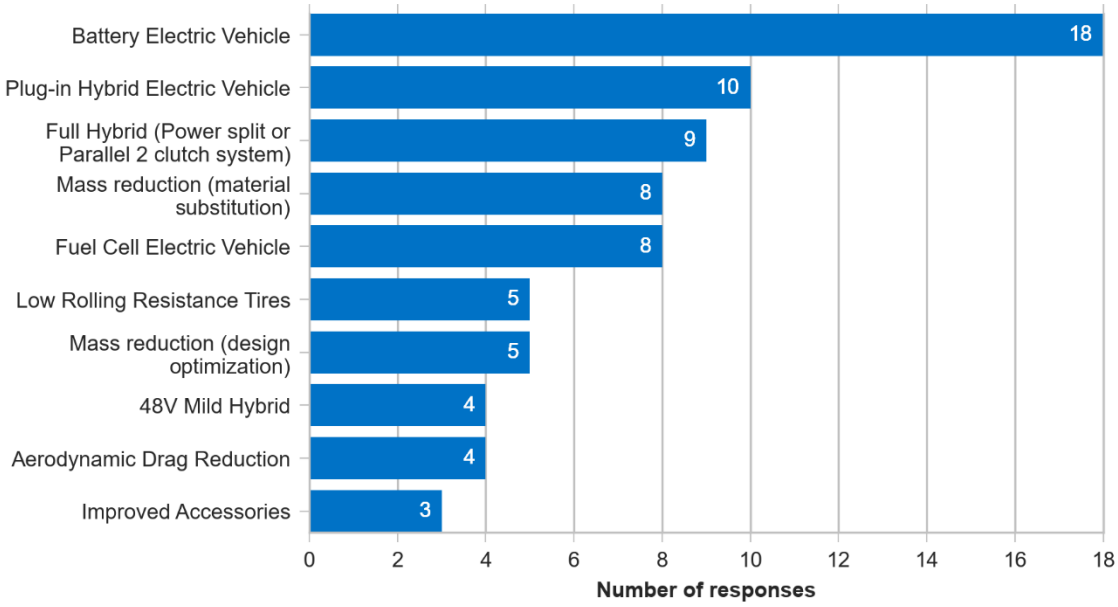

Table 8-26: Summary of responses

Response	Count
Battery Electric Vehicle	18
Plug-in Hybrid Electric Vehicle	10
Full Hybrid (Power split or Parallel 2 clutch system)	9
Fuel Cell Electric Vehicle	8
Mass reduction (material substitution)	8
Mass reduction (design optimization)	5
Low Rolling Resistance Tires	5
48V Mild Hybrid	4
Aerodynamic Drag Reduction	4
Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)	3
Dynamic Cylinder Deactivation Engine Management	2
Stoichiometric Gasoline Direct Injection	2
Turbocharging and downsizing	2
Cooled EGR	2
Electrically Assisted Variable Speed Supercharger	2
Variable Compression Ratio	2
Gasoline compression ignition (e.g. Mazda SPCCI for 2019)	2
8/10-speed automatic transmission	2
Natural gas/biomethane powertrain	1
Variable valve timing and lift	1

Figure 8-27: Has the development and introduction of any of the technologies listed advanced more quickly than was anticipated in 2016?

