

State of California
Environmental Protection Agency
AIR RESOURCES BOARD

**Third Supplement to the
Final Statement of Reasons for Rulemaking,
Including Summary of Comments and Agency Responses**

**PROPOSED AMENDMENTS TO THE CALIFORNIA
ZERO EMISSION VEHICLE PROGRAM REGULATIONS**

Public Hearing Date: January 25, 2001
Agenda Item No.: 01-01-1

Third Supplement dated April 12, 2002

I. GENERAL

In this rulemaking, the Air Resources Board (ARB or Board) is adopting major amendments to the California Zero Emission Vehicle (ZEV) program regulations. The amendments are designed to maintain progress towards commercialization of zero emission vehicles while recognizing near term constraints due to cost, lead time, and technical challenges. The amendments maintain a core ZEV component, but significantly reduce the cost of the program primarily through a reduction in vehicles required in the near-term, and the broadening in scope of vehicle technologies allowed.

The rulemaking was initiated by the December 8, 2000 publication of a notice of a January 25, 2001 hearing to consider ZEV program amendments as originally proposed by ARB staff. At the conclusion of the hearing, the Board adopted Resolution 01-01, in which it approved the originally proposed amendments with a number of modifications. Many of the modifications had been suggested by staff in a document distributed at the hearing; other modifications were initiated by the Board itself. The Resolution directed the ARB Executive Officer to incorporate the approved modifications into the proposed regulatory text, with such other conforming modifications as may be appropriate, and to make the modified text available for a supplemental comment period of at least 15 days as required by Government Code section 11346.8(c). The proposed modifications were made available October 31, 2001 for a 15-day supplemental comment period ending November 15, 2001, and numerous written comments were received. Additional modifications drafted in response to comments were circulated on November 19, 2001, with a comment deadline of December 4. In addition, a November 15, 2001 notice provided an opportunity for the public to submit comments until November 30 on additional material being added to the rulemaking file. Final amendments were adopted by the Executive Officer December 7, 2001. On the same day they were submitted to the Office of Administrative Law, which reviews state regulations for compliance with the state Administrative Procedure Act.

In a January 16, 2002 memorandum, ARB notified OAL that ARB staff had recently determined that, due internal staff miscommunications, the three “15-day” notices soliciting supplemental comment after the January 25, 2001 hearing had not been transmitted to some parties to whom they were required to be sent. Although the supplemental notices had been mailed to approximately 700 persons and transmitted by email to approximately 723 persons, they had not been sent to most of the persons who had submitted the approximately 109 written comments that had been received by ARB on the day of the January 25, 2001 hearing. These persons were entitled under Government Code section 11347.1(b) to have the three supplemental notices sent to them. Attachment A to the January 16, 2002 memorandum – also appended to this Supplement as Attachment A – identified the parties who had submitted comments received on the date of the hearing but had not been sent copies of the three supplemental notices. In the memorandum, the ARB noted that the information being provided could affect the approvability of the amendments.

On January 23, 2002, ARB transmitted to OAL a revised Final Regulation Order containing the adopted amendments with various minor corrections identified in the transmittal memorandum.

Following transmittal of the corrected amendments, on January 23, 2002 OAL issued a Notice of Disapproval of Regulatory Action. One week later, on January 30, 2002 OAL issued its Decision of Disapproval of Regulatory Action. The decision concluded that ARB’s failure to transmit the three supplemental “15-day” notices to the persons identified in Attachment A to ARB’s January 16, 2002 memorandum constituted a violation of Government Code sections 11346.8(c) and 11347.1, and title 1, California Code of Regulations (CCR), section 44. The decision stated:

The Board must provide a procedurally adequate 15-day notice and comment period on all of the changes made and documents added during the three 15-day notices to all of the commenters listed on Attachment A who did not receive the three original 15-day notices prior to resubmittal of this rulemaking action.

The decision also explained that the ARB must correct the three certifications of mailing accompanying the three 15-day notices.

In response to the OAL disapproval, on February 8, 2002, the ARB issued a notice of a special supplemental comment period, attached to this FSOR as Attachment B. This notice, accompanied by the three previously distributed supplemental “15-day” notices, was mailed to all of the persons listed on Attachment A who had provided mailing addresses, and was transmitted by email to all persons listed on Attachment A who had submitted comments by email. It expressed regret that the recipient was one of the persons to whom the 15-day notices had not been sent, and solicited comment until February 25, 2002 on the material covered by the three 15-day notices.

Five recipients of the February 8, 2002 notice submitted comments by the February 25, 2002 comment deadline. After considering and addressing these comments, the Executive Officer issued Executive Order G-02-009, adopting the amendments to title 13, CCR, and to the incorporated ZEV standards and TPs, as they had been corrected January 23, 2002, with one additional nonsubstantial correction.¹

II. SUMMARY OF COMMENTS RECEIVED DURING THE SPECIAL SUPPLEMENTAL COMMENT PERIOD, AND AGENCY RESPONSES

During the special supplemental comment period ending February 25, 2002, the following five recipients of the February 8, 2002 notice submitted comments: California Motor Car Dealers Association, Swift Jeep Chrysler Dodge, LaBrea Chrysler Jeep, A. Trujillo Escareño, and Jennifer Dunham. The submittals of the first three parties included a 48-page "Supplemental Critique of the California Zero Emissions Vehicle Mandate Regulatory Changes Proposed by the California Air Resources Board Staff in October and November 2001" by National Economic Research Associates, Inc. and Sierra Research, Inc. (collectively NERA/Sierra), dated February 25, 2002 (the NERA/Sierra Supplemental Critique). NERA/Sierra had also authored extensive documents submitted by General Motors during the initial comment period, as well as materials submitted during two of the supplemental 15-day comment periods.

Set forth below are summaries of the newly submitted comments along with the ARB's responses.

A. Comments Contained in the NERA/Sierra Supplemental Critique

Battery Electric Vehicle Costs

1. Comment: Staff argues that the Battery Technology Advisory Panel (BTAP) report is intended to apply only to "2003 or soon thereafter." The Executive Summary of the BTAP report suggests that the findings are intended to apply to the next 5 to 7 years. The report also suggests that significant reductions in cost estimates are only likely to be achieved in the event of a major breakthrough in the technologies considered. But staff appears to abandon the report's conclusions even in the short-term. In its review of earlier work done by NERA/Sierra, staff suggests that in the first year of the mandate, when staff expects that just under 4,500 full-function ZEVs would be required, ZEVs should cost only \$15,000 more than a conventional vehicle in 2003. The actual difference in costs based on the BTAP report, however, is likely to be close to three times that estimate. Even if automakers produced the mid-range vehicles that staff appears to assume, the vehicle incremental costs would be more than 50 percent higher than staff's estimates.

¹ All of the corrections are shown in the Addendum to this Final Statement of Reasons. The additional correction is the last change to the Final Regulation Order shown in the Addendum. Parallel corrections have been made to the Standards and Test Procedures document.

Agency Response: In the August 2000 *Staff Report for the 2000 Zero Emission Vehicle Program Biennial Review* (the *Biennial Review Staff Report*), the staff estimates of the incremental cost for battery electric vehicles ranged from \$24,000 for high efficiency NiMH vehicles to \$7,500 for PbA City EVs. In the December 2000 *Staff Report: Initial Statement of Reasons* (the *Initial Statement of Reasons*) for this rulemaking, staff used a midpoint estimate of \$17,000 for full function EVs.

The \$15,000 figure cited by commenters is taken from the October 31, 2001 *ARB Staff Review of Report Entitled "Impacts of Alternative ZEV Sales Mandates on California Motor Vehicle Emissions: A Comprehensive Study"* (the *October 31 Staff Review*). In evaluating the NERA/Sierra study submitted by General Motors January 23, 2001, staff tested the results of a model developed by NERA/Sierra that predicts the effect of new vehicle prices on fleet turnover. One scenario modeled by staff satisfied the ZEV regulation using battery electric vehicles in the near term, replaced by hydrogen fuel cell vehicles as the cost of fuel cell vehicles declined. Due to the nature of the NERA/Sierra model, which fits a curve to various cost/volume data points, staff was unable to precisely mirror the desired cost levels. This point is acknowledged by staff in the *October 31 Staff Review*. As the *October 31 Staff Review* notes on page 31, "the numbers used by staff are low in 2003, higher . . . in 2012, and slightly lower . . . in 2020." Because the purpose of the modeling exercise was to predict the long-term effect of the program on fleet turnover, the difference in 2003 costs did not have a material effect on the results.

The cost estimates prepared by the Battery Technology Advisory Panel were for production levels of 10,000-20,000 packs per year. We recognize that a reduction in the number of battery packs needed in the early years will increase the cost of the packs. The Battery Technology Advisory Panel did not prepare specific estimates for lower production levels. We note, however, that in the early years manufacturers have other alternatives available, such as neighborhood electric vehicles (NEVs), which could serve to reduce their costs. The net effect of these various factors on overall program costs depends on the compliance strategies pursued by the various manufacturers.

2. Comment: Staff claims that in subsequent years there will be further reductions below its astonishingly low 2003 cost estimates. Staff provides no basis for its claim that future technological advances will lead to significant reductions in battery technologies even though the production volumes of batteries and ZEVs will be at the lowest end of the spectrum considered by the BTAP report. Staff provides no way of quantifying the cost-reductions that it asserts will result from technological advances but appears to abandon the BTAP cost estimates and favor a much less rigorous assessment of the future costs of vehicles that use hydrogen fuel cell technology.

Agency Response: This issue is addressed in the response to Comment 160 in the December 7, 2001 *Final Statement of Reasons* (the *FSOR*), and on pages 8-12 of *October 31 Staff Review*. Fundamentally, the commenters argue that the costs assumed in various near term estimates (by staff, or by the Battery Technical Advisory

Panel) will hold true in perpetuity. Staff has argued that it is reasonable to assume continued technical progress and cost reduction. Staff agrees that estimates of long-term cost are by their nature “less rigorous” than near term estimates, but that does not undercut the fact that cost reductions are likely over the 20 year time-frame relevant here.

ZEV Costs in Light of Potential Fuel Cell Vehicles

3. Comment: Staff argues that the NERA/Sierra estimate of a \$32,000 cost increment for ZEVs in 2020 is unrealistic. Staff notes that the A.D. Little report suggests that as early as 2010, hydrogen fuel cell ZEVs could cost as little as \$9,300 more than a conventional vehicle. However, the A.D. Little report is vague concerning the volumes of fuel cell vehicles that would be required to enable automakers to produce them at low cost. The staff report provides no support for the proposition that the production volumes required under the ZEV mandate will lead to low cost hydrogen fuel cell vehicles. Economies of scale are still an important factor and the A.D. Little estimate cited by staff is unlikely to be associated with the volumes required under the ZEV mandate.

Agency Response: The Arthur D. Little report does not specify the production levels associated with the mid term and long term cost projections. The report provides an estimate of costs in the 2010 and 2020 timeframe, based upon expected technical progress, cost and market conditions. Therefore the volume level underlying the cost estimate is presumably thought by Arthur D. Little to be reasonable in that timeframe, and is independent of the number of vehicles required under the California regulation.

4. Comment: ARB staff notes that automakers are spending “billions of dollars” on fuel cell vehicles, presumably to suggest that the technology would not attract such interest if it did not hold the promise of future profitability. This same argument could have been made about electric vehicles. Staff appears to acknowledge that battery electric vehicles are unlikely to provide a low-cost ZEV option, and has now shifted its attention to a new technology, hydrogen fuel cells.

Agency Response: This issue is discussed in the response to Comment 161 in the *FSOR*. In staff’s assessment, the level and extent of manufacturer interest and investment in fuel cell technology significantly exceeds that previously shown for battery technology. Be that as it may, the fact remains that manufacturers continue to aggressively pursue fuel cell technology. For example, since the time that the *FSOR* was published, on January 9, 2002 the United States Department of Energy announced a new public-private partnership between the Department and the nation’s automobile manufacturers to promote the development of hydrogen as a primary fuel for cars and trucks. Under this new program, known as FreedomCAR, the government and the private sector will fund research into advanced hydrogen fuel cell technology for cars and light trucks. As Energy Secretary Abraham stated in his announcement of the program, “The long-term results of this cooperative effort will be cars and trucks that are more efficient, cheaper to operate, pollution-free and competitive in the showroom.”

With regard to the role of battery electric vehicles, staff continues to believe that such vehicles show promise in a variety of applications, including fleets, station car programs, and commuter vehicles.

5. Comment: Even if significant reductions in hydrogen fuel cell vehicle costs are achieved, the lack of infrastructure would remain a tremendous obstacle to the competitiveness of the vehicles. ARB staff ignores this problem, despite its claims to have acknowledged it in its October 31, 2001 review of the January 2001 NERA-Sierra report. To be consistent with its treatment of the purported fuel cost savings to AT PZEV consumers, staff would have to add the additional costs for hydrogen fuel to the costs of meeting the ZEV mandate using hydrogen fuel cell vehicles.

Agency Response: This issue is discussed in the response to comment 161 in the *FSOR*, and on page 12 of the *October 31 Staff Review*. As staff notes, work is underway to address infrastructure issues, and infrastructure for the small number of vehicles required under the ZEV program could be accommodated in a variety of ways. Further, a key goal of the FreedomCAR government-industry research program is the development of technologies that ensure the hydrogen infrastructure needed to support mass produced, affordable hydrogen-powered fuel cell vehicles.

6. Comment: Without infrastructure in neighboring states, the value of hydrogen fuel cell vehicles to motorists would be significantly reduced, since motorists would not be able to travel significant distances out of state. This would require even greater subsidies to induce consumers to purchase these vehicles, a factor completely ignored by ARB staff.

Agency Response: As noted above, infrastructure for the small number of vehicles required under the ZEV program could be accommodated in a variety of ways. Such early vehicles likely are to be found in fleet situations. Mass-market penetration, raising the issue noted by the commenter, likely would not occur until supporting infrastructure was in place.

Costs Related to Battery Industry Structure and Production Volumes

7. Comment: In the *Initial Statement of Reasons*, staff continued to rely on “volume production” estimates of ZEV costs even when expected production levels were an order of magnitude less than the volumes assumed by its sources for cost estimates. It appears now that ARB staff has abandoned earlier sources of ZEV costs, and is now relying on much less detailed and less rigorous cost estimates for hydrogen fuel cell vehicles prepared by A.D. Little. It seems that these costs do not account for production volumes in any respect.

Agency Response: Staff’s cost estimates as published in the *Initial Statement of Reasons* relied upon near term estimates developed by the Battery Technology Advisory Panel. These projections assumed production levels of 10,000-20,000 packs

per year, not volume production. With regard to the long term, staff is not “abandoning” its initial cost estimates. Rather, staff is using its near-term cost estimates for the early years and relying on other sources for long-term estimates. Such long term cost estimates were not a focus of the initial staff work and were not developed as part of the various staff reports.

8. Comment: In August 2000, staff estimated that 22,000 full function vehicles would be needed to comply with the regulation at an incremental cost of \$22,000 to \$24,000. Under the current proposal staff expects that roughly 4,500 vehicles will be produced in 2003 at an incremental cost of roughly \$15,000. Nowhere does staff justify these cost reductions, or the comparably dramatic underestimates of low-volume ZEV costs in later years.

Agency Response: The cost estimates in the August 2000 *Biennial Review Staff Report* ranged from \$13,000 to \$24,000 for full function vehicles, not \$22,000 to \$24,000 as asserted by the commenters. The estimate used for cost calculation purposes in the *Initial Statement of Reasons* was \$17,000, which was a midpoint among the various vehicle cost estimates provided in the August 2000 *Biennial Review Staff Report*. As discussed above, the \$15,000 figure was an outgrowth of the modeling procedure employed.

9. Comment: It is important to emphasize the link between production volumes and technological change, which staff incorrectly suggests that NERA and Sierra have ignored. While NERA and Sierra do believe that the BTAP cost estimates incorporate improvements due to technological change, a large proportion of technological change occurs as a result of “learning by doing” or from high production volumes.

Agency Response: Cost reduction results from design and engineering improvements as well as manufacturing improvements. While the latter may be driven by production volume, the former are not. In fact, during the Biennial Review manufacturers argued that the ZEV regulation should be delayed to allow time for additional cost reduction due to design and engineering enhancements.

Short Term AT PZEV Costs

10. Comment: Staff charges that NERA and Sierra overstate the cost of AT PZEVs reported by Duleep, which staff asserts should be \$2,300, not \$2,500 as NERA and Sierra assume. NERA and Sierra modeled a variety of alternative scenarios corresponding to different costs for AT PZEVs, including \$2,500 for some scenarios. Actual average AT PZEV costs may be higher, if manufacturers produce hybrids from larger vehicles. Sierra’s 1999 analysis of fuel economy improvement potential and its associated cost is the most detailed and comprehensive analysis available. Based on this work, NERA and Sierra determined that the most cost-effective way for automakers to earn AT PZEV credit would be to use a mild hybrid system to earn AT PZEV credits without a fuel efficiency multiplier. Such a vehicle would earn AT PZEV credits but does not have high enough fuel economy to earn an efficiency multiplier in the longer term

due to diffusion of the efficiency improving technologies that are also assumed for the vehicle.

Agency Response: This issue is discussed in the response to Comment 150 in the *FSOR*, and on pages 6-7 of the *October 31 Staff Review*. In brief, the fuel economy improvement for the Prius (\$2,300 as modeled by Duleep) would be sufficient to earn an efficiency multiplier. Vehicles that do not earn an efficiency multiplier would have a lower incremental cost.

Long Term AT PZEV Costs

11. Comment: Staff complains that NERA and Sierra apply their AT PZEV cost assumptions indefinitely, even though they were intended to be used only as near-term costs. NERA and Sierra have modeled scenarios where AT PZEV costs are assumed to be optimistically low, and in which the vehicles receive unrealistically high credits relative to these costs. Even under these scenarios, they find that the ZEV mandate results in higher fleet wide emissions.

Agency Response: This issue is addressed in the response to Comment 158 in the *FSOR*. We concur that changes to the AT PZEV cost assumptions, taken alone, are not sufficient to change the outcome of the NERA/Sierra analysis. As was demonstrated in the *October 31 Staff Review*, however, the combined effect of this and other reasonable changes is more than sufficient to overcome the purported fleet turnover effect.

12. Comment: Staff asserts that there is no basis for the NERA and Sierra assumption that fleet-wide fuel economy will improve. They note that recent fleet-wide trends suggest otherwise. While this trend is correct due to the popularity of sport utility vehicles (SUVs), it is unlikely to continue due to saturation in the market. We believe that fuel economy will improve by about 14 percent by 2020 based on our analysis of fuel economy improvement technology. However, the real issue is that staff's comments regarding fleet wide fuel economy are irrelevant. Even if the fleet average fuel economy does not improve, AT PZEV credits would still be reduced due to improvements in the fuel economy of individual vehicle classes. The fuel economy of vehicles in the individual categories that staff has defined as the basis for establishing AT PZEV credits has and will continue to improve, and this will increase the number of AT PZEVs required or increase the cost of producing them. These factors are unlikely to offset any reductions in the cost of current hybrid vehicle technologies.

Agency Response: This issue is discussed in the response to Comment 158 in the *FSOR*. To the extent that class average fuel economy improves, it will be due to enhanced technology. This technology has a cost. Thus the "base" cost against which the AT PZEV is compared will increase, thus reducing the incremental cost of an AT PZEV vs. the conventional vehicle.

Moreover, commenters elsewhere have argued that the technology associated with vehicles earning AT PZEV credit is not cost effective and is not attractive to consumers. This premise is the basis of their argument that the AT PZEV program imposes significant additional costs on manufacturers. Using that same logic, there is no basis to presume that such technology improvements would spread beyond AT PZEV vehicles. To the extent that certain low cost technologies become commonplace, as discussed in the following comment, they would not be expected to have a significant impact on the class average fuel economy.

13. Comment: Staff questions the possibility that efficiency improvements would be achieved in certain vehicle classes that could not also be applied to hybrid vehicles. Staff therefore questions whether the efficiency improvements in particular vehicle classes would in fact make it more difficult for hybrids to achieve earlier efficiency gains. NERA and Sierra's modeling assumed a variety of potential scenarios for AT PZEVs. Certain technologies, such as CVT, low rolling-resistance tires, and other high efficiency technologies were assumed to be implemented in these milder hybrids to enable them to achieve greater fuel economy, and therefore higher credits than would be warranted by their battery alone. However, many of these technologies are likely to be implemented in the conventional fleet over the next two decades. Thus, the credit received by such vehicles would decline over time, or, if they were to retain their credits in the future, the amount spent on these vehicles would have to increase.