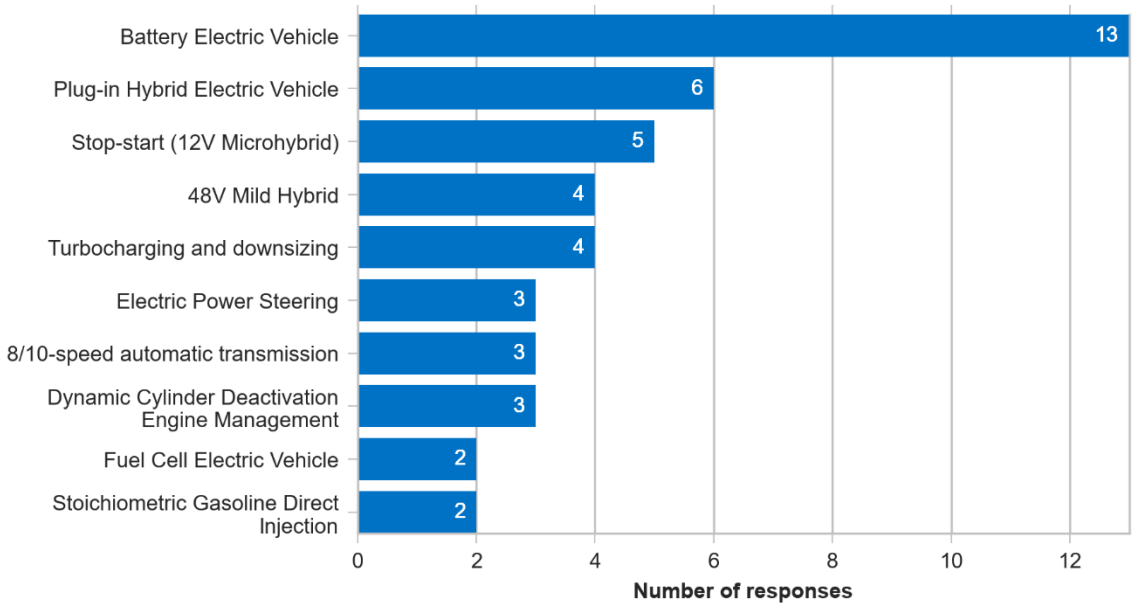

Table 8-27: Summary of responses

Response	Count
Battery Electric Vehicle	13
Plug-in Hybrid Electric Vehicle	6
Stop-start (12V Microhybrid)	5
48V Mild Hybrid	4
Turbocharging and downsizing	4
Dynamic Cylinder Deactivation Engine Management	3
8/10-speed automatic transmission	3
Electric Power Steering	3
Fuel Cell Electric Vehicle	2
Stoichiometric Gasoline Direct Injection	2
None of the above	2
Full Hybrid (Power split or Parallel 2 clutch system)	1
Flex-fuel vehicle	1
Variable valve timing and lift	1
Atkinson Cycle plus Compression Ratio Increase (e.g. Mazda SkyActiv-G)	1
Variable Compression Ratio	1
Gasoline compression ignition (e.g. Mazda SPCCI for 2019)	1
Continuously Variable Transmissions	1
Improved Accessories (high eff. alternators and motors, intelligent cooling and alternator operation)	1
Mass reduction (material substitution)	1

Comparative bar charts

This subsection presents charts to display how supplier views have evolved over time, since the 2018 and 2016 surveys.

Figure 8-28: Did you agree with the policy decision to set the 2025 LDV GHG emission standards when it was announced?

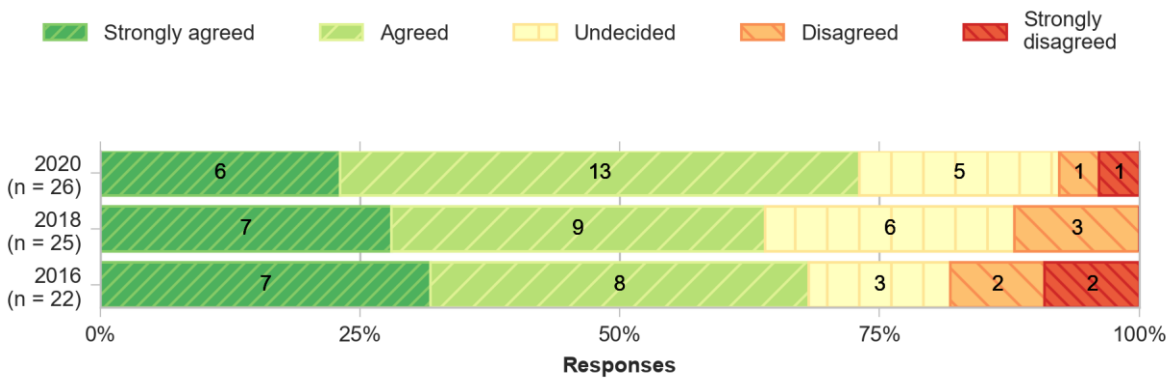

Table 8-28: Summary of responses

Response	2020	2018	2016
Strongly disagree	1	0	2
Disagree	1	3	2
Neither agree nor disagree	5	6	3
Agree	13	9	8
Strongly agree	6	7	7
Total	**26**	**25**	**22**

Figure 8-29: In your view, is it important to start planning and setting targets now for beyond 2026[12]?