Agency Response: As discussed above, fuel efficiency technologies adopted fleet-wide will increase the base cost of a conventional vehicle and lower the relative incremental cost of an AT PZEV. In addition, the fuel economy gains associated with the technologies described by the commenter are modest compared to the fuel economy benefits of hybridization and other more advanced technologies. Given the uncertainties associated with long-term predictions of vehicle technology and cost, this does not appear to be a significant factor.

14. Comment: Staff estimates the costs of battery packs for HEVs in volume production to be \$586. The rest of the staff HEV cost is \$500 and must include the cost associated with compliance with the PZEV standards as well as other HEV specific hardware other than the battery. The August 7, 2000 *Biennial Review Staff Report* refers to these costs as "For future, optimized volume production." Apparently, staff has either forgotten how it originally characterized its \$586 volume production cost estimate for HEV batteries or developed a new one that has not been described or documented in any way.

Agency Response: This is another instance in which the commenters are blurring the distinction between the near term and long term time periods. As staff has stated repeatedly, the cost estimates provided in the August 2000 *Biennial Review Staff Report* and the *Initial Statement of Reasons* were oriented toward the near term. Similarly, the estimates provided by the Battery Technology Advisory Panel, upon which staff relied, covered the 2003 and immediately following time period. These documents

focused on the near term in order to provide the best available background information for the Board as it considered the status of the Zero Emission Vehicle program.

The commenters systematically assume that there will be no further technical improvements or cost reductions through 2020. In staff's view this assumption is unreasonable. It is appropriate and reasonable to assume that there will be further technical progress and cost reduction in the long term.

AT PZEV Maintenance Costs

15. Comment: Despite the fact that AT PZEVs contain all of the componentry that is included in conventional vehicles, plus substantial additional advanced componentry, staff now suggests that the maintenance costs of these new vehicles will not be greater than conventional vehicles without providing any basis. Staff did not mention this change in its estimates until Sierra and NERA pointed it out as an issue, raising the concern about the support behind this changed assumption.

Agency Response: This issue is discussed in the response to Comment 289 in the *FSOR*. In brief, staff is unaware of any significant additional scheduled maintenance costs that could be attributed to the vehicle battery and the electrical components of the powertrain. Therefore, maintenance costs should be limited to the vehicle's ICE and other conventional vehicle components.

Other AT PZEV Cost Adjustments

16. Comment: ARB disputes the suggestion that a high discount rate should be applied to operating cost savings on the grounds that we should not assume that consumers will behave irrationally. They note that the Whinihan declaration does not suggest that consumers irrationally undervalue fuel savings. Studies that have found that consumers discount operating cost savings at a relatively high rate do not assume that consumers are behaving irrationally. Rather, these studies assume that consumers are in fact behaving rationally, and make conclusions about consumer's preferences and "discount rate" based on their observed behavior. To the extent that consumers do not value the purported fuel cost savings of AT PZEVs as much as ARB staff claims, staff has again underestimated the incremental costs of these vehicles.

Agency Response: This issue is discussed in the response to Comment 159 in the *FSOR*. As commenters acknowledge, some studies conclude that consumers "over-value" future fuel savings, while others conclude that consumers "under-value" such savings. Staff uses the same discount rate applied to other cost calculations.

17. Comment: Staff assumes that future hybrid electric vehicles will achieve close to 60 percent improvements in fuel efficiency relative to other vehicles in their class. Even if all hybrid vehicles produced were Prius-type hybrids, they would not achieve these efficiency improvements. Since automakers are likely to produce Prius-type hybrids as well as other "milder" hybrid types that do not achieve the same efficiency gains, staff's

assumptions appear to be optimistic or else appear to include efficiency improvements that should not be counted as resulting from the advanced technology components.

Agency Response: The Prius achieves a 90 percent fuel economy improvement relative to its class average (Prius CMPEG of 57.7 mpg vs. class average CMPEG of 30.4). Staff assumes that the typical AT PZEV will use Prius-type technology, such that the assumed efficiency improvement is readily achievable. Staff uses the same assumptions for its cost estimates. If manufacturers build other milder hybrid types, their costs would be reduced relative to the assumed Prius-type vehicle.

PZEV Costs

18. Comment: Staff has claimed that PZEVs will not cost \$500 more than other vehicles, but instead will only cost \$200 more. Staff has said that this revision is based upon an unpublished communication from a manufacturer and oral comments from other manufacturers regarding the technologies required to comply with the PZEV emission standards, rather than the costs associated with those technologies. Furthermore, it appears that staff neglected to include any cost estimates for production and warranty costs it may have received from its communications with these manufacturers along with its own cost estimates, thereby providing a range of estimates from various sources. Confidentiality of the data could be maintained if it were treated in the same manner as the hardware discussion. Therefore, staff's revision to its PZEV cost estimates is based on nothing in the public record.

Agency Response: This issue is discussed in the response to Comment 276 in the *FSOR*. When reporting the cost-effectiveness of its mobile source control programs ARB has never provided a range of cost estimates that include cost estimates from manufacturers, because manufacturers' cost estimates have generally proven to be substantially overestimated when the vehicles are eventually placed into production. One reason for this discrepancy is that vehicle development staff for the manufacturers typically overestimate costs initially in order to assure sufficient funding for vehicle development and production. Furthermore, staff's estimates are based on the long-term learned costs of an efficient manufacturer for producing vehicles meeting the proposed emission standards, whereas vehicle manufacturers generally point to short-term, up-front costs only. In addition, production costs will vary among manufacturers depending on the degree of innovation the manufacturer may chose to incorporate in its emission control systems and its production methods. Historically, when examined against the cost of actual production vehicles, staff's cost estimates have been proven to more closely reflect production costs than cost estimates provided by the manufacturers.

The commenters' point regarding documentation for the reduction in the cost estimates for PZEVs is extensively covered in the response to Comment 276 in the *FSOR*.

19. Comment: Staff acknowledges that it has ignored the incremental costs associated with going from LEVs or ULEVs to PZEVs, at least in the early years. However, staff contends that the appropriate increment in later years is the increment from SULEVs to

PZEVs, which it estimates and reports. Staff suggests that because of the way that NERA and Sierra model the mandate, the costs associated with going from LEVs or ULEVs to PZEVs should not make a difference to the results because they are incurred early in the mandate and, therefore, are not reflected in the ZEV tax.

Staff is required to properly and completely estimate the costs associated with the mandate, as well as the cost-effectiveness of the regulation based on its estimates. This error on the part of staff leads to an underestimation of the cost of the mandate and an overestimation of its cost-effectiveness. Furthermore, staff has provided no basis for its claim that by 2009 all PZEVs produced by all manufacturers would otherwise have been SULEVs.

If staff's assertion concerning vehicle implementation without the ZEV case is accurate, then it is true that staff's failure to estimate properly the costs associated with the ZEV mandate will have little effect on the "ZEV tax." However, the accuracy of staff's initial assumptions is questionable, and therefore its dismissal of any potential effects on the ZEV tax or on overall fleet-wide emissions appears premature.

Response: This issue is discussed in the response to Comment 156 in the *FSOR*. The commenter appears to be raising two issues. The first involves the accuracy of staff's contention that all PZEVs beginning in 2009 would be SULEV equivalent vehicles in the non-ZEV case. The second relates to staff's assumptions regarding the fleet composition in the non-ZEV case.

In the response to Comment 156, staff stated that "By 2009, PZEVs produced would otherwise have been SULEVs or SULEV equivalent vehicles." If one examines the fleet implementation for the non-ZEV case, beginning in 2009 25 percent of the PC/LDT1 fleet would be SULEVs and 55 percent would meet federal bin 3 emission standards (incrementally less stringent emission standards than SULEV). The fleet implementation for Tier 2 was taken from U.S. EPA's Mobile 6. Clearly the requirement for PZEVs is feasibly met by converting all of the SULEVs and a portion of the bin 3 vehicles to PZEVs. In fact, beginning in 2007, all PZEVs can be derived from SULEV and bin 3 vehicles. Since U.S. EPA has chosen not to publish incremental costs for bin 3 vehicles, staff assumed that the incremental costs for going from bin 3 to PZEV is the same as going from SULEV to PZEV. While this may understate costs to some degree, the error is small in light of the minor difference in emissions standards between bin 3 and SULEV, requiring only minor additional costs.

While questioning the accuracy of staff's assumptions for fleet implementation, the commenter does not identify any specific errors. As noted above, staff relied on U.S. EPA for the implementation schedule for Tier 2 vehicles and is unaware of a more accurate source for this information. It should be noted that fleet implementation schedules for emission inventory purposes are developed with the entire industry in mind. While individual manufacturers may chose a different implementation schedule depending on their specific business plans, staff is in no position to second-guess those plans.

We concur with the commenters' observation that the issue raised by the commenters has little effect on the "ZEV tax" if the staff assumed fleet composition is correct.

Vehicle Costs -- Summary

20. Comment: The ARB staff's assumptions about costs for the ZEV mandate are not plausible estimates. Staff's assumptions are unrealistically optimistic and do not reflect the actual costs that manufacturers are expected to incur as a result of the requirements to manufacture and sell ZEVs, PZEVs, and AT PZEVs. Staff's assumptions for short-term costs contradict earlier published estimates, and they do so on the basis of scant evidence.

Agency Response: Staff's assumptions for short-term costs are consistent with its earlier published estimates and with other sources. The one area where a change has been made involves the estimated cost for PZEVs, and staff has fully supported this revision. Other specific cost issues raised by commenters are addressed in separate comments.

21. Comment: Staff's assumptions regarding longer-term costs are also unjustified. Staff appeals to vague, hopeful notions of "technological change" to support its claim that AT PZEV costs will decline substantially and that fuel cells will provide a cheap solution to the pure ZEV requirements of the mandate. The costs of fuel cell vehicles do not include the huge cost of hydrogen infrastructure. The actual costs of the mandate and the requirements that certain vehicles be sold at artificially low prices will result in the economic hardship for both automakers and California dealers.

Agency Response: As noted above, staff expects that technical change and cost reduction will occur over the 2003-2020 time period. Rather than a "vague, hopeful notion," staff believes that this is a far more reasonable assumption than the commenters' argument that all progress will cease.

22. Comment: The ARB staff misrepresents the NERA and Sierra analysis when it claims that NERA and Sierra concluded that fleet-wide emissions will be higher under the ZEV mandate under "any and all circumstances." The NERA and Sierra analysis simply shows that under any plausible circumstances, the mandate is likely to increase emissions, not reduce them. Staff's response is to assume very implausible circumstances, and then conclude that the concerns raised by the NERA and Sierra analysis can be dismissed.

Agency Response: We concur that the NERA/Sierra analysis used the phrase "any plausible circumstances" rather than "any and all circumstances". But we believe that the staff assumptions are reasonable and that therefore the commenters' statement that "under any plausible circumstances, the mandate is likely to increase emissions, not reduce them" is incorrect.

Assumptions Regarding Vehicle Attributes -- Vehicle Miles Traveled

23. Comment: Jane Hall and Victor Brajer suggested that the “Three Cities” vehicle use studies might not reflect California driving patterns. NERA and Sierra have rebutted this claim, and while ARB staff disavows any reliance on this particular criticism, it fails to address the fundamental issue. Despite acknowledging the performance limitations of electric vehicles, namely that ZEVs will not be able to completely replace conventional vehicle VMT, staff has failed to assess the impact of this fact on its claim regarding the magnitude of emission benefits of the ZEV mandate. This is one important reason why ARB staff overestimates the emission benefits of the ZEV mandate.

ARB staff claims that the BTAP report was intended to apply to the near term battery technology and that range of battery electric vehicles is likely to improve in the future. Large improvements in range and large reductions in recharging times would be required to address battery electric vehicle limitations. Staff cites no evidence to support its claim that range will improve and makes no attempt to quantify the improvements it maintains will occur.

Agency Response: This issue is discussed in the response to Comment 173 in the *FSOR*, and on page 24 of the *October 31 Staff Review*.

24. Comment: Staff asserts that the possible future advent of fuel cell vehicles will address the range constraints assumed in the NERA and Sierra analysis and therefore eliminate the need for any VMT adjustment. This dismissal ignores the major obstacle to the use of hydrogen fuel cell vehicles – the lack of an extensive hydrogen-refueling infrastructure – and is not appropriate. Unless staff accounts for the additional costs of the infrastructure, it is totally unrealistic to assume that hydrogen fuel cell vehicles will be able to complete the same trips completed with gasoline vehicles.

Agency Response: This issue is discussed in the response to Comment 173 in the *FSOR*. Over the time frame under consideration for the ZEV regulation and given the small number of vehicles involved, it is reasonable to assume that fuel cell vehicles could achieve average VMT in various applications. In particular, early fuel cell vehicle placements are likely to occur in fleet applications.

AT PZEV Attributes

25. Comment: ARB staff takes issue with the credits calculated by NERA and Sierra for its AT PZEVs. They claim that a Prius would earn a credit of 0.62 until 2007, and a credit of 0.54 in 2008 and beyond. The NERA and Sierra credit estimates are lower, and staff suggests, incorrect. Higher credits for AT PZEV would reduce the number of vehicles required and therefore reduce the cost of the mandate. It is not clear how staff arrived at its credit amount of 0.62 in the early years of the mandate.

Agency Response: Staff estimates that a Prius-type hybrid would earn a credit of 0.62 until 2007 and 0.544 in 2008 and beyond. The basis for the 0.62 estimate is as follows:

$$\begin{aligned} \text{Credit} &= ((0.2 \text{ base credit}) + (\text{adv. comp. credit})) \times (\text{efficiency multiplier}) \\ &= ((0.2) \quad + \quad (0.29)) \quad \times \quad (1.27) \end{aligned}$$

Where:

$$\begin{aligned} \text{Advanced componentry credit} &= 0.29 \text{ (peak power method)} \\ \text{Efficiency multiplier} &= \text{Prius CMPEG} / (1.5 \times \text{class average CMPEG}) \\ &= 57.7 / (1.5 \times 30.4) \\ &= 1.27 \end{aligned}$$

Staff notes that this estimate does not include the PZEV early introduction multiplier (4.0 in 2003, 2.0 in 2004, and 1.33 in 2005). Thus the scores in those years would be further increased above the 0.62 base level. The early introduction multiplier is taken into account in staff's estimate of vehicle production levels.

Assumptions Regarding Manufacturers' Economic Decisions in the New Vehicle Market Analysis – Relationship Between Regional Costs and Regional Prices

26. Comment: ARB staff is apparently puzzled by the idea that significant cost increases in specified regions, such as those imposed by the ZEV mandate, are likely to lead to differences in regional prices, whereas smaller regional cost increases may not lead to price differences. Staff does not seem to recognize that there are resource costs associated with maintaining different prices in different regions, and that these costs may outweigh the benefits.

Agency Response: This issue is discussed in the response to Comment 162 in the *FSOR*, and on pages 13-16 of the *October 31 Staff Review*. We concur that significant cost increases in specified regions may lead to differences in regional prices, whereas smaller regional cost increases may not lead to price differences. The relevant issue is whether any cost increases due to the ZEV program would be significant enough to merit separate regional treatment. In its *October 31 Staff Review*, staff demonstrated that with reasonable assumptions the purported "ZEV tax" associated with the California regulation was in the range of \$25-40. This is similar to other similar increases that have not resulted in a price increase for California models.

Losses in Market Share to Intermediate Manufacturers

27. Comment: ARB staff avoids NERA and Sierra's point that market share is accounted for in the NERA and Sierra analysis, but is at best a secondary factor in firm decision-making. Staff claims that its only reason for mentioning market share is to point out that manufacturers face competitive pressures. Staff appears to cling to the notion that automakers will willingly choose to increase market shares even if this results in lower long-term profits than they could otherwise achieve. This is an

argument that has no support in the economics or business literature. Given a choice between higher market share and higher profits, firms will choose higher profits. There is no point served by staff stating that automakers required to comply with the ZEV mandate will face competitive pressure from intermediate manufacturers that do not have to comply.

Agency Response: The argument made by staff is that competitive pressure will limit the price increase that can be imposed by major automakers. Prices set by the major automakers would be affected by the presence in the market of intermediate manufacturers able to sell vehicles at a lower cost. This competitive pressure will reduce the demand for major automaker vehicles and as a result the profit-maximizing price will be lower than it otherwise would be.

The *October 31 Staff Review* used the NERA/Sierra methodology. Thus this point does not affect the staff conclusions. To the extent that the price limiting effect discussed above occurs, it would serve to further limit the already minor fleet turnover effect.

Factors Affecting Manufacturer Pricing Decisions

28. Comment: Staff notes that “allocation of costs is a manufacturer decision.” Staff argues that there may be “corporate” reasons for manufacturers to “absorb” losses on particular vehicle lines. Staff also points to precedents suggesting that manufacturers allocate specific regional costs on a national basis when the additional costs are small, and therefore attempts to show that the costs associated with the mandate will not be particularly large.

Staff implies that some “corporate reason” might lead a manufacturer to subsidize certain vehicle lines, and thus not maximize profits. Staff provides no explanation for such behavior, or any indication that the behavior would be relevant to the situation posed by the ZEV mandate. Thus we assume that Staff does not dispute the proposition that profit-maximizing firms will increase prices for vehicles whose marginal costs increase due to the ZEV mandate.

Staff’s argument thus apparently boils down to the following: manufacturers’ costs are indeed likely to rise in California because of the ZEV mandate, and if these cost increases are large, then this could have effects on the California vehicle markets. However, Staff asserts that the cost increases will not be large, and therefore that this is not an issue. As detailed above, we believe that Staff’s assumptions regarding the costs of the mandate are unduly optimistic and unsupported.

Agency Response: Examples of a corporate rationale for subsidizing certain vehicle lines are provided in the Green Car Institute report on *Future EV Pricing*, which was cited in the *October 31 Staff Review*. The *Future EV Pricing* report makes the following observations:

The high initial prices of EVs fail to take into account historic precedents of subsidizing the cost of specialty or low-volume vehicles deemed important to an automaker's overall marketing program or corporate positioning. Whether it was musclecars during the Sixties, sports cars in the Eighties, or now electric cars in the new century, a car that becomes a key part of the company's basic image receives corporate support with less expected in terms of program return-on-investment. (page 1)

In the case of recently introduced hybrid cars from Toyota and Honda, the belief appears to be that brand loyalty based on the respective company's environmental and technological leadership justifies the losses at retail sales. (page 10)

With such high-level support, and the knowledge that pricing is a flexible component as demonstrated with Toyota's and Honda's hybrid strategy, it is logical that auto companies could use their fleet of zero or near-zero emission vehicles as image leaders even if their initial pricing is not designed to fully recover the vehicles' wholesale costs. (page 14)

Thus there is precedent and rationale for manufacturers choosing to absorb losses on specific vehicle lines for corporate strategic reasons.

Specific issues regarding the staff assumptions for incremental vehicle cost are discussed as appropriate elsewhere in this Supplement.

Relationship Between the California Market and Other Markets

29. Comment: ARB staff acknowledges that automakers will consider the effects of the ZEV mandate on costs when making decisions about what to sell in the state. To staff's credit, it appears to recognize that a number of the criticisms made in the memo written by Hall and Brajer were misplaced. Staff recasts these criticisms into a dispute over the likelihood that automakers will confine their price changes to California or change prices in other states as a result of the ZEV mandate. Staff has presented no evidence to dispute the fact that the ZEV mandate will increase manufacturers' marginal costs of selling vehicles in California, or that these cost increases will lead manufacturers to raise prices where costs are higher – namely, in California. These price increases will harm California dealers, but they will have little effect on dealerships outside of California.

Agency Response: This issue is discussed in the response to Comment 162 in the *FSOR*, and on pages 13-16 of the *October 31 Staff Review*. The relevant issue is whether any cost increases due to the ZEV program would be significant enough to merit separate regional treatment. In addition, staff notes that the purported impact on California dealers cited by the commenters is based on the NERA/Sierra analysis. The *October 31 Staff Review* demonstrated that the NERA/Sierra methodology, when

reasonable assumptions are employed, predicts only a minor cost impact on vehicles sold in California.

30. Comment: Staff note approvingly a criticism made by Hall and Brajer that the possibility of cross-border sales in new vehicles will prevent manufacturers from raising prices in California. Neither staff, nor the memo it cites provides any estimates of the extent to which out-of-state dealers compete with in-state dealers. Nor do they offer any estimate of how significantly this competition would be affected by the price increases that result from the ZEV mandate. The memo by Hall and Brajer does refer to a price “ceiling”, which suggests that above a certain price in automakers would be unable to sell any vehicles – a scenario that implies that all vehicles are sold by intermediate automakers or out-of-state dealers. Such a scenario is inconsistent with realities in the market, as NERA and Sierra note in response to the proposed changes.