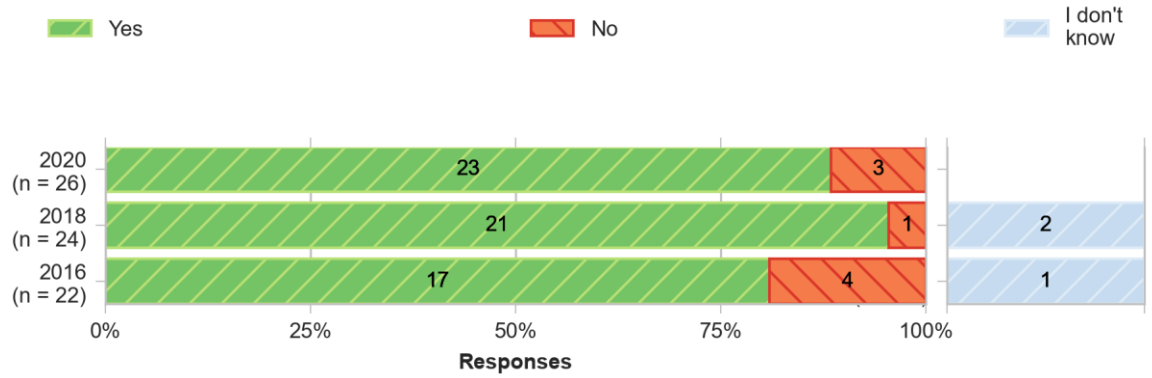

Table 8-29: Summary of responses

Response	2020	2018	2016
Yes	23	21	17
No	3	1	4
I don't know	0	2	1
Total	**26**	**24**	**22**

[12] In the 2018 and 2016 surveys, 2025 was referenced rather than 2026, due to the status of policymaking at the time.

Figure 8-30: What effect do low oil prices have on the sales of ZEV/fuel efficiency technologies[13] that your company produces?

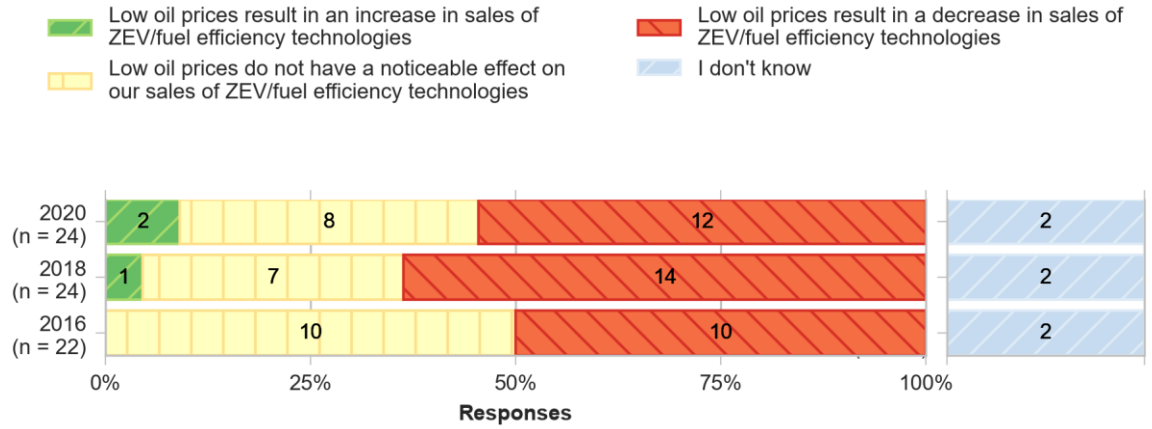

Table 8-30: Summary of responses

Response	2020	2018	2016
Low oil prices result in an increase in sales of ZEV/fuel efficiency technologies	2	1	0
Low oil prices do not have a noticeable effect on our sales of ZEV/fuel efficiency technologies	8	7	10
Low oil prices result in a decrease in sales of ZEV/fuel efficiency technologies	12	14	10
I don't know	2	2	2
Total	**24**	**24**	**22**

[13] In 2020, the survey question asked about the sales of ZEV technologies. In 2018 and 2016, the survey asked about fuel efficiency technologies.