Agency Response: This issue is discussed in the *FSOR*, comment number 162. Similar to the discussion above regarding intermediate manufacturers, the presence in the market of dealers from neighboring states will serve to reduce any price increase that would otherwise be imposed by in-state dealers.

Staff notes that the commenters elsewhere argue that California dealers will be harmed by price increases due to the ZEV regulation (see Comment 31 below). If this is true, it implies that consumers are purchasing cars from neighboring states. This would tend to exert downward pressure on in-state prices, consistent with staff’s argument.

31. Comment: There really is little reason for automakers to care if consumers opt to buy vehicles from out-of-state dealers. California dealers most assuredly do care and would be suffer serious hardship in areas bordering other states as a result of price increases. Since models described by NERA and Sierra do not account for such competition, we conclude that the NERA and Sierra models make conservative assumptions concerning the effects on California dealers.

Agency Response: As noted above, the staff review of the NERA/Sierra arguments concludes that when using reasonable assumptions, the effect of the ZEV program on prices charged for California vehicles would be modest. The effect on dealers bordering other states therefore would similarly be modest.

Industry Expert on Pricing

32. Comment: The ZEV mandate is similar in certain respects to the CAFE standards: the costs of lost profits associated with ZEVs and other required vehicles are linked to the prices of covered vehicles. However, the costs imposed by the ZEV mandate are not opportunity costs or reductions in potential profits – they are balance-sheet costs that the mandate imposes on manufacturers, because manufacturers suffer a loss on each ZEV that they are required to sell, and not simply a reduction of their per-vehicle profit. And while CAFE applies to national sales, the ZEV program applies only in California, and therefore cost and price effects will be confined to the state.

It is true that some costs involved in vehicle manufacturing and sales are sunk. However, many costs are variable depending on the number of vehicles produced and sold. The analysis performed by NERA and Sierra accounted for these viable costs correctly, and ARB staff's suggestion that they are in fact sunk is incorrect. Each additional required ZEV or other mandate vehicle has its own costs associated with it. These costs are marginal costs, and because of the linkages between mandate vehicles and covered vehicles, they will affect pricing decisions for both mandate vehicles and the covered vehicles that are linked to them.

Agency Response: This issue is discussed in the response to Comment 140 in the *FSOR*. It is important to note that the staff analysis used the NERA/Sierra methodology. Therefore these comments, and the similar comments above, have no bearing on the conclusions reached in the *October 31 Staff Analysis*. To the extent that the points raised by staff have merit, they would serve to further reduce the already minor fleet turnover impact predicted by the NERA/Sierra model when using reasonable assumptions.

Assumptions Regarding Consumers' Economic Decisions -- Price Elasticity

33. Comment: ARB staff concur with Hall and Brajer that a more appropriate value for the market elasticity of the industry is -0.87. They argue that although the resulting difference in results is small, it is not insignificant, and when compared with other changes, produces the results that ARB reports. As noted elsewhere, the elasticity adjustment makes little difference to the results even when combined with other assumptions that ARB favors.

Agency Response: This issue is discussed on pages 20-22 of the *October 31 Staff Review*. Even though this assumption in isolation has only a minor impact, in combination with other reasonable assumptions the end result is to negate the purported fleet turnover effect.

Present and Future Price Elasticity

34. Comment: ARB staff offers no evidence in support of the claim that the price elasticity of demand for vehicles is less than it has been in the past, or that previous findings of elasticity are no longer relevant. Without evidence concerning the actual responsiveness of consumer demand to vehicle prices, the information cited by Hall and Brajer cannot be used to draw meaningful conclusions on the likely demand elasticity relevant to the ZEV mandate.

Agency Response: Staff presented data regarding recent trends in consumer preferences, which show that price is relatively less important to consumers, as compared to other vehicle attributes, than in the past. The staff assumption regarding price elasticity is based on the economic literature, however, not on the trend data mentioned by the commenters. ARB staff do not argue that previous findings regarding

elasticity are no longer relevant. Rather, as was pointed out by Hall and Brajer, the relevant literature concludes that an elasticity of less than -1.0 is appropriate.

Consumer Responsiveness to Price Increases Less Than \$500

35. Comment: ARB staff argues that price differences of under \$500 are unlikely to affect consumer decisions, and reiterates its claim that manufacturer incentives, which staff claims are higher than \$500, supports this assertion. Staff's conflation of the pricing differences created by manufacturer incentives with the price differences that would obtain under a ZEV mandate is inappropriate and misleading. Comparing the price differences created by manufacturer incentives to the price differences that would be in effect under the ZEV mandate is akin to comparing temporary, short-term market fluctuations to long-term shifts in the market. The ZEV mandate would impose permanent cost increases on manufacturers and dealers, and therefore would result in permanent price increases. If these price increases were smaller than the price reductions typically employed by manufacturers as manufacturer incentives, then we might expect the number of consumers responding to the price differences to be smaller in the ZEV case over a given time period. But this in no way implies that the overall long-term impact of a ZEV Tax would be less than the impact of a short-term price incentive designed to move a small number of vehicles relatively quickly.

Agency Response: This issue is discussed in the response to Comment 165 in the *FSOR*, and on pages 18-19 of the *October 31 Staff Review*. Staff notes that this issue does not affect the results of the *October 31 Staff Review*, which concluded that when using reasonable assumptions, the reduced fleet turnover predicted by the NERA/Sierra model did not result in an emission increase from the ZEV program. The issue raised by staff regarding consumer response to price increases would serve to further reduce the already small predicted change in fleet turnover.

Use of Single Price Elasticity

36. Comment: ARB staff brushes aside the observation that in one place the Hall and Brajer memo inaccurately claims that NERA and Sierra employ a single elasticity for their entire analysis. Staff appears to argue that this does matter, because elsewhere Hall and Brajer observe that multiple elasticities are used. To the extent that ARB staff relies on this inconsistent discussion of NERA and Sierra's analysis, ARB's arguments are weakened.

Agency Response: The *October 31 Agency Response* used the methodology developed by NERA/Sierra. Discussion about how that methodology was described in an earlier memo is irrelevant. Staff did not rely on any outside description of the elasticity used nor do the commenters provide any indication that staff did so.

Consumer Substitution of LDT2s for PCs and LDT1s

37. Comment: Staff asserts that the real point of the Hall and Brajer memo is that given the low fuel-economy of LDT2s, consumers would be unlikely to switch to larger vehicles. The suggestion that the fuel-economy characteristics of LDT2s make these vehicles unattractive to consumers is belied by the very strong growth in the sales of these vehicles over recent years. Moreover, to the extent that the arguments made by staff and Hall and Brajer rely on the assumption that fuel prices will be higher in the future, and thus reduce demand for LDT2s, they are not appropriate. NERA and Sierra's reliance on historical data is reasonable and probably conservative given EIA's prediction of lower fuel prices (in real terms) over the next 20 years.

ARB quotes approving language from Hall and Brajer that suggests NERA and Sierra assume a dramatic shift to LDT2s from LDT1s. This is not true. Under NERA and Sierra's preferred scenario in their Comprehensive Report, the predicted increases in LDT2 sales in 2010 and 2020 are only 0.8 and 0.9 percent, respectively.

Agency Response: The *October 31 Staff Review* relied upon the methodology developed by NERA/Sierra. The staff concluded that when using reasonable assumptions, the reduced fleet turnover predicted by the NERA/Sierra model did not result in an emission increase from the ZEV program. The issue raised here by staff, regarding possible constraints on the shift from LDT1 to LDT2 vehicles by consumers, would serve to further reduce the already small predicted change in fleet turnover.

38. Comment: Staff suggests that before the 15-Day Notice changes, the mandate may have given manufacturers an incentive to shift their production from PCs and LDT1s to LDT2s. If manufacturers would alter their behavior because of the cost differences imposed by the mandate, then surely these cost differences are large enough that individual consumers will respond to them. Indeed, it seems strange that staff argues that the resulting costs will be too small for consumers to notice, and therefore that the market-level effects that emerge in the NERA and Sierra analysis should be dismissed. Staff's inconsistent attitude towards the market-level effects of the mandate is inappropriate and covers up the fact that the ZEV mandate will lead to real harm to California businesses and consumers.

Agency Response: Staff does not dispute that manufacturers respond to cost changes. The relevant issue is the magnitude of any such effect.

Effects of Gasoline Price on Demand for LDT2s

39. Comment: ARB staff attempts to argue that the troubling effects of the mandate that are predicted by NERA and Sierra's analysis might be changed for the better, if only certain possible future scenarios came to pass. Staff's approach to evaluating the ZEV mandate appears to be based upon the use of extremely optimistic assumptions, rather than realistic assessments. As an example, staff acknowledges that gasoline prices can go up or down, but then only considers the case in which gasoline prices

change in the way that would reduce the negative effects of their regulation. Staff simply ignores the other alternative – that a change in gasoline prices might exacerbate the effects that NERA and Sierra predict.

Agency Response: The *October 31 Staff Review* used the NERA/Sierra methodology. No attempt was made to change assumed gasoline prices. As is the case with other issues raised by the commenters, to the extent that staff's comment has validity it would serve to further reduce the already minor change to fleet turnover.

Demand for ZEVs

40. Comment: ARB staff cites various features of the marketing efforts undertaken by automakers for ZEVs that staff claims are uncharacteristic of typical efforts to sell vehicles. The implication is that the sales data derived from the 1996-2000 period do not provide a sound basis for the estimation of the demand for ZEVs. Manufacturers have made substantial efforts to market ZEVs during 1996-2000, and had every incentive to earn whatever revenues they could on these vehicles. The data on vehicle prices and sales therefore provide the best existing estimate of demand for these vehicles. To account for the possibility that this data underestimates the actual demand for ZEVs, NERA and Sierra analyzed scenarios where demand for ZEVs is inflated ten times the levels of the existing data. ARB staff failed to acknowledge these scenarios; scenarios that show significant increases in overall fleet emissions even with this inflated demand and optimistic assumptions.

Agency Response: Contrary to the assertion by the commenters, staff explicitly acknowledged the NERA/Sierra scenarios under which the assumed demand for ZEVs was increased tenfold. The *October 31 Staff Review* noted that “the NERA/Sierra model ran a case (Scenario E) that assumed that consumer demand is 10 times the level estimated during the MOA period” (*October 31 Staff Review*, page 17).

Staff concurs that this change alone is not sufficient to change the predicted NERA/Sierra outcome. As is the case with other small changes, however, staff demonstrated that in combination a series of reasonable changes to the NERA/Sierra assumptions was sufficient to eliminate the purported emission increase.

Economic Issues Associated With the Scrappage Analysis – Use of National Scrappage Rates in the Scrappage Model

41. Comment: Staff disavows any reliance on the mistaken suggestion by Hall and Brajer that scrappage rates in California could be higher than the national average. However, staff fails to acknowledge evidence that California scrappage rates are actually lower than the national average. Since the NERA and Sierra analysis relies on national data, it likely underestimates the number of existing vehicles that would remain on the road in California, and therefore underestimates the increase in fleet-wide emissions expected because of the mandate.

Agency Response: The *October 31 Staff Review* used the NERA/Sierra methodology, which relied on the NERA/Sierra assumptions regarding scrappage rates.

Gasoline Prices in the Scrappage Model

42. Comment: Staff notes that although the NERA and Sierra analysis does not make any explicit assumptions about future gasoline prices, its reliance on historical price data embeds certain relationships in its model. It is clearly true that any model based on a particular set of data has certain relationships embedded in it – this is the purpose of developing a model. In the absence of strong evidence to the contrary, there seems little reason to modify these assumptions. Given the uncertainties, and the fact that deviations from existing patterns could skew the results in either direction, it is entirely appropriate to rely on average values and relationships, as the analyses performed by NERA and Sierra have done.

Agency Response: The *October 31 Staff Review* used the NERA/Sierra methodology, which relied on the NERA/Sierra embedded relationships based on historical gasoline prices.

Effect of Accelerated Scrappage Programs for Older Vehicles

43. Comment: Other comments have noted that programs designed to promote the scrappage of older vehicles are already in place in California, and ARB has not suggested that it plans to expand these programs in conjunction with the ZEV mandate. Thus any effects of these existing programs on vehicle scrappage are already a feature of the California vehicle markets, and will not affect the expected changes that result from the ZEV mandate. NERA and Sierra's assumptions regarding scrappage rates are likely to underestimate the retention rates in California since California vehicles remain on the road longer than the national average. It is therefore likely that the NERA and Sierra analysis underestimates the increase in emissions caused by the ZEV mandate.

Agency Response: The *October 31 Staff Review* used the NERA/Sierra methodology, which relied on the NERA/Sierra assumptions regarding scrappage rates.

Issues Related to Macroeconomic Effects of the Mandate -- Overall Cost Impacts on California

44. Comment: Despite its assertions to the contrary, staff has not sufficiently answered the charge that the modified mandate significantly increases costs. Although the proposed changes reduce the mandate's initial burden relative to the August 2000 mandate, in later years the cost of the mandate is substantially higher than under the existing mandate. Our analysis shows that although the number of ZEVs is reduced over the course of the mandate, in the later years the number of other vehicles increases such that the new proposal is expected to cost significantly more than the existing mandate, even using staff's unrealistic assumptions regarding costs.

Specifically, NERA/Sierra's calculations using staff's assumptions project a savings under the new proposal of \$232 million in 2005 and \$202 million in 2010, but an increased cost of \$77 million in 2015 and \$221 million in 2020.

Agency Response: The commenters argue that in future years, the cost of the modified regulation to manufacturers is greater than the cost of the ZEV regulation as last amended in 1998-9. We agree that on an annual basis (costs or savings incurred in each year) the cost of the modified regulation begins to exceed the cost of the previous regulation in model year 2015. Due to the large savings accrued in the early years, however, on a *cumulative* basis (cumulative costs or savings since 2003) the modified program still shows a significant net benefit in model year 2020 and beyond. In fact, staff calculates that the "breakeven" point at which the future increased costs outweigh the initial savings does not occur until model year 2035. If one discounts the value of future costs and savings by 5 percent per year (to account for the time value of money) then the modified regulation shows a significant net benefit through 2050 and beyond. Thus we conclude that the amendments adopted in this rulemaking provide a net cost benefit to manufacturers.

In performing these calculations, staff slightly modified the methodology used by the commenters. First of all, the commenter's calculation appears to inappropriately increase the number of PZEVs needed in future model years to keep pace with increased ZEV totals. (Under the adopted amendments, the number of PZEVs ramps up until 2012 but is stable beyond that point; the ZEV percentage requirement increases in 2015 and 2018 but there is no corresponding increase in the PZEV percentage for those years). The second modification corrects for the fact that the most recent staff estimate of the number of vehicles required under the modified program uses updated information regarding manufacturer sales. (The most recent staff estimate uses actual sales for model years 1997-1999 as the sales base for compliance years 2003-2005, and projected sales for model year 2000 as the compliance base for model years 2006 and beyond, whereas the estimates provided in the August 2000 *Biennial Review Staff Report* and the *Initial Statement of Reasons* were based on 1998 model year actual sales). Finally, staff used non-rounded vehicle total and cost information taken directly from its estimates. (The totals provided in the *Initial Statement of Reasons* and the commenters' analysis were rounded).

With those adjustments, but otherwise following the methodology used by commenters, the comparison of the 1998 program and the modified program is as follows:

		2005	2010	2015	2020
Number of vehicles					
1998 regulation					
	PZEV	379689	410237	410237	410237
	AT PZEV	0	0	0	0
	ZEV	21236	41018	41018	41018
Modified regulation					
	PZEV	274601	612629	707872	707872
	AT PZEV	22251	70648	130748	163435
	ZEV	4421	12001	24502	30627
Difference (modified minus 1998)					
	PZEV	-105088	202392	297635	297635
	AT PZEV	22251	70648	130748	163435
	ZEV	-16815	-29017	-16516	-10391
Incremental cost per vehicle					
	PZEV	\$200	\$200	\$200	\$200
	AT PZEV	\$3,282	\$1,086	\$1,086	\$1,086
	ZEV	\$15,147	\$11,976	\$9,901	\$8,939
Cost difference by vehicle type (in millions)					
	PZEV	-\$21	\$40	\$60	\$60
	AT PZEV	\$73	\$77	\$142	\$177
	ZEV	-\$255	-\$348	-\$164	-\$93
Total cost difference (in millions)		-\$203	-\$230	\$38	\$144
Cumulative cost difference (in millions)		-\$732	-\$2,128	-\$2,548	-\$2,040

Thus these calculations show that the amendments adopted in this rulemaking resulting in a cumulative savings of \$2.5 billion in 2015 and \$2.0 billion in 2020, as compared to the ZEV regulation as last amended in 1998-99.

Manufacturer Burden

45. Comment: ARB staff suggests that the overall burden on automakers cannot be considered significant, since the estimated cost of \$450 million in 2006 is only 1.7 percent of the six large automakers combined average net annual income over the last five years. Calculating the burden of the ZEV mandate as a fraction of automakers' income is not appropriate as a criterion for sound policy. The appropriate questions relate to the costs of the mandate and the resulting emission reduction benefits, which in the case of the ZEV mandate are negative. Even if the manufacturers' burden calculation were relevant, staff's estimate is based on its unrealistic cost assumptions. It is conceivable that the proposed mandate could eliminate more than 50 percent of automakers' California profits in 2006. Staff's portrayal of the mandate's burden as a minor one for automakers is clearly inappropriate.

Agency Response: As is demonstrated above, the staff proposed modifications significantly reduce the ZEV program burden on automakers. With regard to calculating the effect of the regulation on automakers, staff believes that its cost estimates are

reasonable. Specific issues regarding staff cost estimates are discussed in other comments as appropriate.

Dealer Burden

46. Comment: ARB staff suggests that the burden on California dealers would not be significant. Seeking to minimize estimates of the dealer burden, staff argues that dealers would benefit from the sale of ZEVs, and that although dealers would face lower profits from new vehicle sales, this effect would be tempered by additional profits from the increase sales of vehicle repair services. In a separate analysis of earlier proposed revisions to the ZEV mandate, NERA estimated that dealers could lose as much as \$39 million in 2010 and \$48 million in 2020 in lower profits as a result of the mandate. While staff argues that NERA and Sierra's costs are too high, there is every reason to believe that ARB staff's cost estimates are far too low. Specifically, counter to ARB staff's claims, dealers will not make money from the sale of ZEVs, since ZEVs will be sold at a loss, will result in additional costs beyond normal vehicles, and prove more difficult to sell due to vehicle characteristics.

Contrary to staff's suggestion, the NERA analysis did account for the increase in vehicle parts and services for the existing fleet, which remain on the road longer and therefore would require additional maintenance and repair. Incorporating staff's suggestion would reduce the dealer losses by less than 10 percent – hardly an effect that will ameliorate the overall adverse impacts of the mandate on California dealerships.

Agency Response: The NERA/Sierra estimates of dealership losses are based on unreasonable estimates regarding ZEV program costs, as explained in the *October 31 Staff Review*. It is not clear that dealers would not profit from the sale of ZEVs. Marketing programs used by some manufacturers during the MOA period provided a bonus to dealers for the sale of a ZEV. Staff concurs with the commenter that increased profits from maintenance and repair of older vehicles on the road would contribute towards an offset of other costs that may be incurred.

Assumptions Relating to Fleet-Wide Vehicle Emissions – Changes to the LEV II Program

47. Comment: ARB staff has argued that the presence of the ZEV mandate will result in even greater benefits as a result of the LEV II follow-up amendments. In actuality, it is difficult to predict how manufacturers will ultimately choose to comply with both the ARB LEV II requirements and the federal Tier 2 requirements. However, it is instructive to review the LEV II and Tier 2 implementation schedules that ARB staff have developed for their EMFAC emissions model. Although the differences vary by model year, the non-ZEV schedule typically has more than double the number of Tier 2 vehicles relative to the ZEV mandate case. Thus, it is difficult to understand how ARB staff can argue that the ZEV mandate results in greater benefits from the LEV II follow-up amendments than a non-ZEV case.