Figure 8-31: In general, do US policies that encourage or force the uptake of ZEVs/fuel efficiency improvements[14] also encourage job growth for your company in the US?

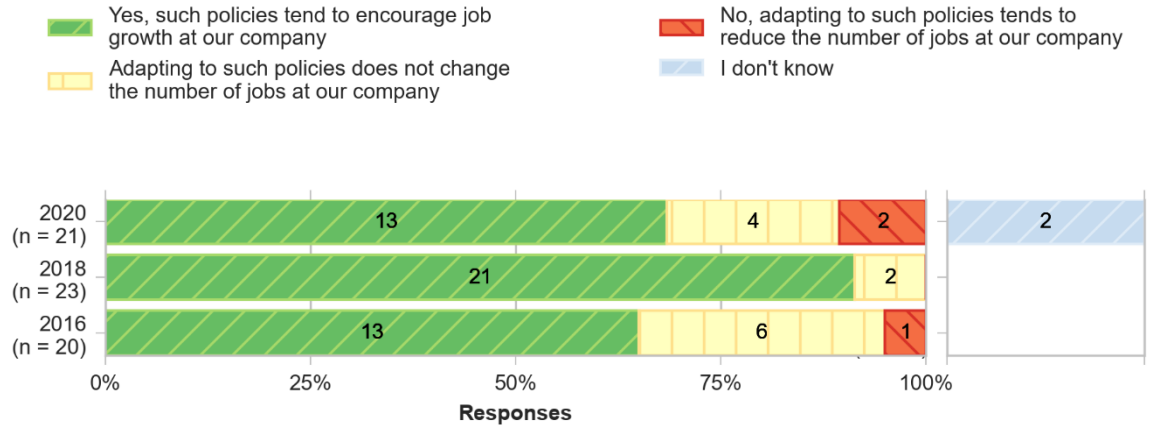

Table 8-31: Summary of responses

Response	2020	2018	2016
Yes, such policies tend to encourage job growth at our company	13	21	13
Adapting to such policies does not change the number of jobs at our company	4	2	6
Yes, adapting to such policies tends to reduce the number of jobs at our company	2	0	1
I don't know	2	0	0
Total	**21**	**23**	**20**

[14] In 2020, the survey question asked about the uptake of ZEV technologies. In 2018 and 2016, the survey asked about fuel efficiency improvements.

Figure 8-32: In general, do US policies that encourage or force the uptake of ZEVs/fuel efficiency improvements[15] also encourage job growth for your company in your industry overall?

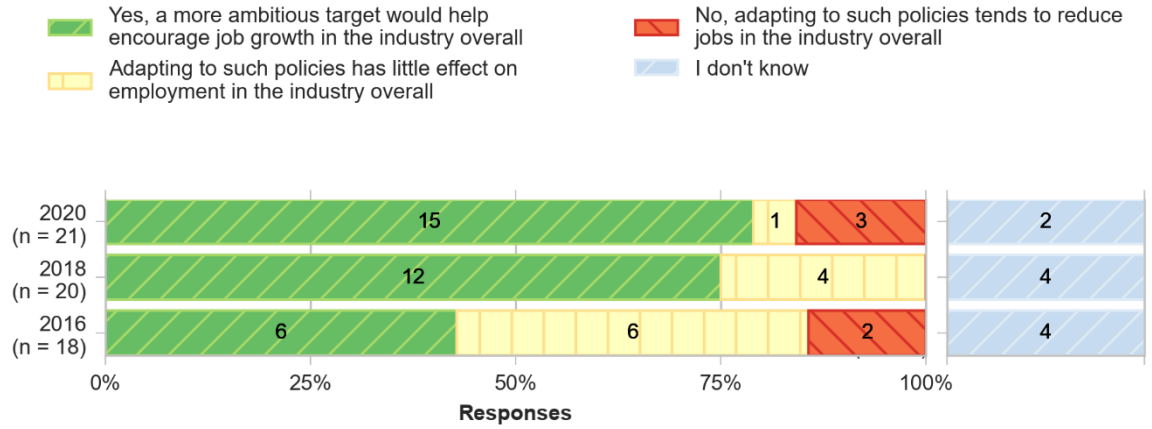

Table 8-32: Summary of responses

Response	2020	2018	2016
Yes, a more ambitious target would help encourage job in the industry overall	15	12	6
Adapting to such policies has little effect on employment in the industry overall	1	4	6
No, adapting to such policies tends to reduce jobs in the industry overall	3	0	2
I don't know	2	4	4
Total	**21**	**20**	**18**

[15] In 2020, the survey question asked about the uptake of ZEV technologies. In 2018 and 2016, the survey asked about fuel efficiency improvements.