Agency Response: This issue is discussed in the responses to Comments 174 and 286 in the *FSOR*. In developing the fleet scenarios for the ZEV case and non-ZEV case, staff incorporated the fleet schedule for Tier 2 into the fleet schedule for LEV II. The fleet schedule for Tier 2 was obtained from U.S. EPA's draft version of Mobile 6. In developing the fleet schedule for the ZEV case, vehicles were moved from the next highest emission category (bin 2) into the PZEV and ZEV categories until the ZEV mandate was satisfied. When the bin 2 category was exhausted, vehicles were moved from the next highest category (bin 3) into the PZEV and ZEV categories, and so on. Since the emission values for Tier 2 categories (bins 2, 3 and 4) are lower than the next highest LEV II category (ULEV), only Tier 2 vehicles were needed to meet the ZEV requirement. Accordingly, the fleet schedule for the non-ZEV case contains more Tier 2 vehicles than the ZEV case. Even though the ZEV case has fewer Tier 2 vehicles, the emission benefits are greater – in part because of the zero-evaporative emission requirement for PZEVs and ZEVs, and the lower NOx emissions from these vehicles. In other words, in the ZEV case, the “cleaner federal models” are required to be even cleaner. Further explanation of the emission benefits of the ZEV case can be found in the response to Comment 174 in the *FSOR*.

Characterization of ZEVs as the “Gold Standard”

48. Comment: ARB staff repeatedly claims that ZEVs represent an indispensable component of their effort to reduce statewide emissions. ARB staff's claim is not only unsubstantiated but incorrect, given estimates of fleet emissions without the mandate that might have been developed using ARB's own emissions forecasting tools. In fact, without the ZEV mandate, emissions from vehicles subject to the mandate are expected to dramatically decline over the next two decades. ARB's claimed benefit for the entire ZEV mandate – less than 5 tons per day of ozone precursors – would scarcely affect overall emissions. Even using ARB's own estimates the benefits of the ZEV mandate by 2020 are simply inconsequential.

Agency Response: The purpose of the ZEV regulation is to encourage the development of technology that will result in widespread penetration of vehicles with extremely low emissions and increased durability. When the ZEV program was adopted in 1990, the intent of the Board was to provide the regulatory push needed for environmentally beneficial technologies to complete in a mature and extremely competitive industry. In keeping with this vision, in the August 2000 *Biennial Review Staff Report* staff modeled the emission benefits what would result in 2020 if 50 percent of all passenger and light-duty vehicles on the road in 2020 were ZEVs. This scenario resulted in a total NMOG plus NOx benefit of 11.75 tons per day in the South Coast, which was a reduction of more than 30 percent from the baseline level. As this scenario illustrates, the emission benefits of this program will increase as ZEV penetration increases in a mature market.

Relationship of CO₂ Emissions to Ozone Formation

49. Comment: ARB staff claims that the reduction in carbon dioxide emissions will contribute to reductions in ground-level ozone concentrations. As an initial matter, carbon dioxide emissions will not be reduced as a result of the ZEV program. These emissions will actually increase under the ZEV program because of the extra credit provided under the CAFE regulations for alternative fueled vehicles such as battery electric or fuel cell vehicles.

Agency Response: In addition to pure ZEVs, the ZEV program also includes AT PZEVs. The staff base case analyses assume, and commenters have concurred, that AT PZEVs will likely be hybrid electric vehicles. Such vehicles have higher energy efficiency than the vehicles they replace which will result in reduced carbon dioxide emissions.

50. Comment: Despite the lack of any demonstrable carbon dioxide emission reduction benefits from the ZEV program, staff claims in the FSOR that increased carbon dioxide emissions will result in increased ground-level ozone levels. This assertion is made without any support. Although Although increased CO₂ emissions would tend to increase atmospheric greenhouse gas concentrations which may contribute to global warming, reliable data do not support a connection between these effects and increased ozone levels. The 0.6° surface temperature increase observed over the past century documented in the report of the Intergovernmental Panel on Climate Change has been confined mainly to the colder months of the year and to the daily minimum temperatures not the daily maximum temperatures. Although the U.S. average annual temperature increased 0.4° C from 1953 to 1990, the average summer maximum temperature actually decreased. All of the warming was therefore due to an increase in the daily minimum temperature. Thus increases in background CO₂ levels have not been observed to change ambient temperatures in a manner that would increase peak ozone concentrations.

Agency Response: The commenters' statements regarding the distribution of temperature increases in 1953 through 1990 are not supported by more recent data, which indicates that higher temperatures have been observed during the summer ozone season. For example, scientists at the National Climatic Data Center (NCDC) have recently reported that the summer of 2001 was the fifth warmest on record in the contiguous United States. Using the world's largest weather database, NCDC scientists calculated conditions for the meteorological summer, June through August 2001.

The preliminary nationally averaged temperature was 73.6° F (23.1° C), which was 1.5° F (0.8° C) above the long-term mean. June through August temperatures have been above average in 11 of the past 15 years. Temperatures were generally above normal nationally. The summer's most notable heat wave in late July and early August began in the southern Plains and stretched into the upper Midwest, with higher-than-normal temperatures extending into the northeastern U.S. by the second week of August. Daily high temperatures in the 90s and 100s, combined with high humidity, led to dangerous

heat stress levels and numerous heat-related deaths. August 2001 ranked as the fourth warmest in written records. The preliminary nationally average temperature was 74.9° F (23.8° C), which was 2.1° F (1.2° C) above the long-term mean.

Projected climate changes would impact the quality of California's air, public health, and environment. Temperature, winds, solar radiation, atmospheric moisture, venting, and mixing affect both the photochemical production of smog as well as the emissions of ozone precursors that are temperature- and solar-radiation dependent. For example, biogenic hydrocarbon emissions are particularly sensitive to changes in air temperature and solar radiation. In addition, meteorology affects the transport, dispersion, and deposition of pollutants and precursors alike.

Air temperature has a direct effect on photochemical reactions producing ozone. But temperature is also an indirect indicator for other mechanisms that can accelerate smog formation. These include stalled high-pressure systems, intensified subsidence, reduced cloud cover, and increased atmospheric water vapor. Thus in this sense, temperature is a surrogate for many other exacerbating factors.

Other Issues – Relevance of the Fleet Turnover Issue

51. Comment: ARB agrees that the fleet turnover issue was raised in the past. Staff does not respond to the argument that the issue is relevant, and that it would be relevant even if it had not been raised in the past. Given the share of California emissions that are accounted for by the existing vehicle fleet, it is imperative that they be included in any assessment of the overall impacts of the ZEV mandate. Staff avoids responding to the basic point made clear by the NERA and Sierra analysis – understanding existing fleet emissions is a prerequisite for understanding the effects of the mandate.

Agency Response: Staff's analyses take into account emissions from the existing fleet. NERA/Sierra argue that the effect of the ZEV program on fleet turnover outweighs any reduction from cleaner new vehicles. In the *October 31 Staff Review* staff demonstrated that using reasonable assumptions, the purported fleet turnover effect posited by NERA/Sierra was not sufficient to offset the emission benefits of the ZEV program.

Discount Rate

52. Comment: ARB dismisses the discount rate discussion as irrelevant and outside the scope of the current modifications. The choice of discount rate is one of many conservative assumptions that the NERA and Sierra analysis included to ensure that it does not overestimate the effects of the ZEV mandate on vehicle prices, scrappage rates, and fleet-wide emissions. ARB staff ignores the fact that these assumptions are already conservative and imposes its own extremely optimistic assumptions on the NERA and Sierra analysis. Staff then concludes that the effects of the ZEV regulation on the age of the fleet and its overall emissions will not be significant.

Agency Response: This issue is discussed in the response to Comment 175 in the *FSOR*. The *October 31 Staff Report* used the NERA/Sierra methodology, including the discount rate.

Staff Modeling of 15-Day Changes

53. Comment: ARB staff rejects the charge that it did not model the effects of its changes to the mandate under the various 15-day notices. Staff claims to have “fully modeled” the fleet-wide effects of the modified ZEV mandate, but in fact they used a simplistic approach that did not incorporate all the new multipliers or the effects on prices of the modified mandate. Since many more ZEVs and other vehicles must be sold under the new mandate, the prices of ZEVs will have to be lower to stimulate the necessary demand, and the prices of new vehicles will have to rise more if manufacturers hope to maximize their profits. This will exacerbate the effects predicted by the earlier NERA and Sierra analyses. Staff claims that its methodology for estimating the effects of the new mandate was appropriate, but in fact it ignores crucial effects of the new mandate and therefore does not represent an adequate analysis.

Agency Response: This issue is discussed in the responses to Comments 287 and 288 in the *FSOR* and in pages 35-38 of the *October 31 Staff Report*. Staff modeled the emission impact of the expanded program using the standard ARB methodology.

The commenters note that staff did not use the NERA/Sierra methodology to specifically predict any change to the purported fleet turnover effect that might result from the addition of LDT2 vehicles. Rather, staff calculated the effect of the Board’s action on total program costs, and increased the purported “ZEV tax” by the same percentage. Using this approach, staff found in its review of the January 2001 NERA/Sierra report that using reasonable ARB assumptions significantly reduced the ZEV tax and the fleet turnover effect, to the extent that the emission increase claimed by NERA/Sierra did not materialize.

B. Other Comments

54. Comment: The ZEV mandate is too costly and is based on unrealistic assumptions used by the Board’s staff to assess its effects. ARB’s assumptions regarding the cost of ZEVs and other vehicles that can earn ZEV credits are unduly optimistic, do not reflect the reality of the challenges facing every one of the technologies at issue, and appear to be based in part on sources that the ARB has not made public. California Motor Car Dealers Association)

Agency Response: The rationale for the staff’s cost assumptions is set forth and appropriately supported in the *October 31 Staff Response*, and the *FSOR*.

55. Comment: The Board’s staff ignores the effects on prices in California that will result from economic decision-making by manufacturers as a result of the ZEV mandate. The actual effects of the ZEV requirements have been estimates in reports

and other materials submitted by NERA/Sierra. Dealers will be directly and adversely affected by those price increases. (California Motor Car Dealers Association)

Agency Response: See the responses to Comments 25 and 56 in this Supplement.

56. Comment: The Board's staff ignores the real-world fleet-wide effects that will result from economic decision-making by consumers under the ZEV mandate. Historical data, empirical evidence and basic economic principles demonstrate that raising prices on new vehicles increases retention rates for existing vehicles. For our dealer members, a higher retention rate for existing vehicles means one thing: reduced new car sales. (California Motor Car Dealers Association)

Agency Response: In the *October 31 Staff Review*, staff carefully considered NERA/Sierra's arguments regarding the fleet turnover effect resulting from the ZEV requirements. It concluded that using reasonable ARB assumptions rather than those used by NERA/Sierra, the NERA/Sierra model would predict a "ZEV tax" of about \$50 per vehicle in 2007. At this modest level, such cost increases would have an insignificant effect on vehicle sales.

Comment: The Board's staff asserts there is pent-up demand for ZEVs without any substantial basis. Based on the experience of our dealer members that have actually marketed ZEVs, there is no such pent-up demand. Moreover, demand for these vehicles simply would not exist. (California Motor Car Dealers Association)

Agency Response: There is significant disagreement over the extent of market demand for electric vehicles. While automakers and opponents assert that the lack of leases during the MOA period demonstrates that the market can only absorb a minimum number of vehicles per year, electric vehicle advocates and fleet operators point to current waiting lists as evidence of strong customer interest. The entire market is new and product availability has been constrained such that true consumer interest is extremely difficult to gauge. In addition, the introduction of city- and neighborhood electric vehicles further clouds the market for electric vehicles. Surveys and market studies indicate that pricing, range and recharge time are the most important factors affecting the EV market. We believe that a market exists for the relatively small number of vehicles required by the regulations and that the single greatest need is for near-term product availability followed by a smooth orderly ramp-up to larger commercialization.

57. Comment: The Board's staff appears to be relying on ZEVs even though there are a multitude of proven technologies for reducing emissions that are less expensive and more reliable. The Board's staff repeatedly claims that ZEVs represent a "gold standard." However, the Board does not explain why the extremely small emission reduction benefits claimed for ZEVs qualify these vehicles for such a distinction. ZEVs are expensive, are not acceptable for the vast majority of consumers, do not offer the consumer the capabilities that are necessary for their personal transportation needs, and therefore are not a cost-effective method of achieving emission reductions. (California Motor Car Dealers Association)

Agency Response: See the response to Comment 48 in this Supplement. ZEVs represent the cleanest vehicle technologies available by reducing criteria and toxic pollutant emissions to the maximum feasible extent. ZEVs eliminate catastrophic and deteriorating emissions issues in older gas-powered cars as well as reduce emissions from “upstream” sources. Clearly, these vehicles are necessary in large quantities if California is going to meet its air quality goals. The program has been reviewed and modified as a result of the advances made in a variety of technologies including fuel-cells, natural gas, and hybrid electric vehicles. The complexity of the regulation is largely a result of the different strategies and technologies being pursued by industry. Significant emission benefits will be achieved in the future as these various technologies are produced in large quantities.

On the subject of cost-effectiveness, see the discussion on pages 21-23 of the *FSOR*.

58. Comment: I have shown and Southern California Edison agrees that the system efficiency of battery powered electric vehicles is LESS than that of gasoline powered vehicles. ZEVs will therefore increase pollution even on a benign charging cycle of eight hours. (Trujillo Escareño)

Agency Response: To quantify the relative efficiencies of current and future technologies, the ARB and the Energy Commission commissioned an analysis of the full fuel cycle energy efficiency of various vehicle technologies. A technical advisory committee with members from each of the affected fuels was established to provide additional expertise and guidance. This work was also intended to quantify the relative global greenhouse gas benefits of each technology by quantifying total carbon dioxide emissions. Energy conversion efficiency of a fuel was determined for the fuel production and energy conversion portions of the fuel cycle, including fuel acquisition and refining, distribution, refueling, and in-vehicle consumption.

The May 2000 study by ARCADIS Geraghty & Miller, *Fuel Cycle Energy Conversion Efficiency Analysis – Status Report*, determined that, at the vehicle level, battery electric vehicles had the highest “miles per equivalent gallon” energy efficiency of all vehicle types analyzed, followed by hydrogen fuel cell and methanol fuel cell vehicles and hybrid electric vehicles. However, on a total fuel-cycle energy use basis, diesel internal combustion engine vehicles and gasoline hybrid electric vehicles used the least energy per mile, followed by electric vehicles. When compared to conventional vehicles, electric vehicles consume approximately 25 percent less energy on a full fuel cycle basis. It should be noted that there was significant debate among technical advisory committee members on the estimated electric vehicle efficiency in 2010. We believe these results conservatively represent the overall energy use of electric vehicles.

59. Comment: Convenience charging stations are anathema to the program because the system efficiency of the ZEVs using them could be as little as 0.1 of one percent of the gasoline powered vehicles. (Trujillo Escareño)

Agency Response: Based on the study referenced in the response to the preceding comment, we believe that the charging efficiency of public chargers will be much higher than suggested by the commenter. Even if the public charger efficiency is lower than projected by staff, electric vehicles will still provide emission benefits on an overall vehicle basis.

60. Comment: Batteries, no matter how good they become do not limit vehicle range. This ultimately is dictated by the power available from the electrical outlet for the charger. No matter how large a battery, to increase range, or how superior a battery may be, it cannot exceed that delivered by the electrical outlet to the charger. Apartment dwellers are limited to one-quarter the power available to homeowners, which means one fourth as much range as for homeowners. (Trujillo Escareño)

Agency Response: We recognize that recharging of electric vehicles takes time. Most charging is expected to take place at night or at work, when there generally will be sufficient time to fully charge an EV. In the earlier years we do not expect apartment dwellers without access to 220 volt charging to be a target market for EVs.

61. Comment: The batteries are the really pejorative feature in the ZEV program. Their efficiency is only about 65 percent on a benign charging cycle. Fast charging totally negates any advantage it might have because of the rapidly increasing losses as the charging time is decreased. (Trujillo Escareño)

Agency Response: As mentioned in the response to Comment 58 above, the ARB and the Energy Commission commissioned an analysis of the full fuel cycle energy efficiency of various vehicle technologies. This analysis included the energy losses from the recharging and discharging of the electric vehicle battery. While the researchers used a higher efficiency value based on input from industry and other stakeholders, the results showed that the overall system efficiency of the electric vehicle is estimated to be approximately 25 percent greater than for conventional vehicles.

62. Comment: The ZEVs do pollute from the power plants smokestacks; even though they don't have any tailpipe emissions. Vehicles only produce oxides of nitrogen under certain operating conditions, but power plants always emit nitrogen oxides when they are operating. (Trujillo Escareño)

Agency Response: To assess total vehicle emissions, the ARB contracted with A.D. Little to assess indirect emissions and relied on the California Energy Commission to quantify power plant emissions for electric vehicles. These results were added to the ARB's own emissions model to compare the different vehicle technologies. The results showed that when taking into account both direct and indirect emissions, the per-vehicle emissions for battery electric vehicles are over 90 percent lower for NMOG and NOx, when compared to the cleanest gasoline vehicle.

63. Comment: The program to put more ZEVs on the market is not going ahead fast enough. People are fed up with pollution and its health hazards and are extremely interested in ZEVs. (Dunham)

Agency Response: The ARB continues to believe in a strong ZEV program and remains committed to achieving zero emissions from vehicles. As explained in the response to Comment 1 of the FSOR, changes were made to the program to address near-term constraints due to cost, lead-time and technical challenges.

ADDENDUM

The adopted amendments contain a few nonsubstantial modifications to the text made available for supplemental comment. Those modifications are set forth below, and are in addition to the modifications identified in footnote 2, page 3 of the Final Statement of Reasons.

Final Regulation Order

- (a) Page 3, amended section 1962(b)(3), fourth line: “under sections 1961(b) and (c), a vehicle” is changed to “under sections 1960.1(g)(2) and 1961(b) and (c), a vehicle”.
- (b) Page 3, amended section 1962(b)(3), seventh line: “~~under sections 1961(b) and (c)~~” is changed to “~~under sections 1960.1(g)(2) and 1961(b) and (c)~~”.
- (c) Page 4, section 1962(c)(2)(A), first line: “150,000-mile” is changed to “150,000” to show a correction to a printing error in Barclays.
- (d) Page 5, amended section 1962(c)(3)(A), middle row of second table, change “20 miles” to “≤20 miles”; last row of second table, change “100 miles” to “=100 miles”.
- (e) Page 5, amended section 1962(c)(3)(B), fourth line: “VMT potential of the vehicle,” is changed to “VMT potential of the vehicle as a percent of total VMT,”.
- (f) Page 10, amended section 1962(d)(1)(A), the last two rows of the table are changed from:

2	any	>100
3	70	>130

to:

2	any	=100
3	=70	=130

- (g) Page 10, amended section 1962(d)(1)(A), last line, “Trucks and Medium-Duty” is changed to “Trucks, and Medium-Duty”.
- (h) Page 10, amended section 1962(d)(1)(B), last row of the table, “>40” is changed to “=40”.
- (i) Page 13, amended section 1962(e)(2)(C), the heading “Alternative Fuel Vehicles” is added and section 1962(e)(2)(C)1. starts on the next line.

- (j) Page 17, amended section 1962(g)(5)(A) last line, “transportation system.” is changed to “transportation system as described in section (g)(5)(B) below.”
- (k) Page 21, amended section 1962(j), immediately above ““NEV” means neighborhood electric vehicle.”, ““MY” means model year.” is added.
- (l) Page 21, Note to section 1962, last line, “43107” is changed to “43107”.
- (m) Page 21, immediately following “§ 1900. Definitions”, “[Subsections ~~(a)(b)~~(1) through ~~(47)~~(18) -- No change]” is changed to “[Subsections (a)(1) through (b)(18) -- No change]”
- (n) Page 22, section 1900(b)(21), change “section 1900(a)(20)” to “section 1900(b)(21)”.
- (o) Page 23, Note to section 1900, last line, “43102, 43104” is changed to “43102, 43103, 43104”. Also “43107, 43204, and 43205.5” is changed to “43107 and 43204-3205.5”.
- (p) Page 23, section 1961(a)(8)(d), fourth line, “Vehicles,” adopted on August 5, 1999, as amended” is changed to “Vehicles, as amended”.
- (q) Page 23, end of section 1960.1(k)(8)(B), “section 1962~~(e)(h)~~.”” is changed to “section 1962~~(e)(h)~~.””.

California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes

- (a) Page C-5, amended section 3.3(a), middle row of second table, change “20 miles” to “ ≤ 20 miles”; last row of second table, change “400 miles” to “ ≤ 400 miles”.
- (b) Page C-5, amended section 3.3(b), fourth line: “VMT potential of the vehicle,” is changed to “VMT potential of the vehicle as a percent of total VMT,”.
- (c) Page C-13, amended section 5.2(c), the heading “*Alternative Fuel Vehicles*” is added and section 5.2(c)(1) starts on the next line.
- (d) Page C-18, amended section 7.5(a) last line, “transportation system.” is changed to “transportation system as described in section (g)(5)(B) below.”