Figure 8-33: Do you think that California and other states should continue to have the authority to set state-level standards[16]?

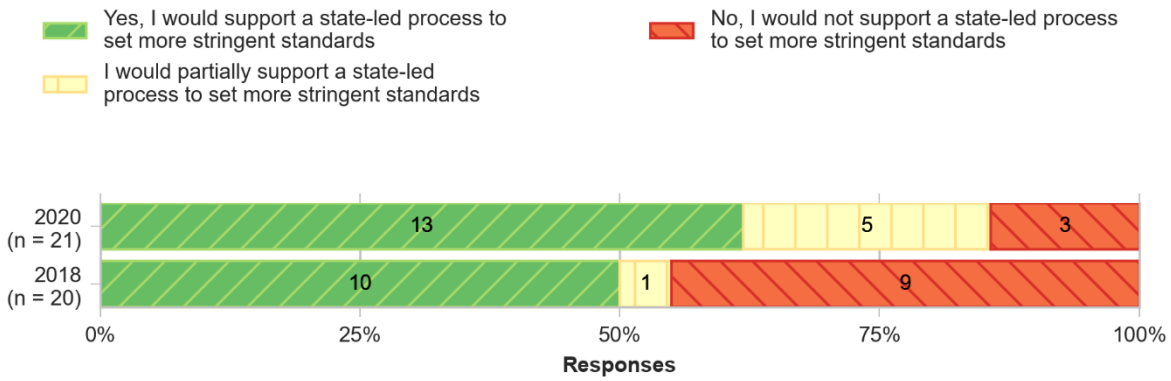

Table 8-33: Summary of responses

Response	2020	2018
Yes, I would support a state-led process to set more stringent standards	13	10
I would partially support a state-led process to set more stringent standards	5	1
No, I would not support a state-led process to set more stringent standards	3	9
Total	**21**	**20**

[16] This question was not included in the 2016 survey.

Figure 8-34: Which of the following targets for LDVs do you think is the best in terms of annual GHG emissions reductions in the US[17]?

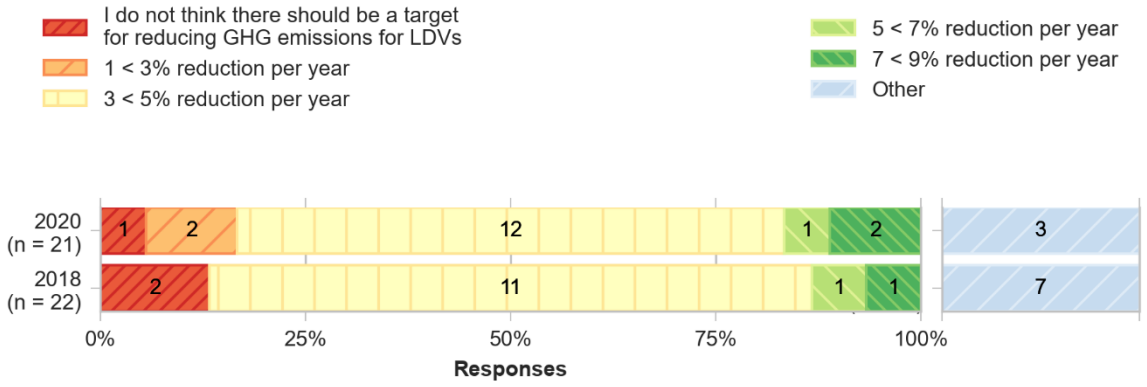

Table 8-34: Summary of responses

Response	2020	2018
I do not think there should be a target for reducing GHG emissions for LDVs	1	2
1 < 3% reduction per year	2	0
3 < 5% reduction per year	12	11
5 < 7% reduction per year	1	1
7 < 9% reduction per year	2	1
Other	3	7
Total	**21**	**22**

[17] This question was not included in the 2016 survey.

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